

ANATOMY

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I. GOAL:

The broad goal of teaching undergraduate students in Anatomy aims at providing comprehensive knowledge of the gross and microscopic structure and development of human body to provide a basis for understanding the clinical correlation of organs or structures involved and the anatomical basis for the disease presentations.

a. Competencies:

The undergraduate must demonstrate:

- Understanding of the gross and microscopic structure and development of human body
- Comprehension of the normal regulation and integration of the functions of the organs and systems on basis of the structure and genetic pattern
- Understanding of the clinical correlation of the organs and structures involved and interpret the anatomical basis of the disease presentations.

b. Broad subject specific objectives

Knowledge: At the end of the course the student should be able to

- Comprehend the normal disposition, clinically relevant interrelationships, functional and cross-sectional Anatomy of the various organs and structures of the body.
- Identify the microscopic structure and correlate elementary ultra structure of various organs and tissues with the functions as a prerequisite for understanding the altered state in various disease processes.
- Comprehend the basic structure and connections of the central nervous system to analyze the integrative and regulative functions of the organs and systems. He should be able to locate the site of gross lesions according to the deficits encountered
- Demonstrate knowledge of the basic principles and sequential development of the organs and systems; recognize the critical stages of development and the effects of common teratogens, genetic mutations and environmental hazards. He should be able to explain the developmental basis of the major variations and abnormalities.

c. Skills:

At the end of the course the student should be able to --

- Identify and locate all the structures of the body and mark the topography of the Living Anatomy.
- Understand clinical basis of some common clinical procedures i.e. intramuscular and intravenous injection, lumbar puncture and kidney biopsy etc.
- Identify the organs and tissues under the microscope.
- Understand the principles of karyotyping and identify the gross congenital anomalies.
- Understand principles of newer imaging techniques and interpretation of CT scan, sonogram, MRI & Angiography.

d. Integration:

The teaching should be aligned and integrated horizontally and vertically in organ systems with clinical correlation that will provide a context for the learner to understand the relationship between structure and function and interpret the anatomical basis of various clinical conditions and procedures.

e. AETCOM-Attitude, Ethics and Communication Modules: Following modules will be conducted and assessed by the Department of Anatomy.

Module 1.5	The cadaver as our first teacher Demonstrate respect and follow the correct procedure when handling cadavers and other biologic tissue
Module 1.1	Identify, discuss Physician's role and responsibility to society and the community that she/he serves

TEACHING HOURS AND METHODS:

Interactive Lectures	210 Hours
Practical, Small Group Learning (Tutorials, Seminars/Integrated Learning)	400Hours
Self-directed learning	10 Hours
Total	620Hours
Early clinical exposure	9 Hours
AETCOM	8 Hours
Grand total	637 Hours

COURSE CONTENTS

The subject has been divided into the following broad areas:

- General anatomy
- General & Systemic histology
- Genetics
- General & Systemic embryology
- Upper limb
- Thorax
- Abdomen
- Pelvis
- Lower limb
- Head and neck
- Neuroanatomy
- Ethics in anatomy

In each of these broad areas, topics have been specified. The content to be covered under each topic has been mentioned as bulleted points. For each topic, competency numbers have been mentioned as per the competency list mentioned above. The content that is related to non-core competencies **(these competencies need not be assessed in the summative examination) have been marked by an asterisk (*)**.

Syllabus of Anatomy at a Glance

1. General Anatomy: Basic tissues of the body, Terminology and Nomenclature, History of Anatomy
2. Elements of Anatomy: Osteology, Arthrology, Myology, Angiology, Neurology.
3. Regional Anatomy: Upper limb, Lower limb, Thorax-including diaphragm, Abdomen including Pelvis, Head and Neck, Brain and Spinal cord.
4. Embryology: Development of individual organs and systems. Postnatal Growth & Development.
5. Histology: General Histology, Microanatomy of individual organs and systems.
6. Human Genetics: Principles of Human Genetics and Molecular Biology.
7. Radiological Anatomy: Skiagrams, Special X-Rays, CT scan and MRI.
8. Living Anatomy
9. Sectional Anatomy: Head & Neck, Brain, Thorax, Abdomen including Pelvis.

10. Applied Anatomy: As applicable

Syllabus

A. GENERAL ANATOMY

(10 Hours)

Topic: Anatomical terminology (AN1.1)

- Normal anatomical position
- Planes of the body
- Terms used for relations and comparison
- Terms used for movements of the body

Topic: General features of bones and Joints (AN1.2, AN2.1 to AN2.6)

- Composition of bone and bone marrow
- Parts, blood and nerve supply of a long bone
- Laws of ossification*
- Special features of a sesamoid bone*
- Types of cartilage with its structure and distribution in body
- Joints with subtypes and examples
- Nerve supply of joints and Hilton's law

Topic: General features of Muscle (AN3.1 to AN3.3)

- Classification of muscle tissue according to structure and action
- Parts of skeletal muscle
- Differences between tendons and aponeuroses with examples
- Shunt and spurt muscles

Topic: General features of skin and fascia (AN4.1 to AN4.5)

- Types of skin and dermatomes in body*
- Structure and function of skin
- Superficial fascia along with fat distribution in body

- Modifications of deep fascia with its functions
- Principles of skin incisions*

Topic: General features of the cardiovascular system (AN5.1 to AN5.8)

- Differences between blood vascular and lymphatic system
- Differences between pulmonary and systemic circulation
- General differences between arteries and veins
- Functional differences between elastic, muscular arteries and arterioles
- Concept of portal system with examples
- Concept of anastomoses and collateral circulation with significance of end arteries
- Functions of meta arterioles, precapillary sphincters, arterio-venous anastomoses*
- Definition of thrombosis, infarction and aneurysm*

Topic: General Features of lymphatic system (AN6.1 to AN6.3)

- Components and functions of the lymphatic system*
- Structure of lymph capillaries and mechanism of lymph circulation*
- Concept of lymphedema and spread of tumors via lymphatics and venous system

Topic Introduction to the nervous system (AN7.1 to AN7.8)

- General plan of nervous system with components of central, peripheral and autonomic nervous systems
- Components of nervous tissue and their functions
- Parts of a neuron
- Classification of neurons based on structure and function
- Structure of a typical spinal nerve
- Principles of sensory and motor innervation of muscles*

- Concept of loss of innervation of a muscle with its applied anatomy
- Type of synapses*
- Differences between sympathetic and spinal Ganglion*

B. GENERAL HISTOLOGY: (30 hours)

Topic : Epithelium (AN65.1 to AN65.2)

- Identification of epithelium under the microscope
- Correlation of structure and function of epithelia
- Ultrastructure of epithelium*

Topic: Connective tissue (AN66.1 to AN66.2)

- Types of connective tissue with functional correlation
- Ultrastructure of connective tissue*

Topic: Muscular tissue (AN67.1 to AN67.3)

- Classification of muscle
- Structure-function correlation of muscle
- Ultrastructure of muscle tissue*

Topic: Nervous tissue (AN68.1 to AN68.3)

- Description and identification of unipolar and multipolar neurons, ganglia, peripheral nerve
- Structure-function correlation of neuron
- Ultrastructure of nervous tissue*

Topic: Blood vessels (AN69.1 to AN69.3)

- Identification of elastic and muscular blood vessels, capillaries under the microscope
- Types and structure-function correlation of blood vessels
- Ultrastructure of blood vessels*

Topic: Glands and Lymphoid tissue (AN70.1 to AN70.2)

- Identification of exocrine glands under the microscope
- Differentiation between serous, mucous and mixed acini
- Identification of lymphoid tissue under the microscope
- Microanatomy of lymph node, spleen, thymus, tonsil and correlation of structure with function

Topic: Bone and Cartilage (AN71.1 to AN71.2)

- Identification of bone under the microscope
- Types and structure-function correlation of bone
- Identification of cartilage under the microscope
- Types and structure function correlation of cartilage

Topic: Integumentary System (AN72.1)

- Identification of skin and its appendages under the microscope
- Correlation of structure and function

C. GENETICS

(8 Hours)

Topic: Chromosomes (AN73.1 to AN73.3)

- Structure of chromosomes with classification
- Technique of karyotyping with its applications
- Lyon's hypothesis

Topic: Patterns of Inheritance (AN74.1 to AN74.4)

- Various modes of inheritance with examples
- Pedigree charts for the various types of inheritance
- Examples of diseases of each mode of inheritance
- Multifactorial inheritance with examples
- Genetic basis and clinical features of achondroplasia, cystic fibrosis, vitamin D resistant rickets, haemophilia, Duchenne's muscular dystrophy and sickle cell anaemia*

Topic: Principle of Genetics, Chromosomal Aberrations and Clinical Genetics (AN75.1 to AN75.5)

- Structural and numerical chromosomal aberrations
- Mosaics and chimeras with examples
- Genetic basis and clinical features of Prader Willi syndrome, Edward syndrome and Patau syndrome*
- Genetic basis of variation: polymorphism and mutation
- Principles of genetic counselling

D. GENERAL EMBRYOLOGY (10 Hours)

Topic: Introduction to embryology (AN76.1 TO AN76.2)

- Stages of human life
- Terms - phylogeny, ontogeny, trimester, viability

Topic: Gametogenesis and fertilization (AN77.1 to AN77.6)

- Uterine changes occurring during the menstrual cycle
- Synchrony between the ovarian and menstrual cycles
- Spermatogenesis and oogenesis
- Stages and consequences of fertilization
- Anatomical principles underlying contraception
- Teratogenic influences; fertility and sterility, surrogate motherhood, social significance of "sex ratio"*

Topic: Second week of development (AN78.1 to AN78.5)

- Cleavage and formation of blastocyst
- Development of trophoblast
- Process of implantation and common abnormal sites of implantation
- Formation of extra embryonic mesoderm and coelom,

bilaminar disc and prochordal plate

- Abortion, decidual reaction, pregnancy tests

Topic: 3rd to 8th week of development (AN79.1 to AN79.6)

- Formation and fate of the primitive streak
- Formation and fate of notochord
- Process of neurulation
- Development of somites and intra embryonic coelom
- Embryological basis of congenital malformations, nucleus pulposus, sacrococcygeal teratomas, neural tube defects
- Diagnosis of pregnancy in first trimester*
- Role of teratogens, alpha fetoprotein*

Topic: Fetal membranes (AN80.1 to AN80.7)

- Formation, functions and fate of chorion, amnion, yolk sac, allantois and decidua
- Formation and structure of umbilical cord
- Formation of placenta, its physiological functions, foeto maternal circulation and placental barrier
- Embryological basis of twinning in monozygotic and dizygotic twins
- Role of placental hormones in uterine growth and parturition
- Embryological basis of estimation of fetal age*
- Types of umbilical cord attachments*

Topic: Prenatal Diagnosis (AN81.1 to AN81.3)

- Methods of prenatal diagnosis
- Indications, process and disadvantages of amniocentesis
- Indications, process and disadvantages of chorion villus biopsy

E. UPPER LIMB

(72 Hours)

Topic: Features of individual bones (Upper Limb) (AN8.1 to AN8.6)

- Clavicle, scapula, humerus, radius, ulna side determination, anatomical position and important features
- Joints formed by the given bone
- Peculiarities of clavicle
- Muscle group attachments on above bones
- Identification and naming of bones in articulated hand
- Parts of metacarpals and phalanges
- Peculiarities of pisiform
- Scaphoid fracture and basis of avascular necrosis*

Topic: Pectoral region (AN9.1 to AN 9.3)

- Pectoralis major, pectoralis minor attachment, nerve supply and action
- Breast - location, extent, deep relations, structure, age changes, blood supply, lymphatic drainage, microanatomy and applied anatomy
- Development of breast*

Topic: Axilla, Shoulder and Scapular region (AN 10.1 to AN10.13)

- Axilla - boundaries and contents
- Axillary artery and tributaries of vein - origin, extent, course, parts, relations and branches
- Brachial plexus - formation, branches, relations, area of supply of branches, course and relations of terminal branches
- Axillary lymph nodes - anatomical groups and areas of drainage
- Variations in formation of brachial plexus
- Erb's palsy and Klumpke's paralysis - anatomical basis and clinical features*
- Enlarged axillary lymph nodes - anatomical basis*
- Latissimus dorsi and trapezius - location, attachment, nerve

supply and actions

- Arterial anastomosis around the scapula*
- Boundaries of triangle of auscultation*
- Deltoid and rotator cuff muscles
- Serratus anterior - attachment and actions
- Shoulder joint - type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, muscles involved, blood supply, nerve supply and applied anatomy
- Anatomical basis of injury to axillary nerve during intramuscular injections*

Topic: Arm and Cubital fossa (AN11.1 to AN11.6)

- Muscle groups of upper arm
- Biceps and triceps brachii
- Important nerves and vessels in arm - origin, course, relations, branches (or tributaries), termination
- Venepuncture of cubital veins - anatomical basis
- Saturday night paralysis - anatomical basis
- Cubital fossa - boundaries and contents
- Anastomosis around elbow joint*

Topic: Forearm and hand (AN12.1 to AN12.15)

- Ventral forearm muscle groups with attachments, nerve supply and actions
- Nerves and vessels of forearm - origin, course, relations, branches (or tributaries), termination
- Flexor retinaculum - identification and attachments
- Anatomical basis of carpal tunnel syndrome
- Small muscles of hand
- Movements of thumb and muscles involved

- Blood vessels and nerves in hand - course and branches
- Anatomical basis of claw hand
- Fibrous flexor sheaths, ulnar bursa, radial bursa and digital synovial sheaths
- Infection of fascial spaces of palm*
- Dorsal forearm muscle groups - attachments, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of back of forearm
- Wrist drop - anatomical basis
- Compartments deep to extensor retinaculum
- Extensor expansion - identification and formation

Topic: General Features, Joints, Radiographs, Living Anatomy and Embryology (AN13.1 to AN13.8)

- Fascia of upper limb and compartments
- Veins of upper limb
- Lymphatic drainage of upper limb
- Dermatomes of upper limb*
- Elbow joint, proximal and distal radio ulnar joints, wrist joint and first carpometacarpal joint - type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements, blood and nerve supply
- Sternoclavicular joint, acromioclavicular joint, carpometacarpal joints and metacarpophalangeal joints*
- Bones and joints of upper limb seen in anteroposterior and lateral view radiographs of shoulder region, arm, elbow, forearm and hand
- Bony landmarks of upper limb - jugular notch, sternal angle, acromial angle, spine of the scapula, vertebral level of the medial end, inferior angle of the scapula
- Palpation of brachial artery and radial artery
- Testing of muscles: trapezius, pectoralis major, serratus

- anterior, latissimus dorsi, deltoid, biceps brachii, brachioradialis
- Development of upper limb*

F. THORAX

(70 Hours)

Topic: Thoracic cage (AN21.1 to AN21.11)

- Salient features of sternum, typical rib, 1st rib and typical thoracic vertebra
- Features of 2nd, 11th and 12th ribs*
- Features of 1st, 11th and 12th thoracic vertebrae*
- Boundaries of thoracic inlet, cavity and outlet
- Extent, attachments, direction of fibres, nerve supply and actions of intercostal muscles
- Course, relations and branches of a typical intercostal nerve
- Origin, course and branches / tributaries of anterior, posterior intercostal vessels and internal thoracic vessels
- Origin, course, relations and branches of atypical intercostal nerve, superior intercostal artery and subcostal artery*
- Type, articular surfaces and movements of manubriosternal, costovertebral, costotransverse and xiphisternal joints
- Mechanics and types of respiration
- Costochondral and interchondral joints*
- Boundaries and contents of the superior, anterior, middle and posterior mediastinum

Topic: Heart and Pericardium (AN22.1 to AN22.7)

- Pericardium - subdivisions, sinuses, blood supply and nerve supply
- External and internal features of each chamber of the heart
- Origin, course and branches of coronary arteries
- Anatomical basis of ischaemic heart disease
- Formation, course, tributaries and termination of coronary sinus

- Fibrous skeleton of heart
- Position and arterial supply of the conducting system of heart

Topic: Mediastinum (AN23.1 to AN23.7)

- Oesophagus - external appearance, relations, blood supply, nerve supply, lymphatic drainage and applied anatomy
- Thoracic duct - extent, relations, tributaries and applied anatomy
- Origin, course, relations, tributaries and termination of superior venacava, azygos, hemiazygos and accessory hemiazygos veins
- Branches and relations of arch of aorta and descending thoracic aorta
- Location and extent of thoracic sympathetic chain
- Description of splanchnic nerves*
- Right lymphatic duct - extent, relations and applied anatomy

Topic: Lungs and Trachea (AN24.1 to AN24.6)

- Pleura - extent, recesses with their applied anatomy, blood supply, lymphatic drainage and nerve supply
- Lungs - side determination, external features including root and clinical correlates
- Description of bronchopulmonary segments
- Phrenic nerve - formation and distribution
- Blood supply, lymphatic drainage and nerve supply of lungs
- Extent, length, relations, blood supply, lymphatic drainage and nerve supply of trachea*

Topic: Radiological anatomy of thorax (AN25.7 and AN25.8)

- Identification of structures seen on a plain x ray chest (PA view)
- Identification of and description in brief of a barium swallow*

Topic: Histology of thorax (AN25.1)

- Identification, drawing and labelling of a slide of trachea and lung

Topic: Embryology of thorax (AN25.2 to AN25.6)

- Development of pleura, lung and heart
- Fetal circulation and changes occurring at birth
- Embryological basis of: 1) atrial septal defect, 2) ventricular septal defect, 3) Fallot's tetralogy and 4) tracheo-esophageal fistula
- Developmental basis of common cardiac congenital anomalies, transposition of great vessels, dextrocardia, patent ductus arteriosus and coarctation of aorta
- Development of aortic arch arteries, superior vena cava, inferior vena cava and coronary sinus*

G. ABDOMEN AND PELVIS

(145 hours)

Topic: Anterior abdominal wall (AN44.1 to AN44.7)

- Planes (transpyloric, transtuberular, subcostal, lateral vertical), regions and quadrants of abdomen
- Anterior abdominal wall - fascia, blood vessels and nerves
- Rectus sheath - formation, contents, linea alba and linea semilunaris
- Inguinal canal - extent, boundaries, contents of inguinal canal, Hesselbach's triangle
- Anatomical basis of inguinal hernia
- Attachments of muscles of anterior abdominal wall
- Common abdominal incisions*
- Umbilicus - position, dermatome and applied aspects*

Topic: Posterior abdominal wall (AN45.1 to AN45.3)

- Thoracolumbar fascia
- Lumbar plexus - root value, formation and branches
- Other nerve plexuses of posterior abdominal wall*
- Major subgroups of back muscles, nerve supply and action*

Topic: Male external genitalia (AN46.1 to AN46.5)

- Testes - coverings, internal structure, side determination, blood supply, nerve supply and lymphatic drainage
- Descent of testis with its applied anatomy
- Parts of epididymis
- Penis - parts, components, blood supply and lymphatic drainage
- Anatomical basis of varicocoele*
- Anatomical basis of phimosis and circumcision*
- Spermatic cord and its contents

Topic: Abdominal cavity (AN47.1 to AN47.14)

- Greater and lesser sac - boundaries and recesses
- Naming and identification of peritoneal folds and pouches
- Anatomical basis of ascites, peritonitis and subphrenic abscess*
- Spleen - anatomical position, external features, peritoneal and visceral relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Anatomical basis of splenic notch, accessory spleens and Kehr's sign*
- Coeliac trunk - origin, course, important relations and branches
- Abdominal part of oesophagus - anatomical position, blood supply, nerve supply, lymphatic drainage and applied aspects

- Stomach - anatomical position, external features, peritoneal and visceral relations, blood supply, nerve supply, lymphatic drainage and applied anatomy
- Anatomical basis of lymphatic spread in carcinoma stomach and different types of vagotomy*
- Mesentery - extent, borders, contents, relations and applied aspects
- Small Intestine - parts, macroscopic difference between jejunum and ileum, nerve supply and lymphatic drainage
- Superior mesenteric artery - origin, course, termination, important relations and branches
- Large intestine - features, extent, peritoneal and other relations
- Caecum - anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Vermiform appendix - anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Inferior mesenteric artery - origin, course, important relations and branches
- Duodenum - anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Pancreas - anatomical position, external and internal features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Liver and extrahepatic biliary apparatus - anatomical position, external features, important peritoneal relations and visceral relations, blood supply, nerve supply, lymphatic drainage and applied aspects

- Clinical importance of Calot's triangle*
- Anatomical basis of site of needle puncture in liver biopsy, referred pain in cholecystitis and obstructive jaundice*
- Portal vein - formation, course, relations, tributaries and sites of anastomoses
- Anatomical basis of haematemesis and caput medusae in portal hypertension
- Kidneys - anatomical position, side determination, coverings, external features, important visceral relations, blood supply, nerve supply, lymphatic drainage and applied anatomy
- Anatomical basis of radiating pain of kidney to groin*
- Ureter - extent, parts, course, relations, constrictions, blood supply, nerve supply, lymphatic drainage and applied aspects
- Suprarenal gland - anatomical position, coverings, external features, important visceral and other relations, blood supply, nerve supply, lymphatic drainage and applied aspects
- Thoraco abdominal diaphragm - attachments, major and minor openings, nerve supply and actions
- Thoraco abdominal diaphragm - abnormal openings and diaphragmatic hernia*
- Abdominal aorta - origin, course, important relations and branches
- Inferior vena cava - formation, course, relations and tributaries

Topic: Pelvic wall and viscera (AN48.1 to AN48.8)

- Muscles of pelvic diaphragm
- Position, features, important peritoneal and other relations, blood supply, nerve supply, lymphatic drainage and clinical aspects of important male and female pelvic viscera

- Origin, course, important relations and branches of internal iliac artery
- Branches of sacral plexus
- Anatomical basis of suprapubic cystostomy, urinary obstruction in benign prostatic hypertrophy, retroverted uterus, prolapse uterus, internal and external haemorrhoids, anal fistula, vasectomy, tubal pregnancy and tubal ligation*
- Neurological basis of automatic bladder*
- Lobes involved in benign prostatic hypertrophy and prostate cancer*
- Structures palpable during vaginal and rectal examination*

Topic: Perineum (AN49.1 to AN49.5)

- Boundaries and contents of superficial and deep perineal pouch
- Perineal body - identification and description
- Perineal membrane in male and female
- Ischiorectal fossa - boundaries, contents and applied anatomy
- Anatomical basis of perineal tear, episiotomy, perianal abscess and anal fissure*

Topic: Vertebral column (AN50.1 to AN50.4)

- Curvatures of the vertebral column
- Type, articular ends, ligaments and movements of intervertebral joints, sacroiliac joints and pubic symphysis
- Site, direction of the needle and structures pierced during lumbar puncture
- Anatomical basis of scoliosis, lordosis, prolapsed disc, spondylolisthesis and spina bifida*

Topic: Sectional Anatomy of Abdomen and Pelvis (AN51.1, AN51.2)

- Cross sections at T8, T10 and L1 (transpyloric plane) levels
- Midsagittal section of male and female pelvis

Topic: Histology and embryology (AN52.1 to AN52.8)

- Microstructure of oesophagus, gastro-oesophageal junction*, fundus of stomach, pylorus of stomach
- Microstructure of duodenum, jejunum, ileum
- Microstructure of colon, appendix
- Microstructure of liver, gallbladder, pancreas
- Microstructure of kidney, ureter, suprarenal gland
- Microstructure of testis, epididymis, vas deferens, penis, prostate gland
- Microstructure of ovary, uterus, uterine tube, cervix*, placenta, umbilical cord, corpus luteum*
- Development of anterior abdominal wall*
- Development and congenital anomalies of diaphragm
- Development and congenital anomalies of foregut
- Development and congenital anomalies of midgut
- Development and congenital anomalies of hindgut
- Development of urinary system
- Development of male reproductive system
- Development of female reproductive system

Topic: Osteology (AN53.1 to AN53.4)

- Lumbar vertebrae - anatomical position, salient features, articulations and attachments of muscle groups
- Sacrum and coccyx - anatomical position, salient features, articulations and attachments of muscle groups
- Bony pelvis - anatomical position, boundaries of pelvic inlet,

pelvic cavity and pelvic outlet,

- True and false pelvis with sex differences
- Clinical importance - sacralization of lumbar vertebra, lumbarization of 1st sacral vertebra, types of bony pelvis*

Topic: Radiological anatomy (AN 54.1 to AN54.3)

- Features of plain X ray abdomen
- Contrast X ray barium swallow, barium meal, barium enema
- Cholecystography
- Intravenous and Retrograde pyelography
- Hysterosalpingography
- ERCP*
- CT abdomen*
- MRI abdomen and pelvis*
- Abdominal arteriography*

H. LOWER LIMB

(75 hours)

Topic: Features of individual bones (lower limb) (AN 14.1 - 14.4)

- Hip bone, femur, patella, tibia, fibula - side determination, anatomical position and important features
- Joints formed by the given bone
- Muscle group attachments on above bones
- Importance of ossification of lower end of femur and upper end of tibia
- Identification and naming of bones in articulated foot with individual muscle attachments*

Topic: Front & Medial Side of Thigh (AN15.1 to AN15.5)

- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of anterior thigh
- Major muscles with their attachment, nerve supply and actions

- Femoral triangle - boundaries and contents
- Anatomical basis of psoas abscess & femoral hernia*
- Adductor canal - boundaries and contents

Topic: Gluteal region & Back of thigh (AN16.1 to AN16.6)

- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of gluteal region
- Major muscles with their attachment, nerve supply and actions
- Anatomical basis of sciatic nerve injury during gluteal intramuscular injections
- Anatomical basis of Trendelenburg sign
- Hamstring group of muscles with their attachment, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels on the back of thigh
- Popliteal fossa - boundaries, roof, floor, contents and relations

Topic: Hip joint (AN17.1 to AN17.3)

- Type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the hip joint
- Anatomical basis of complications of fracture neck of femur*
- Dislocation of hip joint and surgical hip replacement*

Topic: Knee joint, Antero lateral compartment of leg & Dorsum of foot (AN18.1 to AN18.7)

- Major muscles of anterolateral compartment of leg with their attachment, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of anterolateral compartment of leg
- Anatomical basis of foot drop
- Type, articular surfaces, capsule, synovial membrane,

ligaments, relations, movements and muscles involved, blood and nerve supply, bursae around the knee joint

- Anatomical basis of locking and unlocking of the knee joint
- Anatomical basis of knee joint injuries*
- Anatomical basis of osteoarthritis*

Topic: Back of leg & Sole (AN19.1 to AN19.7)

- Major muscles of back of leg with their attachment, nerve supply and actions
- Origin, course, relations, branches (or tributaries), termination of important nerves and vessels of back of leg
- Concept of “peripheral heart”
- Sole - layers, muscles, vessels and nerves
- Anatomical basis of rupture of calcaneal tendon*
- Factors maintaining arches of the foot and their importance
- Anatomical basis of flat foot and club foot*
- Anatomical basis of metatarsalgia and plantar fasciitis*

Topic: General features, Joints, Radiographs & Living Anatomy (AN 20.1 - 20.10)

- Tibiofibular and ankle joints - type, articular surfaces, capsule, synovial membrane, ligaments, relations, movements and muscles involved, blood and nerve supply
- Subtalar and transverse tarsal joints*
- Fascia lata, venous drainage, lymphatic drainage, retinacula and dermatomes of lower limb
- Anatomical basis of enlarged inguinal lymph nodes*
- Anatomical basis of varicose veins and deep vein thrombosis
- Bones and joints of lower limb seen in anteroposterior and lateral view radiographs of various regions of lower limb
- Palpation of arterial pulses in a simulated environment - femoral, popliteal, anterior tibial, posterior tibial and dorsalis

pedis arteries

- Basic concept of development of lower limb*

I. HEAD AND NECK

(110 hours)

Topic: Skull osteology (AN26.1 to AN26.7)

- Anatomical position of skull
- Identification and naming of individual skull bones
- Features of norma frontalis, verticalis, occipitalis, lateralis and basalis
- Cranial cavity - subdivisions, foramina and structures passing through them
- Morphological features of mandible
- Features of typical and atypical cervical vertebrae (atlas and axis)
- Concept of membranous ossification*
- Features of the 7th cervical vertebra*

Topic: Scalp (AN27.1 and AN27.2)

- Scalp - layers, blood supply, nerve supply and surgical importance
- Emissary veins and their role in spread of infection from extracranial route to intracranial venous sinuses

Topic: Face and parotid region (AN28.1 to AN28.10)

- Muscles of facial expression and their nerve supply
- Sensory innervation of face
- Origin / formation, course, branches / tributaries of facial vessels
- Branches of facial nerve with distribution
- Cervical lymph nodes and lymphatic drainage of head, face and neck
- Superficial muscles of face, their nerve supply and actions

- Anatomical basis of facial nerve palsy
- Surgical importance of deep facial vein
- Parotid gland - parts, borders, surfaces, contents, relations, nerve supply, course of its duct and surgical importance
- Anatomical basis of Frey's syndrome*

Topic: Posterior triangle of neck (AN29.1 to AN29.4)

- Sternocleidomastoid muscle - attachments, nerve supply, relations and actions
- Anatomical basis of Erb's and Klumpke's palsy
- Anatomical basis of wry neck*
- Attachments of inferior belly of omohyoid, scalenus anterior, scalenus medius and levator scapulae*

Topic: Cranial cavity (AN30.1 to AN30.5)

- Cranial fossae and related structures
- Major foramina with structures passing through them
- Identification and description of dural folds and dural venous sinuses
- Clinical importance of dural venous sinuses
- Effect of pituitary tumours on visual pathway*

Topic: Orbit (AN31.1 to AN31.5)

- Extraocular muscles - demonstration and description
- Nerves and vessels in the orbit - demonstration and description
- Anatomical basis of Horner's syndrome*
- Components of lacrimal apparatus
- Anatomical basis of oculomotor, trochlear and abducent nerve palsies along with strabismus

Topic: Anterior triangle of neck (AN32.1 and AN32.2)

- Boundaries and subdivisions of anterior triangle

- Boundaries and contents of muscular, carotid, digastric and submental triangles

Topic: Temporal and infratemporal region (AN33.1 to AN33.5)

- Temporal and infratemporal fossae - extent, boundaries and contents
- Muscles of mastication - attachments, direction of fibres, nerve supply and actions
- Temporomandibular joint - articulating surface, type and movements
- Clinical significance of pterygoid venous plexus
- Features of dislocation of temporomandibular joint*

Topic: Submandibular region (AN34.1 and AN34.2)

- Submandibular salivary gland - morphology, relations and nerve supply including submandibular ganglion
- Anatomical basis of formation of submandibular stones*

Topic: Deep structures in the neck (AN35.1 to AN35.10)

- Deep cervical fascia - parts, extent, attachments and modifications
- Thyroid gland - location, parts, borders, surfaces, relations and blood supply
- Subclavian artery - origin, parts, course and branches
- Internal jugular and brachiocephalic veins - formation, course, relations, tributaries and termination
- Cervical lymph nodes - extent, drainage and applied anatomy
- Cervical sympathetic chain - extent, formation, relation and branches
- IX, X, XI and XII cranial nerves - course and branches in the neck
- Anatomical basis of clinical features of thyroid swellings*

- Anatomical basis of clinical features of compression of subclavian artery and lower trunk of brachial plexus by cervical rib*
- Fascial spaces of neck*

Topic: Mouth, pharynx and palate (AN36.1 to AN36.5)

- Palatine tonsil - morphology, relations, blood supply and applied anatomy
- Composition of soft palate
- Waldeyer's lymphatic ring - components and functions
- Pyramidal fossa - boundaries and clinical significance*
- Anatomical basis of tonsillitis, tonsillectomy, adenoids and peritonsillar abscess*
- Clinical significance of Killian's dehiscence*

Topic: Cavity of nose (AN37.1 to AN37.3)

- Nasal septum and lateral wall of nose - features, blood supply and nerve supply
- Paranasal sinuses - location and functional anatomy
- Anatomical basis of sinusitis and maxillary sinus tumours*

Topic: Larynx (AN38.1 to AN38.3)

- Larynx - morphology, structure of the walls, nerve supply, blood supply and actions of intrinsic and extrinsic muscles
- Anatomical aspects of laryngitis*
- Anatomical basis of recurrent laryngeal nerve injury*

Topic: Tongue (AN39.1 and AN39.2)

- Tongue - morphology, nerve supply, embryological basis of nerve supply, blood supply, lymphatic drainage and actions of extrinsic and intrinsic muscles
- Anatomical basis of hypoglossal nerve palsy*

Topic: Organs of hearing and equilibrium (AN40.1 to AN40.5)

- External ear - parts, blood supply and nerve supply
- Middle ear and auditory tube - boundaries, contents, relations and functional anatomy
- Features of internal ear*
- Anatomical basis of otitis externa and otitis media*
- Anatomical basis of myringotomy*

Topic: Eyeball (AN41.1 to AN41.3)

- Eyeball - parts and layers
- Anatomical aspects of cataract, glaucoma and central retinal artery occlusion*
- Intraocular muscles – position, nerve supply and actions*

Topic: Back region (AN42.1 to AN42.3)

- Contents of the vertebral canal
- Suboccipital triangle - boundaries and contents
- Semispinalis capitis and splenius capitis - position, direction of fibres, relations, nerve supply and actions*

Topic: Head and Neck Joints, Histology, Development, Radiography and Living Anatomy (AN43.1 to AN43.9)

- Atlantooccipital joint and atlantoaxial joint - movements with muscles producing them
- Microanatomy of - pituitary gland, thyroid gland, parathyroid gland, tongue, salivary glands, tonsil, epiglottis, cornea and retina
- Microanatomy of - olfactory epithelium, eyelid, lip, sclero corneal junction, optic nerve, cochlea, organ of Corti and pineal gland*
- Development and developmental basis of - congenital anomalies of face, palate, tongue, branchial apparatus, pituitary gland, thyroid gland and eye

- Testing of muscles of facial expression, extraocular muscles and muscles of mastication,
- Palpation of arteries - carotid, facial and superficial temporal arteries
- Location of hyoid bone, thyroid cartilage and cricoid cartilage with their vertebral levels
- Identify the anatomical structures in 1) Plain X ray skull - AP and lateral view; 2) Plain X ray cervical spine AP and lateral view; 3) Plain X ray of paranasal sinuses
- Carotid and vertebral angiograms - anatomical route and anatomical structures*

J. NEUROANATOMY (90 hours)

Topic: Meninges and CSF (AN56.1 and AN56.2)

- Meninges - layers with their extent and modifications
- Circulation of CSF with its applied anatomy

Topic: Spinal cord (AN57.1 to AN57.5)

- Spinal cord - external features, extent in child and adult with its clinical implications
- Transverse section of spinal cord at mid cervical and mid thoracic level
- Ascending and descending tracts at mid thoracic level of spinal cord
- Anatomical basis of syringomyelia*

Topic: Medulla oblongata (AN58.1 to AN58.4)

- Medulla oblongata - external features
- Transverse section of medulla oblongata at the level of 1) pyramidal decussation; 2) sensory decussation; 3) inferior olivary nucleus
- Cranial nerve nuclei in medulla oblongata with their

functional components

- Anatomical basis and effects of medial and lateral medullary syndrome*

Topic: Pons (AN59.1 to AN59.3)

- Pons - external features
- Transverse section of pons at the upper and lower level
- Cranial nerve nuclei in pons with their functional components

Topic: Cerebellum (AN60.1 to AN60.3)

- Cerebellum - external and internal features
- Connections of cerebellar cortex and intracerebellar nuclei
- Anatomical basis of cerebellar dysfunction*

Topic: Midbrain (AN61.1 to AN61.3)

- Midbrain - external and internal features
- Internal features of midbrain at the level of superior and inferior colliculus
- Anatomical basis and effects of Benedikt's and Weber's syndrome*

Topic: Cranial nerve nuclei and cerebral hemispheres (AN62.1 to AN62.6)

- Cranial nerve nuclei with their functional components
- Tracing of all the twelve (12) cranial nerves from their origin, course, branches and correlate to their lesions.
- Cerebral hemispheres - poles, surfaces, sulci, gyri and functional areas
- White matter of cerebrum
- Basal ganglia and limbic lobe - parts and major connections
- Dorsal thalamus, hypothalamus, epithalamus, metathalamus and subthalamus boundaries, parts, gross relations, major nuclei and connections
- Circle of Willis - formation, branches and major areas of distribution

Topic: Ventricular system (AN63.1 and AN63.2)

- Lateral, 3rd and 4th ventricles - parts, boundaries and features
- Anatomical basis of congenital hydrocephalus*

Topic: Histology and Embryology (AN64.1 to AN64.3)

- Microanatomical features of spinal cord, cerebellum and cerebrum
- Development of neural tube, spinal cord, medulla oblongata, pons, midbrain, cerebral hemispheres and cerebellum
- Various types of open neural tube defects with their embryological basis*

K. List of Histology Slides

General histology	Systemic histology	
1. Epithelial tissue	1. Breast	35. Cornea
2. Connective tissue	2. Lung	36. Retina
3. Serous salivary gland	3. Trachea	37. Spinalcord
4. Mucous salivary gland	4. Oesophagus	38. Cerebellum
5. Mixed salivary gland	5. Stomach fundus	39. Cerebrum
6. Hyaline cartilage	6. Stomach pylorus	
7. White fibrocartilage	7. Duodenum	
8. Elastic cartilage	8. Jejunum	
9. TS of compact bone	9. Ileum	
10. LS of compact bone	10. Large intestine	
11. TS of skeletal muscle	11. Appendix	
12. LS of Skeletal muscle	12. Liver	
13. Cardiac muscle	13. Gall bladder	
14. Large artery	14. Pancreas	
15. Large vein	15. Kidney	
16. Medium sized artery	16. Ureter	
17. Medium sized vein	17. Urinary bladder	
18. Lymph node	18. Testis	
19. Thymus	19. Epididymis	
20. Palatine Tonsil	20. Vas deferens	
21. Spleen	21. Prostate	
22. Peripheral nerve TS	22. Ovary	
23. Peripheral nerve LS	23. Fallopian tube	
24. Sensory ganglia	24. Uterus	
25. Autonomic ganglia	25. Cervix	
26. Thick skin	26. Placenta	
27. Thin skin	27. Umbilical cord	
	28. Lip*	
	29. Tongue	
	30. Epiglottis	
	31. Pituitary gland	
	32. Thyroid	
	33. Parathyroid gland	
	34. Adrenal gland	

L. ETHICS IN ANATOMY - AN82.1

- Demonstrate respect and follow the correct procedure when handling cadavers and other biologic tissue

M. LIVING ANATOMY

i) UPPER LIMB :

BONY LANDMARKS (PALPATION OF):

Clavicle , spine of scapula, inferior angle of scapula, coracoid process of the scapula, epicondyles of humerus, olecranon process of ulna ;

JOINTS (DEMONSTRATION OF MOVEMENTS): Shoulder joint, shoulder girdle, elbow joint, radio-ulnar joint (Superior & inferior), wrist joint, 1st carpo-metacarpal joint, MP (Metacarpophalangeal joint) and IP (Interphalangeal joints) joints.

MUSCLES (DEMONSTRATION OF ACTIONS) :

Principle of testing: trapezius, serratus anterior, latissimus dorsi, pectoralis major, deltoid, biceps brachii, brachialis, extensors of elbow, supinators, wrist extensors, wrist flexors, small muscles of hand.

NERVES: Palpation of Ulnar nerve behind the medial epicondyle of humerus

VESSELS (Pulsation of): brachial artery, radial artery

OTHERS: Anatomical snuff box (boundaries)

ii) LOWER LIMB:

BONY LANDMARKS (PALPATION OF): anterior superior iliac spine and iliac crest of hip bone, greater trochanter and adductor tubercle of femur, head and neck of fibula, medial

and lateral malleoli of tibia and fibula, tibial tuberosity, subcutaneous Living of tibia, patella.

JOINTS (DEMONSTRATION OF MOVEMENTS): Hip, knee, ankle and subtalar joints.

MUSCLES (DEMONSTRATION OF ACTION): Hip flexors and extensors, abductors, adductors.

Knee: Flexors and extensors

Ankle: Dorsiflexors and plantar flexors

Subtalar: Invertors and evertors

NERVES: Palpation of common peroneal nerve

VESSELS (Pulsation of): Femoral artery, popliteal artery, dorsalis pedis artery, posterior tibial artery

OTHERS: Palpation of ligamentum patellae and iliotibial tract.

iii) ABDOMEN

BONY LANDMARKS (PALPATION OF): Anterior superior iliac spine of hipbone

JOINTS (DEMONSTRATION OF MOVEMENTS): Intervertebral joints

MUSCLES (DEMONSTRATION OF ACTION): Oblique muscles of abdomen, Transversus abdominis, Rectus abdominis

NERVES: Dermatome T10

OTHERS: Enlarged liver, spleen, bimanual palpation of kidney, abdominal quadrants and regions. Position of superficial and deep inguinal rings. Demonstration of renal angle and surface marking of Mc.Burney's point and importance.

iv) THORAX :

BONY LANDMARKS (PALPATION OF): Sternal angle, counting of rib spaces locating thoracic spines

JOINTS (DEMONSTRATION OF MOVEMENTS): Intervertebral joints

MUSCLES (DEMONSTRATION OF ACTION): Respiratory movements

OTHERS: Palpation of apex beat, apices of the lungs and triangle of auscultation

v) HEAD AND NECK:

BONY LANDMARKS (PALPATION OF): Nasion, Glabella,inion, mastoid process, suprameatal triangle, zygoma, zygomatic arch, angle of mandible, Head of mandible

JOINTS (DEMONSTRATION OF MOVEMENTS):
Temporomandibular joint

MUSCLES (DEMONSTRATION OF ACTION): of mastication muscles and action of facial muscles.

VESSELS (PULSATION OF): Facial artery

PALPATION OF: Symphysis menti, hyoid bone, thyroid cartilage, Trachial rings, suprasternal notch, spine of C7

JOINTS (DEMONSTRATION OF MOVEMENTS): Atlanto-occipital and atlanto axial joints, cervical joints

MUSCLES (DEMONSTRATION OF ACTION):
Sternocleidomastoid, Neck flexors and extensor

VESSELS (PULSATION OF): Common carotid artery, external carotid artery

OTHERS: Palpation of Thyroid gland.

N. CERTIFICATION OF SKILL

Certification of skills will be based on achievement of the following skills.

The student should be able to-

SL NO	Skills
1	Focus the given histology slide under the microscope, identify the tissue and draw a neat labelled diagram
2	Read the skiagram aloud and show the shadows of important organs on skiagram.
3	Explain the given embryological model
4	Hold the given bone in its normal anatomical position and show its bony features and muscle attachments
5	Write the signs and symptoms and state the underlying cause of given chromosomal anomaly.
6	Palpate/ locate the important structures of the body and demonstrate the movements of joints.

O. EARLY CLINICAL EXPOSURE

Sl. No.	Topic	Dept. concerned	Setting
1.	IVF	OBG	Classroom
2.	Joints	Orthopedics	Classroom
3.	Varicose Veins	Surgery	Classroom
4.	Hydrocephalus	Pediatrics	Classroom
5.	Bell's Palsy	Medicine	Classroom
6.	Thyroid enlargement	Medicine	Classroom
7.	Cataract	Community medicine	PHC
8.	Pleural Effusion	Medicine	Hospital visit
9.	Inguinal Hernia	Surgery	Hospital visit
10.	Ascites	Medicine	Hospital visit

Note: The above mentioned ECE Topics are subject to necessary modifications as per the changes in incidence and frequency of cases.

P. SELF DIRECTED LEARNING

Ten hours of dedicated time for SDL is provided for Anatomy, which will also be assessed periodically. The SDL will be conducted as seminars, museum studies and library assignments.

Q. INTEGRATED TEACHING

Systems have been horizontally aligned within the subjects of MBBS Phase I, as well as vertically integrated with other Phases of MBBS.

**R. Simulation Virtual Lab (SVL) activity in
KLE'S Advanced Simulation Centre And Skill Lab**

Session for recapitulation of the gross anatomy, sectional anatomy, microscopy, radiological images and general embryological aspects on Anatomage (Virtual dissection table) in the clinical skill lab, throughout the year in batches. These sessions will be assessed periodically.

ASSESSMENT AND ELIGIBILITY

A) ATTENDANCE

Every candidate must have minimum of 75% attendance in theory; which includes Interactive lectures and Self-directed learning (SDL). Students are expected to have minimum of 75% attendance in each of these components separately.

The candidate must have minimum of 80% attendance in practical separately; which includes early clinical exposure (ECE), practical/small group teaching (SGT) and tutorial. Students are expected to have minimum of 75% attendance in each of these components separately.

The candidate must have minimum of 75% attendance in AETCOM separately. The academic year is calculated from date of commencement of academic session to the last working day as notified by the university to be eligible to appear for university examination in that subject.

Attendance in both internal examinations/part completion tests and preliminary examination is compulsory. Refer Annex I-III

B) INTERNAL ASSESSMENT

Internal assessment shall be based on day-to-day assessment. It shall relate to different ways in which learners participate in learning process which includes Part completion tests, home assignments, continuous class tests, self-directed learning (seminar, museum and library assignments) in theory and in practicals students should have successfully completed certifiable skills competencies, AETCOM competencies, activity related to stimulated laboratory and research activity. The learner must have completed log book and practical record book.

There will be two, part completion tests and one preliminary examination both in theory and practical. The candidate must score minimum of 40% marks in internal assessment of theory and practical separately. Candidate must secure at least 50% marks combined in theory and practical to be eligible for appearing at the final University examination. (Refer Annex I-III).

Internal assessment marks shall not be added to summative assessment. However, internal assessment will be displayed under a separate column in detailed marks card.

As per the decision of Authority and subject expert, the Candidates (with genuine reasons only) not securing minimum eligibility are required to write additional 'Betterment' Internal Assessment before the final university examination.

C) SUBMISSION OF LOG BOOK AND LABORATORY RECORD NOTE BOOK Refer to table for scheme of assessment in practicals

Candidate must have completed the required certifiable competencies for that phase of training and completed the log book appropriate for that phase of training to be eligible for appearing at the final university examination of that subject.

At the time of Practical Examination each candidate shall submit to the Examiners his/ her log book and laboratory record book duly certified by the Head of the Department as a bonafide record of the work done by the candidate. Submission of the log book/ case record to the

department is required for eligibility to appear for the final examination of the subject.

Formative assessment			Continuous Internal assessment Theory					Total	
1 st PCT Theory	2 nd PCT Theory	Prelims Theory (Paper I and II)	Home Assignment	Continuous Class Test (LMS)	Self-directed Learning				Attendance Theory
					Seminar	Museum Study	Library Assignments		
100	100	200	15	30	15	15	15	10	500

KAHER's JAWAHERLAL NEHRU MEDICAL COLLEGE

LAGAVIBE

DEPARTMENT OF ANATOMY

MBBS Phase-I

SCHEME OF THEORY ASSESSMENT

FORMATIVE AND CONTINUOUS

KAHER's JAWAHERLAL NEHRU MEDICAL COLLEGE

BELAGAVI

DEPARTMENT OF ANATOMY

MBBS Phas-I

SCHEME OF PRACTICAL ASSESSMENT

FORMATIVE AND CONTINOUS

Formative assessment			Continuous Internal assessment (Practical)						Total
			Log Book (150)				Journal (Record book)	Attendance Practical	
1 st PCT Practical	2 nd PCT Practical I	Prelims Practical	Certifiable skills-based competencies (Through OSPE/OSCE/ Spots /Exercise/ Others)	AETCOM Competencie s	SVL Lab	Research			
100	100	100	60	30	40	20	40	10	500

MARKS DISTRIBUTION FOR
ANATOMY UNIVERSITY ANNUAL EXAMINATIONS

Phase of Course	Theory	Practicals	Passing criteria
1st MBBS			
Anatomy	Paper 1 - 100 marks	200	<ul style="list-style-type: none"> • In subjects having two papers, the learner must secure minimum 40 % of marks in aggregate (both papers together) to pass in the said subject. • A candidate shall obtain 50 % marks in aggregate together in theory and practical. He/she should obtain 60:40 minimum or 40:60 minimum in University examination separately in theory and practical.
	Paper 2 - 100 marks		
Physiology	Paper 1 - 100 marks	200	
	Paper 2 - 100 marks		
Biochemistry	Paper 1 - 100 marks	200	
	Paper 2 - 100 marks		

Supplementary examinations and declaration of results shall be processed within 3-6 weeks from the date of declaration of the results of the main examination every professional year, so that the students, who pass, can join the main batch for progression.

If the student fails in the supplementary examination of first MBBS, he shall join the batch of next academic /subsequent year. There shall be no supplementary batches. Partial attendance of examination in any subject shall be counted as an attempt.

A student, who fails in the First Professional examination, shall not be allowed to join the Second Professional.

**TYPE, NUMBER OF QUESTION AND DISTRIBUTION OF
MARKS FOR THEORY PAPERS**

TYPE OF QUESTION	NUMBER OF QUESTION	MARKS FOR EACH QUESTION	TOTAL MARKS
MCQ	20	1	20
LONG ESSAY	2	10	20
SHORT ESSAY	9	5	45
SHORT ANSWER	5	3	15
Total			100

Blue Print for theory examinations

PAPER - I

***Distribution of Portion for Theory Paper-I will be as follows:**

Chapter / Topic	Type & No. of Questions	Marks
All topics	M.C.Q. 20	20
Head & Neck, Brain and Spinal cord, Thorax including diaphragm , Upper limb	Long Essay 2x10	20
Head & Neck, Brain and Spinal cord, Thorax including Diaphragm , Upper limb , General Anatomy, General Histology and Relevant Systemic Histology, General Embryology and Relevant Systemic Embryology	Short Essays 9x5	45
General Anatomy, General Histology and Relevant Systemic Histology, General Embryology and Relevant Systemic Embryology and also Head & Neck, Brain and Spinal cord, Thorax including diaphragm and Upper limb	Short Answer 5x3	15
	TOTAL	100

*** One Long essay, One Short essay, one MCQ would be Case based question.**

*** A strict division of the topic may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.**

PAPER - II*

*Distribution of Portion for Theory Paper-II will be as follows:

Chapter / Topic	Type & No. of Questions	Marks
All topics	M.C.Q. 20	20
Gross Anatomy of Abdomen, Pelvis, perineum and Lower limb	Long Essay 2x10	20
Gross Anatomy of Abdomen, Pelvis, perineum , Lower limb, Relevant Systemic Embryology & Relevant Systemic Histology and Genetics	Short Essays 9x5	45
Relevant Systemic Histology, Relevant Systemic Embryology, Genetics and also Abdomen, Pelvis, Perineum ,Lower limb and AETCOM	Short Answer 5x3	15
	TOTAL	100

- * **One Long essay, One Short essay, one MCQ would be Case based question.**
- * **One Short answer will be from AETCOM Modules in paper II compulsorily.**
- * **A strict division of the subject may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.**

**TYPE, NUMBER OF QUESTION AND DISTRIBUTION OF
MARKS FOR PRACTICAL IN SUBJECT OF ANATOMY**

TYPE OF QUESTION	NUMBER OF QUESTION	MARKS FOR EACH QUESTION	TOTAL MARKS
<u>Gross Practical</u>			
Gross Spotters	10 (Gross spotters -9 and Case based spotter-1)	2	20
Gross discussion-	2 (Above diaphragm-1 and Below diaphragm-1)	15	30
Total			50
<u>Histology Practical</u>			
Histology Spotters	10 (Histology slides-9 and Genetic chart-1)	1	10
Slide discussion	2 (General histology-1 and Systemic histology-1)	10	20
Total			30
<u>Viva-voce</u>			
Living Anatomy	-	-	5
Osteology	-	-	5
Radiological anatomy	-	-	5
Embryology models	-	-	5
Total			20
Final Total of Practical exam			100

LIST OF RECOMMENDED BOOKS

General anatomy

- Handbook of General Anatomy, BD Chaurasia / General Anatomy, Vishram Singh

Histology

- diFiore's Atlas of Human Histology with Functional Correlation, Victor P Eroschenko / Wheater's Functional Histology: A Text and Colour Atlas
- Textbook of Human Histology with colour Atlas, Inderbir Singh
Textbook of human Histology, Yogesh Sontakke / Textbook of Histology and Practical Guide, Gunasegaran / Histology: Text and Atlas, Brijesh Kumar

Embryology

- Textbook of Human Embryology, Inderbir Singh / Langman's textbook of Medical Embryology, TW Sadler / Textbook of Human Embryology, Yogesh Sontakke

Human genetics

- Human Genetics, SD Gangane / Medical Genetics, GP Pal / Emery's Elements of Human Genetics, Peter Turnpenny and Sian Ellard

Gross anatomy including neuroanatomy

- Cunningham's Manual of Practical Anatomy Volumes I,II and III
- Theime Dissector, Vishram Singh – all volumes
- Grays Student Dissector
- BD Chaurasia's / Dutta's / Vishram Singh's Textbook of Anatomy - all volumes
- Textbook of Human Anatomy , Yogesh Sontakke
- Grant's atlas / McMinn's atlas / Netter's atlas
- Clinically Oriented Anatomy, K L Moore / Clinical Anatomy by Regions, Richard Snell / Clinical Anatomy (A Problem Solving Approach) (2 volumes), Neeta Kulkarni
- Gray's Anatomy for Students, South Asia Edition.

- Clinical Neuroanatomy, Richard Snell / Textbook of Neuroanatomy, IB Singh / Textbook of Clinical Neuroanatomy, Vishram Singh

Surface and radiological anatomy

- Surface and radiological anatomy, A Halim / Surface and radiological anatomy, Ashwini Appaji and Roopa Kulkarni

Others

- Stedman's Medical Dictionary
- Gray's Anatomy The Anatomical Basis of Clinical Practice

PHYSIOLOGY

PHYSIOLOGY

GOAL:

The goal of teaching undergraduate students in physiology is to make them understand the physiological principles and normal homeostatic mechanisms of normal human body so that he/she can understand the disease pattern better.

I. Competencies:

The undergraduate must demonstrate:

- Understanding of the normal functioning of the organs and organ systems of the body,
- Comprehension of the normal structure and organization of the organs and systems on basis of the functions,
- Understanding of age - related physiological changes in the organ functions that reflect normal growth and development,
- Understand the physiological basis of diseases.

Board subject specific objectives

Ia. Knowledge: At the end of the course, the student will be able to:

- Describe the normal function of all the system, the regulatory mechanisms and interactions of the various systems for well-coordinated total body functions.
- Understanding the relative contribution of each organ system in the maintenance of the milieu interior (homeostasis)
- Explain the physiological aspects of the normal growth and development.
- Analyze the physiological responses and adaptation to environmental stress. Comprehend the physiological principals underlying pathogenesis and treatment of disease.
- Correlate knowledge of physiology of human reproductive system in relation to National Family Welfare program.

Ib. Skills: At the end of the course the student shall be able to:

- Conduct experiments designed for study of physiological phenomenon.
- Interpret experimental/investigative data.
- Distinguish between normal and abnormal data derived as a result of clinical examination and tests, which he/she has performed and observed in the laboratory.
- Recognize and get familiar with newer computerized and advanced instruments like medspiror, semen quality analyzer, EMG and TMT.

Ic. Integration: The teaching should be aligned and integrated horizontally and vertically in organ systems in order to provide a context in which normal function can be correlated both with structure and with the biological basis, its clinical features, diagnosis and therapy.

Id. Physiology: AETCOM-Attitude, Ethics and Communication Modules

Physiology	Module 1.2, Module 1.3	Demonstrate empathy in patient encounters
	Module 1.4	Demonstrate ability to communicate to patients in a patient, respectful, non-threatening, non-judgmental and empathetic manner

II. DISTRIBUTION OF TEACHING METHODS AND HOURS FOR PHASE-1 MBBS

Interactive Lectures	130 Hours
Practical, Small Group Learning (Tutorials, Seminars/Integrated Learning)	300 Hours
Self-directed learning	10 Hours
Total	440 Hours
Early clinical exposure	9 Hours
AETCOM	14 Hours
Grand total	458 Hours

COURSE CONTENTS

List of systems included in Physiology:

- General Physiology
- Haematology
- Nerve and Muscle Physiology
- Gastrointestinal Physiology
- Cardiovascular Physiology
- Respiratory Physiology
- Renal Physiology
- Endocrine Physiology
- Reproductive Physiology
- Neurophysiology (Nervous System and Special Senses)
- Integrated Physiology

Theory

130 Hours

1. General Physiology PY 1.1 to 1.9

7 Hours

- Structure and functions of a mammalian cell.
- Homeostasis.
- Intercellular communications. Apoptosis.
- Transport mechanisms across cell membranes.
- Fluid compartments of the body. pH and Buffer systems in the body.
- Resting membrane potential and Action potential.
- Evaluation of functions of the cells and its products, its communications and their applications in clinical care and research.

2. Haematology PY 2.1 to 2.13

12 Hours

- Composition and functions of blood components.
- Plasma Proteins- origin, forms, variations and functions.
- RBC- formation (erythropoiesis) and its regulation, morphology, functions and variations.
- Hemoglobin - synthesis, variants, functions and its breakdown.
- Anemia and Jaundice- definition and classification, Patho Physiology.
- WBC- formation and its regulation, morphology, functions and variations.
- Immunity – types, mechanism and regulation.
- Platelets- formation and its regulation, morphology, functions and variations. Hemostasis. Anticoagulants. Bleeding and Clotting disorders (hemophilia and purpura). Blood groups.
- Blood banking and transfusion. Rh incompatibility.
- Lymph-composition, circulation and functions.

3. Nerve and Muscle Physiology PY 3.1 to 3.18

7 Hours

- Neuron and neuroglia- structure, types and functions.
- Nerve fibers- classification, functions & properties.
- Nerve injuries- degeneration and regeneration in peripheral nerves.
- Neuromuscular junction- structure and transmission of impulses.
- Neuromuscular blocking agents. Myasthenia gravis.
- Muscle fibers: types, structure and functions.
- Action potential in nerve, skeletal & smooth muscles.
- Muscle contraction-molecular basis (skeletal and smooth), Isotonic and Isometric contraction.
- Energy sources and metabolism.
- Gradation of muscular activity.
- Muscle dystrophy- Myopathies.

- Strength-duration curve.

4. Gastrointestinal Physiology PY 4.1 to 4.10 12 Hours

- Physiological anatomy of digestive system. Enteric nervous system.
- GI Secretions-composition, mechanism of secretion, functions and regulation of secretion of saliva, gastric Juice, pancreatic secretion, intestinal and bile secretion.
- GIT movements- types, regulation and functions. Defecation reflex. Role of dietary fibers.
- Digestion and absorption of nutrients & role of dilatory fibers.
- GIT hormones- source, regulation and functions. Gut-brain axis.
- Structure and functions of liver and gall bladder.
- Gastric function tests, pancreatic exocrine function tests & liver function tests.
- Pathophysiology of achalasia cardia, peptic ulcer, gastro-esophageal reflux disease, vomiting, diarrhea, constipation, adynamic ileus, Hirschsprung's disease.

5. Cardiovascular Physiology PY 5.1 to 5.16 18 Hours

- Functional anatomy of heart.
- Properties of cardiac muscle- morphological, electrical, mechanical and metabolic. Pacemaker and conducting system. Cardiac impulse-generation and conduction. Cardiac cycle.
- Electrocardiography- basics, normal ECG, uses and cardiac axis. Abnormal ECG- arrhythmias, heart block and myocardial infarction.
- Haemodynamics of circulatory system.
- Local and systemic cardiovascular regulatory mechanisms.
- Heart rate- factors affecting.
- Cardiac output- factors affecting, regulation and measurement.
- Blood pressure- components, determinants, factors affecting, regulation and applied aspects.
- Regional circulation- microcirculation, lymphatic circulation, coronary, cerebral, capillary, skin, pulmonary, splanchnic and fetal circulation.
- Pathophysiology of shock, syncope, heart failure and coronary artery disease.

6. Respiratory Physiology PY 6.1 to 6.10

12 Hours

- Functional anatomy of respiratory tract.
- Mechanics of respiration- Mechanism of ventilation; Pressure and volume changes; Alveolar surface tension; surfactant (source, chemical nature, functions) and Hyaline membrane disease; Compliance; Airway resistance; Dead space; Alveolar ventilation; Ventilation-perfusion ratio; Diffusion capacity of lungs, Lung volumes and capacities – definition, normal values, determination and significance.
- Transport of respiratory gases- Oxygen and Carbon dioxide.
- Neural and chemical regulation of respiration.
- Physiology of high altitude and deep-sea diving.
- Principles of artificial respiration and oxygen therapy.

- Pathophysiology of hypoxia, dyspnea, cyanosis, asphyxia, drowning and periodic breathing.
- Lung function tests and its clinical significance.

7. Renal Physiology PY 7.1 to 7.9

9 Hours

- Structure and functions of kidney.
- Juxta-glomerular apparatus.
- Renal blood flow.
- Role of renin-angiotensin system.
- Mechanism of urine formation.
- Concentration and diluting mechanisms.
- Renal regulation of fluid and electrolytes balance.
- Acid-base balance. Renal function tests including concept and significance of renal clearance.
- Structure and innervation of urinary bladder.
- Physiology of micturition, and its abnormalities.
- Cystometry and normal cystometrogram.
- Artificial kidney, Dialysis and Renal transplantation.

8. Endocrine Physiology PY 8.1 to 8.6

12 Hours

- Introduction and general principles of endocrinology.
- Mechanism of action of steroid, protein and amine hormones.
- Synthesis, secretion, transport, physiological actions, regulation and effect of altered (hypo and hyper) secretion of pituitary gland, thyroid gland, parathyroid gland, adrenal gland, pancreas and hypothalamus.
- Physiology of Bone and Calcium metabolism.
- Function tests- Thyroid, Endocrine Pancreas, Adrenal Cortex and Adrenal Medulla.
- Minor endocrine glands – Thymus, Pineal body, Heart and Kidney.
- Obesity and metabolic syndrome, Stress response.

9. Reproductive Physiology PY 9.1 to 9.12

10 Hours

- Sex determination, sex differentiation and their abnormalities.
- Puberty- onset, progression, stages, early and delayed puberty.
- Male Reproductive System: Physiological anatomy. Spermatogenesis and its regulation.
- Testicular hormones. Semen and its analysis. Cryptorchidism.
- Female Reproductive System: Physiological anatomy. Oogenesis. Ovarian hormones. Menstrual cycle- changes in ovary, uterus, cervix, vagina and hormonal regulation. Ovulation and its detection. Fertilization. Implantation. Physiology of pregnancy, Pregnancy tests. Placenta. Fetoplacental unit. Parturition. Lactation. Composition of breast milk.
- Contraceptive methods for male and female.
- Effects of removal of gonads on physiological functions.
- Hormonal changes and their effects during perimenopause and menopause.
- Causes of infertility and role of IVF in its management.

- Psychological and psychiatric disturbances associated with reproductive physiology.

10. Neurophysiology PY 10.1 to 10.20

A. Nervous System:

22 Hours

- Organization.
- Synapse, Receptors and Reflex- types and properties.
- Sensory system- Somatic sensations and sensory tracts (including Physiology of pain) and sensory disturbances.
- Motor system- Motor tracts, mechanism of maintenance of tone, voluntary movements, posture and equilibrium.
- Spinal cord- functions and lesions.
- Vestibular apparatus.
- Reticular activating system.
- Autonomic nervous system.
- Organization, connections and functions of cerebral cortex, basal ganglia, thalamus, hypothalamus, cerebellum and limbic system and their abnormalities.
- Temperature regulation- mechanism, adaptation to altered temperature (heat and cold environment), mechanism of fever, cold injuries and heat stroke.
- Physiology of sleep and EEG. Memory, learning and speech and their disorders.
- Formation, circulation and functions of CSF. Blood brain barrier. Chemical transmission.

B. Special Senses

9 Hours

- Eye: Functional anatomy of eye.
- Optics and Image forming mechanisms.
- Physiology of vision including visual acuity, color vision, field of vision, refractive errors, light reflexes, accommodation reflex, dark and light adaptations.
- Visual pathway and its lesions. Visual evoked potentials.
- Ear: Functional anatomy of ear and auditory pathways.
- Physiology of hearing.
- Deafness and its causes.
- Hearing tests.

- Auditory potentials.
- Taste and Smell: Modalities, perception and their abnormalities.

11. Integrated Physiology PY 11.1 to 11.12

- Exercise- cardio-respiratory and metabolic adjustments during exercise (isotonic and isometric), exercise in heat and cold, physical training effects.
- Temperature regulation- mechanism, adaptation to altered temperature (heat and cold environment), mechanism of fever, cold injuries and heat stroke.
- Physiological consequences of sedentary lifestyle.
- Brain death.
- Physiology of Infancy. * Physiology of aging, free radicals and antioxidants. *
- Physiology of meditation. *

(* ‘Non-core’ competencies as per “Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India”).

PRACTICALS

180 Hours

The following list of practicals is minimum and essential. Additional exercise can be included as and when feasible and required. All the practicals have been categorized as “Procedures” and “Demonstrations”. The procedures are to be performed by the students during practical classes to acquire skills. Some of these would be included in the practical during university examination. Those categorized as “Demonstrations” are to be shown to students during practical classes. However, these demonstrations would not be included in the university examinations but questions based on these would be given in the form of data, charts, problems and case- histories for interpretation by students in the examinations.

I. Procedures to be performed by the students

A. Haematology

50 Hours

All hematological practicals will be briefed along with clinical case scenarios and students will be trained to interpret the results of the same.

- 1) Study of Microscope
- 2) Collection of Blood
- 3) Study of Fresh drop of blood
- 4) Effect of Isotonic, Hypertonic and Hypotonic saline on RBC
- 5) Principles of Hemocytometry
- 6) RBC count PY2.11
- 7) WBC count PY2.11
- 8) Estimation of Hemoglobin PY2.11
- 9) Determination of RBC indices-MCV, MCH, MCHC and Color Index PY2.11
- 10) Differential Leucocyte Count PY2.11
- 11) Bleeding time and Clotting time PY2.11
- 12) Blood Grouping PY2.11

B. Procedures to be performed on human subjects

40 Hours

1. Spirometry - Lung Volumes and Capacities, FEV₁, MVV and Dyspnoeic Index PY6.8
2. Vitalography PY6.8
3. Peak Expiratory Flow Rate (PEFR) by Wright's mini peak flow-meter PY6.10
4. Demonstrate Basic Life Support in a simulated environment
[Artificial Respiration and Cardio-pulmonary Resuscitation] PY11.14
5. Recording of Blood Pressure at rest PY5.12
6. Effect of Posture, mild and moderate Exercise on BP PY5.12
7. Harvard step test and its impact on induced physiologic parameters PY3.16
8. Record and interpret Lead II ECG PY5.13
9. Autonomic Function Tests :
 BP response to isometric exercise by Hand Dynamometer
 Recording of sinus arrhythmias. PY5.14
10. Mosso's Ergography PY3.14
11. Visual Field by Perimetry PY10.20

C. Clinical Examination

60 Hours

- 1) Introduction to the Clinical Examination [history taking and general physical examination] PY11.13
- 2) Examination of Radial Pulse PY5.12
- 3) Clinical Examination of Respiratory System PY6.9
- 4) Clinical Examination of Cardiovascular System PY5.15
- 5) Clinical Examination of Abdomen PY4.10
- 6) Examination of Higher mental functions PY10.11
- 7) Examination of Sensory System PY10.11
- 8) Examination of Motor System including Reflexes PY10.11
- 9) Examination of Cranial Nerves PY10.1 & PY10.20

II. Demonstrations

10 Hours

- 1) Haematology:
 - Osmotic fragility PY2.12
 - Erythrocyte sedimentation rate PY2.12
 - Haematocrit PY2.12

 - Reticulocyte count PY2.13

 - Platelet count PY2.13
- 2) Record Arterial pulse tracing using finger plethysmography* PY5.16
- 3) Stethography - at rest, effect of deglutition, exercise, voluntary hyperventilation and breaking point after breath holding
- 4) Tests of cardiovascular autonomic functions* PY5.14(* 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India")

III. Interpretation of – Charts, Problems, Graphs and Case histories 10 Hours

1. Interpretation of all system charts case histories & calculations

Note:- Charts also include - Interpret growth chart* PY11.9, Interpret anthropometric assessment of infants* PY11.10 (*these two charts are 'Non-core' competencies as per "Competency based Undergraduate Curriculum for the Indian Medical Graduate 2018: Medical Council of India")

IV. Computer Assisted Learning 10 Hours

A. Amphibian Nerve-Muscle and Interpretation of charts & Graphs

- Simple muscle twitch
- Effect of changes in temperature on simple muscle twitch
- Effect of two successive stimuli on muscle contraction
- Effect of multiple successive stimuli (treppe, clonus, tetanus)
- Study of fatigue in skeletal muscle
- Effect of load on muscle

B. Amphibian / Mammalian Heart - Interpretation of charts & Graphs

- Normal cardiogram
- Effect of temperature on frog heart
- Effect of vagus on frog's heart
- Perfusion of isolated heart and effect of ions (NaCl, KCl, CaCl₂)
- Perfusion of isolated heart and effect of drugs (adrenaline, acetyl choline)

SKILL CERTIFICATION:

List and number of sessions for skill certification is given below:

	Topics	Number required to certify as per NMC
PY5.12	Record blood pressure at rest and in different grades of exercise and postures in a volunteer or simulated environment & radial pulse	1 each x 3
PY5.15	Perform Clinical examination of Cardiovascular system in a normal volunteer or simulated environment	1 each x 3
PY6.9	Demonstrate the correct clinical examination of the respiratory system in a normal volunteer or simulated environment	1 each X 3
PY11.1 3	Demonstrate the general physical examination in a normal volunteer or simulated environment	1 each x 3
PY4.10	Demonstrate clinical examination of Abdomen in a normal volunteer or simulated environment	1 each X 3
PY10.1 1	Demonstrate the correct clinical examination of the nervous system: Higher functions, sensory system, motor system, reflexes, cranial nerves in a normal volunteer or simulated environment	1 each (total 5)
PY10.2 0	Demonstrate (i) Testing of visual acuity, color and field of vision and (ii) hearing (iii) Testing for smell and (iv) taste sensation in volunteer / simulated environment	1 each (total 4)

EARLY CLINICAL EXPOSURE (ECE):

Sl No	Topics	Settings	Department
1	Pathophysiology of Edema	Hospital	Medicine
2	Blood Bank	Hospital	Pathology
3	Goiter	Classroom	Surgery
4	Hemiplegia	Hospital/Classroom	Medicine
5	Refractive Errors / Deafness	Hospital	Ophthalmology/ENT
6	Obstructive vs Restrictive Lung Diseases	Hospital/Classroom	Respiratory Medicine
7	MI/ECG changes	Classroom	Medicine
8	Dialysis / Artificial Kidney	Hospital	Nephrology
9	ANC / Family Planning	Community	PSM
10	Pathophysiology of peptic ulcer	Classroom/Hospital	Medicine

- The above mentioned ECE topics are subjected to necessary changes as per the incidence and frequency of disease.
- **Basic science correlations:** Discussion based on case vignettes, graphs, clinical videos, patient in classroom setting, etc. linked to various systems in physiology.

II. ASSESSMENT AND ELIGIBILITY

A) ATTENDANCE

Every candidate must have minimum of 75% attendance in theory; which includes Interactive lectures and Self-directed learning (SDL). Students are expected to have minimum of 75% attendance in each of these components separately.

The candidate must have minimum of 80% attendance in practical separately; which includes early clinical exposure (ECE), practical/small group teaching (SGT) and tutorial. Students are expected to have minimum of 75% attendance in each of these components separately.

The candidate must have minimum of 75% attendance in AETCOM separately. The academic year is calculated from date of commencement of academic session to the last working day as notified by the university to be eligible to appear for university examination in that subject.

Attendance in both internal examinations/part completion tests and preliminary examination is compulsory. Refer Annex I-III

B) INTERNAL ASSESSMENT

Internal assessment shall be based on day-to-day assessment. It shall relate to different ways in which learners participate in learning process which includes Part completion tests, home assignments, continuous class tests, self directed learning (seminar, museum and library assignments) in theory and in practicals, students should have successfully completed certifiable skills competencies, AETCOM competencies, activities related to stimulated laboratory, BSRC laboratory and research activity. The learner must have completed log book and practical record book.

There will be two, part completion tests and one preliminary examination both in theory and practical. The candidate must score minimum of 40% marks in internal assessment of theory and practical separately. Candidate must secure at least 50% marks combined in theory and practical to be eligible for appearing at the final University examination. (Refer Annex I-III).

Internal assessment marks shall not be added to summative assessment. However, internal assessment will be displayed under a separate column in detailed marks card.

As per the decision of Authority and subject expert, the Candidates (with genuine reasons only) not securing minimum eligibility are required to write additional 'Betterment' Internal Assessment before the final university examination.

C) SUBMISSION OF LOG BOOK AND LABORATORY RECORD NOTE BOOK Refer to table for scheme of assessment in practicals

Candidate must have completed the required certifiable competencies for that phase of training and completed the log book appropriate for that phase of training to be eligible for appearing at the final university examination of that subject.

At the time of Practical Examination each candidate shall submit to the Examiners his/ her log book and laboratory record book duly certified by the Head of the Department as a bonafide record of the work done by the candidate. Submission of the log book/ case record to the department is required for eligibility to appear for the final examination of the subject.

KAHER's JAWAHERLAL NEHRU MEDICAL COLLEGE

BELGAVI

DEPARTMENT OF PHYSIOLOGY

MBBS PHASE I

SCHEME OF ASSESSMENT THEORY FORMATIVE AND CONTINUOUS

Formative assessment			Continuous Internal assessment Theory						
1 st PCT	2 nd PCT	Prelims	Home Assignment	Continuou s Class Test (LMS)	Self-directed Learning			Attendance Theory	Total
Theory	Theor y	Theory			Seminar	Museum Study	Library Assignments		
		(Paper I AND II)							
100	100	200	15	30	15	15	15	10	500

KAHER's JAWAHERLAL NEHRU MEDICAL COLLEGE

BELGAVI

DEPARTMENT OF PHYSIOLOGY

MBBS PHASE I

SCHEME OF ASSESSMENT PRACTICAL FORMATIVE AND CONTINUOUS

Formative assessment			Continuous Internal assessment (Practical)						Total
			Log Book (150)				Journal (Record book)	Attendance Practical	
1st PCT Practical	2nd PCT Practical	Prelims Practical	Certifiable skills-based competencies (Through OSPE/OSCE/ Spots /Exercise/ Others)	AETCOM Competencies	SVL Lab+ BSRC activity	Research			
100	100	100	60	30	40	20	40	10	500

MARKS DISTRIBUTION FOR
PHYSIOLOGY UNIVERSITY ANNUAL EXAMINATIONS

Phase of Course	Theory	Practical	Passing criteria
1st MBBS			
Anatomy	Paper 1 - 100 marks	200	<ul style="list-style-type: none"> • In subjects having two papers, the learner must secure minimum 40 % of marks in aggregate (both papers together) to pass in the said subject. • A candidate shall obtain 50 % marks in aggregate together in theory and practical. He/she should obtain 60:40 minimum or 40:60 minimum in University examination separately in theory and practical.
	Paper 2 - 100 marks		
Physiology	Paper 1 - 100 marks	200	
	Paper 2 - 100 marks		
Biochemistry	Paper 1 - 100 marks	200	
	Paper 2 - 100 marks		

Supplementary Examination:

- Supplementary Examination and declaration of results shall be processed within 3-6 weeks from the date of declaration of the results of the main examination.
- If the candidate fails in the supplementary examination of first MBBS, he shall join the batch of next academic/subsequent year. There shall be no supplementary batches.
- A candidate who fails in the First Professional examination, shall not be allowed to join the Second Professional.

Scheme of Summative Examination

Summative Assessment: following points should be considered.

- Each subject shall have Two Theory papers of 100 marks each
- Each subject shall have Practical and Viva-Voce of 100 marks (80+20)
-

University Examination: Theory- 200 marks (2 papers of 100 marks each)

Type & No of Questions		Marks
MCQ	20 X 1 mark each	20
Long Essay	2 X 10 marks each	20
Short Essay	9 X 5 marks each	45
Short Answers	5 X 3 marks each	15
Total Marks		100

A. Theory:

200 Marks

There will be two theory papers of 100 marks each and duration of each paper will be of 3 hours. The pattern of questions would be as follows.

PAPER-I*

Distributions of portion for theory papers will be as follows:

Topics	Type & No. of Questions	Marks
All Topics	MCQ 20 X 1	20
Blood Cardiovascular System Respiratory System Gastrointestinal System Renal System	Long Essays 2 X 10	20
General Physiology Blood Cardiovascular System Respiratory System Gastrointestinal System Renal System	Short Essays 9 X 5	45
General Physiology Blood Cardiovascular System Respiratory System Gastrointestinal System Renal System. (Topic which is not covered in Long Essays can be covered here)	Short Answers 5 X 3	15
Total		100

PAPER-II*

Topics	Type & No. of Questions	Marks
All Topics	MCQ 20 X 1	20
Central Nervous System Special senses Nerve Muscle Physiology Endocrine System Reproductive System	Long Essays 2 X 10	20
Central Nervous system Special senses Endocrine System Reproductive System Nerve Muscle Physiology	Short Essays 9 X 5	45
Central Nervous system Special senses Endocrine System Reproductive System Nerve Muscle Physiology (Topic which is not covered in Long Essays can be covered here)	Short Answers 5 X 3	15
	Total	100

*A strict division of the topic may not be possible and some overlapping is inevitable. Students should be prepared to answer overlapping topics.

Note:

- Case based questions shall be asked in MCQs, Long and Short essays.
- Applied Physiology can be included in both the papers; I and II.

B. Practical:**80 Marks**

There shall be four practical sessions, each carrying 20 marks. The distribution of content and marks for the practical would be:

Practical I: 20 Marks	
Haematology	15
Problem Chart/ Case History	5
Practical II: 20 Marks	
1. Clinical Examination - I (CVS /RS)	15
2. General Physical Examination/ Abdominal Examination	5
Practical III: 20 Marks	
Human Practical	15
Amphibian Graphs	5
Practical IV: 20 Marks	
Clinical Examination - II (CNS)	15
Case History	5
Total	80
Viva: 20 Marks	
General Physiology, Blood, Gastrointestinal System, Renal System	5
Respiratory System, Cardiovascular System, Integrated Physiology	5
Endocrine System, Reproduction System	5
Nerve Muscle Physiology, CNS, Special Senses	5
Total	20
Grand Total of Practical examination	100

- Problem Chart/ Case History and Amphibian Graphs can be in the form of spotters/OSPE

Recommended Books: (Latest Editions)

Textbooks

Sl. No.	Title	Author	Publishers
1.	Text of Medical Physiology	Guyton A. C.	Elsevier Publishers
2.	Review of Medical Physiology	Ganong W F.	Lange/McGraw Hill Companies
3.	Text book of Medical Physiology	Jain A. K.	Avichal Publishing Company
4.	Comprehensive Text book of Medical Physiology	Pal G. K.	Jaypee Brothers Medical Publishers
5.	Textbook of Medical Physiology	CC Chatterjee's Human Physiology	CBS Publishers
6.	Concise Medical Physiology	Chaudhuri S.K.	New Central Book Agency (P) Ltd.
7	Indu Khurana	Textbook of Medical Physiology	Elsevier India

Practical Manuals

Sl. No.	Title	Author	Publishers
1.	Manual of Practical Physiology	Jain A. K.	Arya Publications
2.	A Textbook of Practical Physiology	Ghai C.L	Jaypee Brothers Medical Publishers
3.	Hutchison's Clinical Methods	Hunter, Bomford	Bailliere Tindal

Reference Books: (Latest Books)

Sl. No.	Title	Author	Publishers
1.	Clinical Physiology	Campbell E. J. M.	ELBS
2.	Physiology	Berne R. M. & Levy M. N.	Mosby Publication
3.	Human Physiology	Schmidt R.F. & Thews G.	Springer Verlog,
4.	Physiology & Biophysics	Patton H. D.	W.B.Sounders
5	Text of Physiology	Rainer & Nindhaest	Springer verlog

BIOCHEMISTRY

BIOCHEMISTRY

GOAL

To make the Undergraduate students understand the scientific basis of the life processes at the molecular level and to orient them towards the application of the knowledge in solving clinical problems.

I. Competencies:

The learner must demonstrate an understanding of:

- Biochemical and molecular processes involved in health and disease, Importance of nutrition in health and disease.
- Biochemical basis and rationale of clinical laboratory tests, and demonstrate ability to interpret these in the clinical context.

Broad subject specific objectives

Ia. Knowledge: At the end of the course, the student shall be able to.

- Enlist and describe the cell organelles with their molecular and functional organization.
- Delineate structure, function and interrelationships of various biomolecules and consequences of deviation from the normal.
- Understand basic enzymology and emphasize on its clinical applications wherein regulation of enzymatic activity is disturbed.
- Describe digestion and assimilation of nutrients and consequences of malnutrition.
- Describe and integrate metabolic pathways of various biomolecules with their regulatory mechanisms.
- Explain the biochemical basis of inherited disorders with their associated sequel.
- Describe mechanisms involved in maintenance in water,

electrolyte and acid base balance and consequences of their imbalances.

- Outline the molecular mechanisms of gene expression and regulation, basic principles of biotechnology and their applications in medicine.

Ib. Skills: At the end of the course, the student shall be able to:

- Make use of conventional techniques / instruments to perform biochemical analysis relevant to clinical screening and diagnosis;
- Analysis and interpret investigative data;
- Demonstrate the skills of solving scientific and clinical problems and decision making.

Ic. Integration: The teaching/learning programme should be integrated horizontally and vertically, as much as possible. to enable learners to make clinical correlations and to acquire an understanding of the cellular and molecular basis of health and disease

Id. AETCOM-Attitude, Ethics and Communication Modules: Following modules will be conducted and assessed by the Department of Biochemistry.

Module 1.1	Enumerate and describe the role of a Physician in health care system
Module 1.1	Describe and discuss the commitment to lifelong learning as an important part of Physician growth.

II. DISTRIBUTION OF TEACHING METHODS AND HOURS FOR PHASE-1 MBBS

Interactive Lectures	78 Hours
Practical, Small Group Learning (Tutorials, Seminars/Integrated Learning)	144 Hours
Self-directed learning	10 Hours

Total	232 Hours
Early clinical exposure	9 Hours
AETCOM	4 Hours
Grand total	245 Hours

III. COURSE CONTENTS

Topic: Basic Biochemistry

Introduction to Biochemistry **1 Hrs**

Cell and Subcellular Organelles **2 Hrs**

BI 1.1: Describe the molecular and functional organization of a cell and its subcellular components

- Cell organelles –Biochemical functions
- Cell Membrane - Fluid mosaic model
- Transport across cell membranes with examples
 - Passive transport – Diffusion and facilitated transport (ion channels)
 - Active transport – Primary and Secondary
 - Endocytosis and Exocytosis
 - Aquaporins
 - Applications in clinical care and research

Topic: Enzymes- **8 Hrs**

BI 2.1: Explain the fundamental concepts of Enzyme, Isoenzyme, Alloenzyme, Coenzyme & Co- factors. Main classes of IUBMB nomenclature.

- Enzymes- Definition, General properties, IUBMB Classification.
- Cofactors, Coenzymes, metalloenzymes and metal activated enzyme
- Enzyme specificity

BI 2.3: Describe and explain the Basic principles of enzyme activity

- Factors affecting enzyme activity
- Effect of substrate concentration - Michaelis -Menton theory(derivation not required), Km value and its significance
- Mechanism of enzyme action; Substrate strain theory, covalent catalysis, Acid base

catalysis, Metal ion catalysis.

- Enzyme regulation by- short term (Covalent modification, Zymogen activation, Allosteric regulation, Feedback regulation) and long-term regulation (Induction and repression)

BI 2.4: Describe and discuss enzyme inhibitors as poisons and drugs and as therapeutic enzymes

- Enzyme inhibition – Competitive, Non-competitive and Uncompetitive inhibition with examples of clinical importance
 - Suicide inhibition

BI 2.5: Describe and discuss clinical utility of various serum enzymes as markers of pathological conditions.

BI 2.7: Interpret Laboratory results of enzyme activities & Clinical utility of various enzymes as markers of pathological conditions-

Clinical Enzymology – Concept of plasma functional and non-functional enzymes

- Diagnostic Importance of enzymes – LDH, CK, AST, ALT, ALP, GGT, Amylase, Lipase, ACP, 5' nucleotidase
- Isoenzymes – Definition, Diagnostic Importance of isoenzymes with examples.
- Enzymes as Therapeutic agents

BI 2.6: Discuss use of enzymes in laboratory investigations (Enzyme-based assays)

- Enzymes used in diagnostic assays as laboratory reagents/analytical reagents

Topic: Chemistry and Metabolism of Carbohydrates – 11 Hrs

BI 3.1: Discuss and differentiate monosaccharides, di-saccharides and polysaccharides - examples of main carbohydrates as energy fuel, structural element and storage in the human body

- Carbohydrates: Definition, Biomedical importance, Classification with examples

- Monosaccharide derivatives – Uronic acids, amino sugars, Glycosides, Sorbitol, Mannitol and their Clinical significance.
- Disaccharides, oligosaccharides –composition and clinical significance
- Polysaccharides –Homopolysaccharides – Composition and Importance of starch, glycogen, Dextran, Cellulose and Inulin.
- Heteropolysaccharide – Mucopolysaccharides: Composition, function and clinical significance
- Concept of glycation, glycosylation and its clinical significance
- Importance of Glycoproteins

BI 3.2 and BI 3.3: Describe the processes involved in digestion and assimilation of carbohydrates from food and its storage

- Digestion and absorption of carbohydrates and its clinical significance
- Lactose intolerance
- Glucose transporters: Insulin dependent and Insulin independent uptake of glucose by tissues

BI 3.4: Define and differentiate the Pathways of carbohydrate metabolism

BI 3.5 and BI 3.7: Describe and discuss the regulation, functions and integration of carbohydrate along with associated diseases/disorders. Describe the Common poisons that inhibit crucial enzymes of carbohydrate metabolism (e.g.; fluoride, arsenate)

- Glycolysis (Aerobic and Anaerobic)- Site, substrates, key steps, energetics, regulation, inhibitors and its clinical Significance. Action of Fluoride on Glycolysis
- Rapaport Luebering cycle and its significance
- Gluconeogenesis- Site, substrates, key steps, energetics, regulation and its clinical Significance
- Cori's cycle and Glucose alanine cycle

- Glycogen Metabolism (Glycogenesis, Glycogenolysis)- Site, substrates, key steps, energetics, regulation and its clinical Significance
- Inborn errors of carbohydrate metabolism: Glycogen storage disorders
- Significance of HMP shunt pathway and uronic acid pathway
- Glucose-6-Phosphate dehydrogenase deficiency
- Galactosemia, Essential Fructosuria, Hereditary fructose intolerance

BI 3.6 and BI 3.7: Describe and discuss the Concept of TCA cycle as amphibolic pathway and its regulation. Describe the Common poisons that inhibit crucial enzymes of carbohydrate metabolism (e.g.; fluoride, arsenate). Citric acid cycle- Site, substrates, key steps, energetics, regulation, inhibitors and its clinical Significance.

- Amphibolic role and Anaplerotic reaction of TCA Cycle.
- Action of Arsenate, Malonate and Flouroacetate on TCA cycle

BI 3.8: Discuss and interpret the Laboratory results of analytes associated with metabolism of carbohydrates- Discussion and interpretation of

- Galactosemia
- Hereditary fructose intolerance
- Von Grike's disease
- Diabetes mellitus
- Poor glycemic control of DM with complication of keto acidosis.
- Chronic Complications of Diabetes mellitus

BI 3.9: Discuss the mechanism and significance of blood glucose regulation in health and disease.

BI 3.10: Interpret the Results of blood glucose levels and other laboratory investigations related to disorders of carbohydrate metabolism- Interpretation-

- Regulation of blood glucose levels in well fed condition and fasting/ starvation
- Guidelines for diagnosis of Diabetes mellitus
- Diabetes mellitus – types, metabolic changes, complications and monitoring of DM patients
- Glucose Tolerance Test

Topic: Chemistry and Metabolism of Lipids –

12 Hrs

BI 4.1: Describe and discuss the main classes of lipids (Essential/non-essential fatty acids, cholesterol and hormonal steroids, triglycerides, major phospholipids and sphingolipids) relevant to human system and their major functions.

- Definition, Modified Bloor's classification with examples.
- Clinical significance of lipids
- Fatty acids - Definition, examples and importance of Essential fatty acids, Mono and Polyunsaturated fatty acids, omega 3, omega 6 fatty acids and Trans- fatty acids.
- Triacylglycerol – composition and importance
- Phospholipids - Types, functions with clinical importance, respiratory distress syndrome
- Glycolipids – Types and importance
- Cholesterol - structure and biological importance
- Lipoproteins - Types and functions

BI 4.2: Describe the processes involved in digestion and absorption of dietary lipids and key features of their metabolism-

- Digestion and Absorption of Lipids
 - Steatorrhea
- Key features of following Pathways – Site, substrates, key steps, energetics, regulation

and its clinical Significance

- Beta oxidation
- Ketogenesis, ketolysis
- Cholesterol biosynthesis upto mevalonate. Derivatives of Cholesterol
- Other types of Oxidation of fatty acids and associated disorders

BI 4.3: Explain the regulation of lipoprotein metabolism & associated disorders.

BI 4.4: Describe the structure and functions of lipoproteins, their functions, interrelations & relations with atherosclerosis

- Lipoprotein metabolism- Structure, Composition, Types, Functions and metabolism of Chylomicrons, VLDL, LDL, HDL
- Atherosclerosis – definition, role of lipids in atherogenesis (LDL, Oxidized LDL, Lp(a), Small dense LDL, HDL)
- Hyperlipoproteinemias
- Biochemical basis of use of hypolipidemic drugs
- Fatty liver and lipotropic factors

BI 4.5: Interpret laboratory results of analytes associated with metabolism of lipids

BI 4.7: Interpret laboratory results of analytes associated with metabolism of lipids-

Interpretation of

- Lipid profile, Dyslipidemia
- Lab tests in Myocardial infarction

BI 4.6: Describe the therapeutic uses of prostaglandins and inhibitors of eicosanoid synthesis.

- Outline of Prostaglandins and eicosanoid synthesis
- Biological functions of PGs
- Therapeutic uses of prostaglandins and inhibitors of eicosanoid synthesis

Topic: Chemistry and Metabolism of Proteins-

16 Hrs

BI 5.1: Describe and discuss structural organization of proteins-

- Amino acids – Classification based on side chain properties, nutritional requirement and on basis of metabolic fate
- Standard and non-standard amino acids
- Isoelectric pH
- Primary, secondary, super secondary structures/ motifs, domains, tertiary and quaternary structures and its clinical significance
- Bonds stabilizing protein structure

BI 5.2: Describe and discuss functions of proteins and structure-function relationships in relevant areas e.g., hemoglobin and selected hemoglobinopathies

- Proteins – Definition, Classification based on functions and nutritional value
- Denaturation - definition, causes, properties of a denatured protein, significance.
- Structure function relationship of proteins - hemoglobin, myoglobin, collagen and Insulin

BI 5.3: Describe the Digestion and absorption of dietary proteins.

- Digestion and absorption, and associated disorders

BI 5.4: Describe Common disorders associated with protein metabolism.

- General reactions – Transamination, Transmethylation, Transdeamination, Deamination - Oxidative and nonoxidative and their significance.
- Biogenic amines
- Sources and fate of ammonia - Trapping, Transport and Disposal of ammonia, ammonia toxicity. Urea cycle and its disorders.
- Amino acid metabolism
 - Glycine – specialised products and their importance
 - Phenylalanine, Tyrosine – metabolic pathway, synthesis of catecholamines, other

specialised products formed from tyrosine and their importance. Phenylketonuria, Albinism, Alkaptonuria, Tyrosinemia, Pheochromocytoma

- Tryptophan- synthesis of serotonin and melatonin and their importance. Hartnup's disease, Carcinoid syndrome
- Sulphur containing amino acids – functions of cysteine and methionine. Synthesis and Functions of SAM, SAH. Homocysteine and Homocysteinemia

- Formation of Nitric oxide and its importance
- Important functions/products from histidine, serine, Aspartate, Asparagine, glutamate, glutamine, serine, branched chain amino acids. Maple Syrup Urine Disease, Aminoaciduria

BI 5.5: Interpret laboratory results of analytes associated with metabolism of proteins- Interpretation

BI 11.5: Describe screening of urine for inborn errors & describe the use of paper chromatography

- Newborn screening tests- Interpretation of laboratory reports of Inborn errors of metabolism.
- Inborn errors of metabolism – enzyme defects, clinical features, laboratory diagnosis and biochemical basis of management of – PKU, Tyrosinosis, Alkaptonuria, Albinism, Homocystinuria, Maple syrup urine disease (MSUD)

Topic: Metabolism and homeostasis – 43 Hrs

Metabolism in specialized tissues 4 hrs

BI11.1 to 11.19: Plasma proteins 1 hrs

- Functions of albumin, importance of ferritin, transferrin, alpha 1 acid glycoprotein and C reactive protein, Multiple myeloma

BI 6.1: Discuss the metabolic processes that take place in specific organs in the body in the fed and fasting states.

- Metabolic processes taking place in specific organs in the body in fed, fasting, exercise states and starvation.
- Adipose tissue – Hormones secreted from adipose tissue (adipokines – leptin, adiponectin) their functions and role in hunger and satiety.

Nucleotide metabolism

3 hrs.

BI 6.2: Describe and discuss metabolic processes in which nucleotides are involved.

BI 6.3: Describe the common disorders associated with nucleotide metabolism.

BI 6.4: Discuss the laboratory results of analytes associated with gout & Lesch Nyhan syndrome

- Enumerate the Purines and Pyrimidines.
- Define Nucleotides and Nucleoside
- Outline of de novo synthesis of purines and pyrimidines
 - Sources of atoms of Purine and Pyrimidine ring
- Salvage pathway of purine biosynthesis and Significance
 - Describe the degradation of Purine nucleotides: Site, substrates, key steps, energetics, regulation, inhibitors and its clinical Significance.
- Etiology, manifestations and biochemical basis of clinical manifestations of Gout
- Purine analogues used as anticancer drugs
- Etiology, manifestations and biochemical basis of clinical manifestations of –Lesch Nyhan syndrome, SCIDS and Orotic aciduria

Vitamins

12 hrs

BI 6.5: Describe the biochemical role of vitamins in the body and manifestations of their deficiency

- Definition and classification of Vitamins
- Fat soluble vitamins (A, D, E, K)- RDA, Sources, Absorption, Storage, Biochemical functions, Deficiency manifestations and hypervitaminosis.

- Water soluble vitamins (Vitamin C, Folic acid, Vitamin B12, Thiamine, Riboflavin, Niacin, Pyridoxine, Biotin, Pantothenic acid)- RDA, Sources, Biochemical functions, Deficiency manifestations
- Antivitamins

Minerals

5 hrs

BI 6.9: Describe the functions of various minerals in the body, their metabolism and homeostasis

BI 6.10: Enumerate and describe the disorders associated with mineral metabolism.

- Major elements and trace elements
- Calcium, phosphorus, Iron- Sources, RDA, absorption and transport, Homeostasis, Functions, Biological reference range, disorders associated with them
- Copper, Zinc, Selenium, Fluoride, Iodine, Magnesium, Molybdenum- Sources, RDA, Functions and disorders associated with it.

Biological oxidation and Electron Transport Chain

2 hrs

BI 6.6: Biochemical processes involved in generation of energy in cells.

- High Energy Compounds – Definition and Biological significance.
- Enumerate the enzymes and coenzymes involved in transporting the reducing equivalents across mitochondria.
- Electron Transport Chain – Organization, components, flow of electrons.
 - Oxidative Phosphorylation – Sites, mechanism (Chemiosmotic theory).
 - Inhibitors of Electron Transport Chain and oxidative phosphorylation. Uncouplers and their significance.
 - Indicate the role of Mitochondria in apoptosis and list the diseases due to energy production in mitochondria- OXPHOS diseases.

Water and acid base balance and Imbalance

7 hrs

BI 6.7: Describe the processes involved in maintenance of normal pH, water & electrolyte

balance of body fluids and the derangements associated with these.

BI 6.8: Discuss and interpret results of Arterial Blood Gas (ABG) analysis in various disorders- Interpretation

- Compartmental distribution of water and electrolytes in ICF and ECF
- Regulation of water and electrolyte balance
- Disorders of Water imbalance- Dehydration, contraction, depletion and expansion
- Disorders of electrolyte imbalance – causes and clinical features of Hyperkalemia, Hypokalemia, Hypernatremia, Hyponatremia
- Regulation of pH of blood by buffers, respiratory and renal mechanisms
- Anion gap and its significance
- Acidosis and alkalosis (metabolic and respiratory) – causes, compensatory mechanisms and lab findings

Hemoglobin metabolism

4 hrs

BI 6.11: Describe the functions of haem in the body and processes involved in its metabolism. Porphyrin metabolism.

- Biosynthesis of Heme and associated disorders – Trace pathway of biosynthesis of Heme- Site, substrates, key steps, energetics, regulation, and its clinical Significance.
- Porphyrins- enumerate the different types of Porphyrins with their enzyme defect.
- Describe the salient features of Acute intermittent Porphyria
- Degradation of Heme (bilirubin metabolism) and their associated disorders- Site, substrates, key steps, energetics, regulation, and its clinical Significance.
- Describe in detail heme degradation and bilirubin metabolism
- Jaundice – definition, types, causes, lab diagnosis,
- Congenital hyperbilirubinemias

BI 6.12: Describe the major types of hemoglobin and its derivatives found in the body and their physiological/ pathological relevance.

- Normal Hemoglobin variants/derivatives – Adult, fetal and embryonic types
- Abnormal hemoglobin variants/derivatives– carboxy, sulph, metHb.
- Hemoglobinopathies – molecular defects, pathophysiological changes in thalassemia's

and sickle cell anemia

Organ function tests

6 hrs

BI 6.13: Describe the functions of the kidney, liver, thyroid and adrenal glands.

BI 6.14: Describe the tests that are commonly done in clinical practice to assess the functions of these organs (kidney, liver, thyroid and adrenal glands).

BI 11.3 Describe the chemical components of normal urine.

BI 11.4 Urine analysis to estimate and determine normal and abnormal constituents.

BI 11.17: Explain the basis and rationale of biochemical tests done in the following conditions: Diabetes mellitus, Dyslipidemia, Myocardial infarction, Renal failure, Gout, Proteinuria, Nephrotic syndrome, Edema, Jaundice, Liver diseases, Pancreatitis, Disorders of acid- base balance, Thyroid disorders

BI 6.15: Abnormalities of kidney, liver, thyroid and adrenal glands.

- Liver function tests
Functions of liver, Indications, classification and interpretation with knowledge of normal biological ranges.
- Kidney function tests
Functions of kidney, Indications, classification and interpretation with knowledge of normal biological ranges.
- Thyroid function tests
Functions of thyroid, Indications, classification and interpretation with knowledge of normal biological ranges.
- Adrenal function tests
Functions of adrenal, Indications, classification and interpretation with knowledge of normal biological ranges.
- Mechanism of action of Group I and Group II hormones

Topic: Molecular biology –

12 Hrs

BI 7.1: Describe the structure and functions of DNA and RNA. Outline of cell cycle.

- Nitrogenous bases: Purines and Pyrimidines (Major, Minor, Free Bases)
- Nucleosides and Nucleotides – Structure, examples, Importance

- Nucleoside derivatives: NMP, NDP, NTP cAMP, SAM, PAPS, UDP sugars etc
- Synthetic Nucleotide Analogues and their application
- Structure and function of DNA (B-DNA)
- Structural organization of DNA to form chromatin (Primary and Secondary)
- Types of RNA (hnRNA, mRNA, rRNA, tRNA, snRNA) with structure and functions
- microRNA (miRNA) and small interfering RNA (siRNA) and their applications in medicine
- Cell cycle- Phases and significance.

BI 7.2: Describe the processes involved in replication & repair of DNA. Transcription & translation mechanisms.

- DNA replication - prokaryotic and eukaryotic replication, requirements, process, inhibitors, Telomere, Telomerase and its importance
- DNA repair mechanisms. Diseases associated with DNA repair
- Transcription process- Transcriptional units, promoter regions, RNA polymerases in prokaryotes and eukaryotes, Differences between prokaryotic and Eukaryotic transcription and Inhibitors of transcription process. Post transcriptional modifications of mRNA
- Genetic Code and its characteristics
- Protein Biosynthesis: Requirements and activation of amino acids, Translation in Eukaryotes, Inhibitors of Translation. Post translational modifications

BI 7.3: Describe gene mutations. Basic mechanism of regulation of gene expression.

- Mutations, causes, types of mutation, Consequences with examples
- Regulation of Gene expression: Gene, introns, exons, cistron
- Regulation of gene expression in prokaryotes with illustration of Lac Operon concept.
- Regulation of gene expression in eukaryotes – Role of enhancers, repressors, DNA regulatory elements, gene amplification, gene rearrangement, RNA processing, RNA editing, mRNA stability.

BI 7.4: Describe applications of molecular technologies like recombinant DNA technology, PCR in the diagnosis and treatment of diseases with genetic basis.

- Recombinant DNA technology, DNA cloning - process and application
- PCR technique and its application
- Blotting techniques
- Concept, types and application of gene therapy.
- DNA Polymorphism, SNP, VNTR, RFLP
- DNA genomic and cDNA libraries
- DNA Probes
- DNA Microarrays
- Overview of Human Genome Project HGP

Detoxification and Biotransformation of xenobiotics

2 hrs

BI 7.5: Describe the role of xenobiotics in disease

- Phase –I reactions and Phase-II reactions: Oxidation, Hydroxylation, reduction, hydrolysis, Acetylation, Methylation, and Conjugation reactions-Glucuronic acid, Glutathione, Glycine
- Xenobiotics and disease caused.
- Biotransformation
- Cytochrome P450 system

BI 7.6: Describe the anti-oxidant defense systems in the body.

BI7.7: Role of oxidative stress in the pathogenesis of conditions such as cancer, complications of diabetes mellitus and atherosclerosis.

- Free radicals: Generation of Reactive oxygen species (ROS), Damage produced reactive oxygen species, Lipid peroxidation, free radical Scavenging system
- Anti-oxidant defense system of our body – enzymes, vitamins, metabolites as antioxidants
- Role of oxidative stress in atherosclerosis, diabetes mellitus and cancer

Topic: Nutrition

5 Hrs

BI 8.1: Discuss the importance of various dietary components and dietary fiber

BI 8.6: Nutritional importance of commonly used items of food including fruits and vegetables.

(Macro- molecules & its importance)

BI11.24: Enumerate advantages and/or disadvantages of use of unsaturated, saturated and Trans fats in food.

- Calorific Value: Definition, Calorific Value of Foods
- Respiratory quotient: Definition, RQ of carbohydrates, proteins, lipids.
- Nutritional importance of Carbohydrates- Dietary sources, Dietary fibres – definition, examples, importance, Glycemic index – definition, calculation, importance
- Nutritional importance of Lipids-Dietary sources, Requirements, Essential fatty acids, polyunsaturated fatty acids, Hazards of Trans fatty acids, Benefits and hazards of cholesterol
- Nutritional importance of Proteins –Dietary sources, Requirements, essential amino acids, Nitrogen balance, quality of proteins (Biological value of proteins.)
- Nutritional importance of Vitamins and minerals,
- Balanced diet – definition, composition

BI 8.3: Provide dietary advice for optimal health in childhood and adult, in disease conditions like diabetes mellitus, coronary artery disease and in pregnancy.

- BMR – Definition, Normal values, Factors affecting BMR
- SDA – Definition SDA of macromolecules and significance (Thermogenic effect of food)
- Physical activity
- Energy requirement for optimal health: Calculation of calorific requirement in mild, moderate, severe workers, pregnant and lactating women
- Dietary advices for diabetes and coronary artery disease.

BI 8.2: Describe the types and causes of protein energy malnutrition and its effects

- Types, causes and effects of Protein energy malnutrition

BI8.4: Describe the causes (including dietary habits), effects and health risks associated with being overweight/ obesity.

- Obesity – Definition, BMI, types, causes, role of GI peptides and adipokines in obesity, associated health risks (e.g., metabolic syndrome)

Topic: Extracellular Matrix-**2 Hrs**

BI 9.1: List the functions and components of the extracellular matrix (ECM)

BI 9.2: Discuss the Involvement of ECM components in health and disease

BI 9.3: Describe protein targeting & sorting. Associated disorders.

- Composition and functions of ECM – Proteins: Composition and functions of Collagen, elastin, fibrillin, fibronectin, laminin and Proteoglycans.
- Disorders associated with extracellular matrix. E.g. Osteogenesis Imperfecta, Ehler-Danlos syndrome, Scurvy, Alpha anti trypsin deficiency.
- Protein targeting and sorting, Disorders associated with protein targeting and sorting.

Topic: Oncogenesis and immunity-**3 Hrs**

BI 10.1: Describe the cancer initiation, promotion, oncogenes & oncogene activation. p53 and apoptosis.

BI 10.2: Describe various biochemical tumor markers and the biochemical basis of cancer therapy.

- Cell cycle, regulation, abnormal cell growth, programmed cell death (apoptosis)
- Mutagens and carcinogens: Definitions, examples and their actions in carcinogenesis
 - Proto oncogenes and their activation, oncogenes, tumour suppressor genes and their role in development of cancer
 - Oncogenic viruses (HPV and cervical cancer)
 - Growth factors and their receptors.
 - Tumour markers and their importance in diagnosis and prognosis of cancer
 - Cell signalling (action of hormones and growth factors) – Cell surface receptors
 - G protein coupled signaling, catalytic receptor signaling, steroid receptor signaling
 - Biochemical basis of cancer therapy – alkylating agents, antimetabolites, topoisomerase inhibitors, antibiotics, hormones, receptor blockers, radiotherapy etc
 - Monoclonal antibodies and their application

BI 10.3: Describe the cellular and humoral components of the immune system. Types and structure of antibody

BI 10.4: Describe and discuss innate and adaptive immune responses, self/non-self-recognition and the central role of T-helper cells in immune responses

BI 10.5: Describe antigens and concepts involved in vaccine development.

- Innate and adaptive/acquired immunity: definition and difference
- Cellular and humoral components of Innate and adaptive immunity
- Concept of self/non-self-recognition, immune tolerance and autoimmunity
 - Immunoglobulins – Classes, structure function relationship
 - Ig class switching
 - Types of acquired immunity
 - Vaccination: Definition, immunological developments of vaccination, types of vaccines
 - Recombinant DNA technology in vaccine development.

Topic: Biochemical Laboratory Tests/Biochemistry Practicals

60 Hrs

The following list of practical is minimum and essential. Additional exercise can be included as and when feasible and required. All the Practical's have been categorized as "skill Practical's/procedures" and "Demonstrations". The procedures are to be performed by the students during practical classes to acquire skills. Some of these would be included in the practical during university examination. Those categorized as "Demonstrations" are to be shown to students during practical classes. However, these demonstration practicals would be given in the form of charts, problems and case- histories for interpretation by students in the examinations (OSPE).

PERFORM (SKILL) AND INTERPRETATION-DOAP SESSIONS

BI 11.21 Demonstrate estimation of glucose, creatinine, urea and total protein in serum.

BI 11.7 Demonstrate the estimation of serum creatinine and creatinine clearance

BI 11.8 Demonstrate estimation of serum proteins, albumin and A:G ratio

BI 11.22 Calculate albumin: globulin (AG) ratio and creatinine clearance

BI 11.4 and BI 11.20 Urine analysis to estimate and determine normal and abnormal constituents

BI 11.20 Identify abnormal constituents in urine, interpret the findings and correlate these with pathological states.

BI 11.4: Perform urine analysis to estimate and determine normal constituents

- Examine Physical properties.
- Chemical constituents: Inorganic constituents (Calcium, Phosphorus and Ammonia) and Organic constituents (Urobilinogen, Urea, Uric acid and Creatinine)

BI 11.20: Perform urine analysis to estimate and determine abnormal constituents in urine interpret the findings and correlate these with pathological states.

- Chemical tests for Glucose, Ketone Bodies, Blood, Proteins, Bile salts and Bile Pigments
- Demonstration by using Dip sticks

BI 11.21: Estimation of glucose

- Analyze the given case, estimate blood glucose by standard method and interpret the results.

BI 11.21: Estimation of urea

- Analyze the given case, estimate blood urea by standard method and interpret the results.

BI 11.7: Estimation of serum creatinine and creatinine clearance

- Analyze the given case, estimate blood and urine creatinine by standard method and interpret the results.

BI 11.8: Estimation of serum proteins, albumin and A: G ratio

- Analyze the given case, estimate serum proteins, albumin and calculate A: G ratio by standard method and interpret the results.

Demonstration and interpretations/Laboratory visit/BSRC VISIT/KLE'S Advanced Simulation Centre and Skill laboratory

BI 11.1 Commonly used laboratory apparatus and equipment's, good safe laboratory practice and waste disposal and BI 11.19 Outline the basic principles involved in the functioning of instruments commonly used in a biochemistry laboratory and their applications

- Observe Lab safety and Biomedical waste disposal, commonly used lab equipment, glassware and reagents
- BI 11.19, BI 11.6 and BI 11.18: Outline the basic principles involved in the functioning of instruments commonly used in a biochemistry laboratory and their applications
- Demonstrate the Colorimeter, spectrophotometer, pH meter
- BI 11.2, 11.16: Describe the preparation of buffers and estimation of pH.

- Observe Preparation of buffers and estimation of pH using pH meter
- BI 11.9 Demonstrate the estimation of serum total cholesterol and HDL- cholesterol
- Estimation of Total cholesterol and High-density lipoprotein (HDL) cholesterol
- BI 11.10 Demonstrate the estimation of triglycerides
- Estimation of Triglycerides
- BI 11.11 Demonstrate estimation of calcium and phosphorous
- Estimation of Calcium and Phosphorous
- BI 11.12 Demonstrate the estimation of serum bilirubin
- Estimation of Serum Bilirubin
- BI 11.13 Demonstrate the estimation of SGOT/ SGPT and BI2.2: Observe the estimation of SGOT & SGPT
- Estimation of AST(SGOT), ALT(SGPT) activity BI 11.14 Demonstrate the estimation of alkaline phosphatase, Estimation of ALP activity
- BI 11.16, BI 11.5, BI 5.5, and BI 11.19 Observe use of commonly used equipment's/ techniques in biochemistry laboratory including pH meter/ ABG/ISE. Paper chromatography of amino acid, Protein electrophoresis, TLC, PAGE, Electrolyte analysis by ISE, ABG analyzer, ELISA, Immunodiffusion
- Demonstrate serum protein electrophoresis, types and applications
- Observe paper chromatography/TLC of amino acids/sugars, types and applications.

Hospital Laboratory visit and collection centre

- Specimen collection and preanalytical errors in clinical Biochemistry:
- Basic concepts of clinical chemistry laboratory, Clinical chemistry autoanalyzer (Automation – advantages) and quality control (Internal and External quality control, Precision, Accuracy, QC rules), Biological reference intervals
- Blood gas analysis using ABG analyzer
- Estimation of serum electrolytes by ISE

BSRC (Basic Science Research Centre) Visit

- Enumerate the list of equipment's and their applications
- Principle, procedure and applications of ELISA, protein extraction, Blotting techniques, PAGE
- Principle, procedure and applications of PCR, DNA isolation
- Immunodiffusion

KLE'S Advanced Simulation Centre and Skill laboratory

BI11.15 Describe & discuss the composition of CSF

- Analysis of CSF

CERTIFICATION OF SKILL

SL NO	Skill with Competency Number	Number required to certify as per NMC
1	BI 11.4 Perform urine analysis to estimate and determine normal constituents	1 each x 3
2	BI 11.4 - BI 11.20 Perform urine analysis to estimate and determine abnormal constituents in urine interpret the findings and correlate these with pathological states.	1 each x 3
3	BI 11.7 Estimation of serum creatinine and creatinine clearance	1 each x 3
4	BI 11.8 Estimation of serum proteins, albumin and A:G ratio	1 each x 3
5	BI 11.21 Estimation of glucose and Demonstrate the use of glucometer	1 each x 3
6	BI 11.21 Estimation of urea	1 each x 3

EARLY CLINICAL EXPOSURE:

Sl No	Topic	Setting	Department
1.	Vitamin A deficiency	Classroom	Ophthalmology

2.	Vitamin D deficiency-	Classroom	Biochemistry
3.	AITO- DM-Diabetes Mellitus	Hospital	General Medicine
4.	Dyslipidaemia	Classroom	General Medicine
5.	Thyroid Disorders	Classroom	Endocrinology
6.	GOUT	Classroom	Biochemistry
7.	Jaundice	Hospital	General medicine
8.	IEM(Inborn Errors of Metabolism)	Classroom	Child Development Clinic
9.	Nephrotic Syndrome	Hospital	Paediatrics
10.	Protein Energy Malnutrition	Community	Community Medicine

* The above mentioned ECE topics are subjected to necessary changes as per the incidence and frequency of disease

SELF DIRECTED LEARNING:

Ten hours of dedicated time for SDL is provided for Biochemistry, which will also be assessed periodically. The SDL will be conducted as seminars, museum studies and library assignments.

INTEGRATED TEACHING

Systems have been horizontally aligned within the subjects of MBBS Phase I, as well as vertically integrated with other Phases of MBBS.

HOME ASSIGNMENT and CONTINUOUS CLASS TEST: Will be conducted periodically.

SVL activity in KLE'S Advanced Simulation Centre And Skill Laboratory

Students will Visit the stimulation and skill laboratory in batches and assessment will be done after the visits.

III. ASSESSMENT AND ELIGIBILITY

A) ATTENDANCE

Every candidate must have minimum of 75% attendance in theory; which includes Interactive lectures and Self-directed learning (SDL). Students are expected to have minimum of 75% attendance in each of these components separately.

The candidate must have minimum of 80% attendance in practical separately; which includes early clinical exposure (ECE), practical/small group teaching (SGT) and tutorial. Students are expected to have minimum of 75% attendance in each of these components separately.

The candidate must have minimum of 75% attendance in AETCOM separately. The academic year is calculated from date of commencement of academic session to the last working day as notified by the university to be eligible to appear for university examination in that subject.

Attendance in both internal examinations/part completion tests and preliminary examination is compulsory. Refer Annex I-III

B) INTERNAL ASSESSMENT

Internal assessment shall be based on day-to-day assessment. It shall relate to different ways in which learners participate in learning process which includes Part completion tests, home assignments, continuous class tests, self directed learning (seminar, museum and library assignments) in theory and in practicals students should have successfully completed certifiable skills competencies, AETCOM competencies, activity related to stimulated laboratory, BSRC laboratory and research activity. The learner must have completed log book and practical record book.

There will be two, part completion tests and one preliminary examination both in theory and practical. The candidate must score minimum of 40% marks in internal assessment of theory and practical separately. Candidate must secure at least 50% marks combined in theory and practical to be eligible for appearing at the final University examination. (Refer Annex I-III).

Internal assessment marks shall not be added to summative assessment. However, internal assessment will be displayed under a separate column in detailed marks card.

As per the decision of Authority and subject expert, the Candidates (with genuine reasons only) not securing minimum eligibility are required to write additional 'Betterment' Internal Assessment before the final university examination.

C) SUBMISSION OF LOG BOOK AND LABORATORY RECORD NOTE BOOK Refer to table for scheme of assessment in practicals

Candidate must have completed the required certifiable competencies for that phase of training and completed the log book appropriate for that phase of training to be eligible for appearing at the final university examination of that subject.

At the time of Practical Examination each candidate shall submit to the Examiners his/ her log book and laboratory record book duly certified by the Head of the Department as a bonafide record of the work done by the candidate. Submission of the log book/ case record to the department is required for eligibility to appear for the final examination of the subject.

ANNEXURE-I**JAWAHERLAL NEHRU MEDICAL COLLEGEKAHER's****BELGAVI****DEPARTMENT OF BIOCHEMISTRY****MBBS PHASE I****SCHEME OF ASSESSMENT THEORY FORMATIVE AND CONTINUOUS**

Formative assessment			Continuous Internal assessment Theory						
1st PCT	2nd PCT	Prelims	Home Assignment	Continuou s Class Test (LMS)	Self-directed Learning			Attendance Theory	Total
Theory	Theor y	Theory			Seminar	Museum Study	Library Assignments		
		(Paper I & II)							
100	100	200	15	30	15	15	15	10	500

ANNEXURE-II
JAWAHERLAL NEHRU MEDICAL COLLEGEKAHER's
BELGAVI
DEPARTMENT OF BIOCHEMISTRY
MBBS PHASE I
SCHEME OF ASSESSMENT PRACTICAL FORMATIVE AND
CONTINUOUS

Formative assessment			Continuous Internal assessment (Practical)					Journal (Record book)	Attendance Practical	Total
			Log Book (150)				Research			
1 st PCT Practical	2 nd PCT Practical	Prelims Practical	Certifiable skills-based competencies (Through OSPE/OSCE/ Spots /Exercise/ Others)	AETCOM Competencies	SVL Lab+ BSRC activity	Research				
100	100	100	60	30	40	20	40	10	500	

ANNEXURE III
MARKS DISTRIBUTION FOR
BIOCHEMISTRY UNIVERSITY ANNUAL EXAMINATIONS

Phase of Course	Theory	Practicals	Passing criteria
1st MBBS			
Anatomy	Paper 1 - 100 marks	200	<ul style="list-style-type: none"> • In subjects having two papers, the learner must secure minimum 40 % of marks in aggregate (both papers together) to pass in the said subject. • A candidate shall obtain 50 % marks in aggregate together in theory and practical. He/she should obtain 60:40 minimum or 40:60 minimum in University examination separately in theory and practical.
	Paper 2 - 100 marks		
Physiology	Paper 1 - 100 marks	200	
	Paper 2 - 100 marks		
Biochemistry	Paper 1 - 100 marks	200	
	Paper 2 - 100 marks		

Supplementary examinations and declaration of results shall be processed within 3-6 weeks from the date of declaration of the results of the main examination every professional year, so that the students, who pass, can join the main batch for progression.

If the student fails in the supplementary examination of first MBBS, he shall join the batch of next academic /subsequent year. There shall be no supplementary batches. Partial attendance of examination in any subject shall be counted as an attempt.

A student, who fails in the First Professional examination, shall not be allowed to join the Second Professional.

SCHEME OF BIOCHEMISTRY SUMMATIVE EXAMINATION

Summative Assessment following points should be considered.

- Each subject shall have Two theory papers of 100 marks each
- Each subject shall have Practicals and viva voce of 100 marks

University Examination: Theory- 200 marks (2 papers of 100 marks each)

	Topics	Type of Questions	Marks distribution
Theory Paper I	<ul style="list-style-type: none"> • Molecular and functional organization of a cell and its subcellular components • Enzymes • Chemistry and Metabolism of Carbohydrates • Chemistry and Metabolism of Lipids • Chemistry and Metabolism of Proteins • Nutrition 	MCQ Long Essay Short Essay Short Answers	MCQs 20x1= 20 LEQ 2 x10=20 SEQ 9x5 = 45 SAQ 5x3 = 15
Theory Paper II	Metabolism and Homeostasis <ul style="list-style-type: none"> • Metabolism in specialised tissue • Plasma proteins • Nucleotide metabolism • Vitamins • Minerals • Biological oxidation • Water and acid base balance • Haemoglobin metabolism • Organ function test • Molecular Biology • Detoxification and antioxidant system • Extracellular Matrix • Oncogenesis and Immunity • AETCOM-Attitude, Ethics and Communication module. 	MCQ Long Essay Short Essay Short Answers	MCQs 20 x 1 =20 LEQ 2x 10 = 20 SEQ 9 x 5 = 45 SAQ 5 x 3= 15 *1 question on AETCOM carrying 3 marks shall be asked in paper II compulsorily.

*** Case based question shall be one MCQ, one short essay and one long essay**

***A strict division of the topic may not be possible and some overlapping of topics is inevitable. Students should be prepared to answer overlapping topics.**

BIOCHEMISTRY UNIVERSITY PRACTICAL EXAMINATION

80 marks + Viva Voce 20 marks- Total 100 marks

Practical- 80 marks (4 exercises)	Exercises	Marks
Objective Structured Practical Examination (OSPE):	4 stations (each carrying 5 marks)	20 marks
Qualitative analysis:	Urine analysis to estimate and determine normal and abnormal constituents	20 marks
Quantitative analysis:	Performance of any one of the following •Estimation of plasma glucose •Estimation of serum and urine creatinine and Creatinine Clearance calculations •Estimation of blood urea •Estimation of Total Protein and Albumin in serum. Calculation of A:G ratio	20 marks
Case report Interpretation:	Interpretation of case reports related to • Lab safety and Biomedical waste disposal, Commonly used lab equipment, glassware and reagents • Liver Functions tests, Kidney Function tests and adrenal gland Function tests • Diabetes Mellitus, Dyslipidemia, Myocardial infarction, Renal failure, Gout, Proteinuria, Nephrotic syndrome, Edema, Jaundice, Liver diseases, Pancreatitis, Disorders of acid- base balance, Thyroid disorders	20 marks
Sub-Total		80 Marks
Viva-Voce		20 marks
Grand Total		100 marks

DISTRIBUTION OF TOPICS FOR BIOCHEMISTRY

VIVA VOCE

Topic I:

- Molecular and functional organization of a cell and its subcellular components
- Enzymes
- Chemistry & Metabolism of Carbohydrates

Topic II:

- Chemistry and Metabolism of Lipids
- Chemistry and Metabolism of Proteins
- Nutrition

Topic III:

Metabolism and Homeostasis

- Metabolism in specialized tissue
- Plasma proteins
- Nucleotide metabolism
- Vitamins
- Minerals
- Biological oxidation
- Water and acid base balance
- Haemoglobin metabolism
- Organ function test

Topic IV:

- Molecular Biology
- Detoxification and antioxidant system
- Extracellular Matrix

- Oncogenesis and Immunity

RECOMMENDED TEXT BOOKS

Recent editions are recommended

1. DM Vasudevan. Textbook of Biochemistry for Medical students
2. Indumati V. Integrated Textbook of Biochemistry. 2nd Edition
3. Lippincott Illustrated Reviews – Biochemistry- Denise Ferrier
4. Dinesh Puri. Textbook of Biochemistry
5. Pankaja Naik. Biochemistry
6. Namrata Chhabra. Case oriented approach towards Biochemistry.
7. T.N. Pattabhiraman. Laboratory manual and Practical Biochemistry, 4th edition

REFERENCE BOOKS: (Recent editions)

1. Harpers' Illustrated Biochemistry
2. Marshall and Bangert. Clinical Chemistry
3. Baynes and Dominiczak. Medical Biochemistry
4. Bhagavan and Ha. Essentials of Medical Biochemistry with clinical cases
5. Stryer. Biochemistry

Board of studies for: Para clinical (Medical)

Subject: Pathology Post graduate:

Changes in the curriculum for the year: 2023- 2024

Name of the Chairperson: Dr.Nayana Hashilkar

Extental members: Dr. Jyotilaksmi, Dr.Sitalakshmi

In-house Members (Pathology): Dr.Sunita Patil, Dr. Reshma Karishetti, Dr Ashwini Ratnakar

S.No	Reform	Changed Reform	Basis for the change	Remarks
1	Cognitive Domain:-			
	Only the broad outline was provided	Course contents are same with elaboration of the all the topics of pathology including- General & Systemic Pathology, Hematology & Transfusion medicine, Laboratory, Clinical Pathology and Parasitology. Topics like Special techniques, Instrumentation and automation, Automation in Pathology, Good lab practices and safety, Quality assurance program, Biomedical Waste management , Biostatistics, Research Methodology and Clinical Epidemiology,	NMC recommendations	The same will be implemented from 2023 batch

		Ethics and Medico legal aspects relevant to Pathology, Current topics and recent advances in pathology are also elaborated.		
2	General or over all Psychomotor skill			
	The competencies were inclusive but not explicitly defined	The level of expertise the PG students are expected to attain is clearly and the individual components of the competencies has been explicitly defined The New components added	NMC recommendations	The same will be implemented from 2023 batch
	Histopathology	Competency no 13 newly added	NMC recommendations	The same will be implemented from 2023 batch
	Hematology:	1, 7, 9(v,vii, xvi), 12 newly added	NMC recommendations	The same will be implemented from 2023 batch
	Laboratory medicine Names of Biochemical tests mentioned	It is mentioned comprehensively with emphasis on maintenance and trouble shooting	NMC recommendations	The same will be implemented from 2023 batch
	Transfusion Medicine	No change		
	Autopsy- Hidden	Mentioned explicitly	NMC recommendations	The same will be implemented from 2023 batch
	Molecular biology	Newly added	NMC recommendations	The same will be implemented from 2023 batch

	Immunopathology	More elaborate and explicit	NMC recommendations	The same will be implemented from 2023 batch
	Electron microscopy	Newly added	NMC recommendations	The same will be implemented from 2023 batch
	Digital pathology	Newly added	NMC recommendations	The same will be implemented from 2023 batch
	Teaching	More explicit	NMC recommendations	The same will be implemented from 2023 batch
	Research	Explicitly mentioned	NMC recommendations	The same will be implemented from 2023 batch
3	Teaching learning methods and Postings to laboratories/assignments			
	Postings to laboratories/assignments	Duration of postings has changed to 36 months (including exams) from 35 months	NMC recommendations	The same will be implemented from 2023 batch
	Postings to laboratories/assignments	For all posting durations range of months have been mentioned [Fixed months were defined earlier]. Blood bank postings have been merged with haematology. Immunohistochemistry has been added to surgical pathology.	NMC recommendations	The same will be implemented from 2023 batch

		Museum techniques and record management posting has been deleted.		
	Teaching learning methods	<ul style="list-style-type: none"> • Lectures have been reduced to 10 from 20, topics of lectures have been defined • Student learning like -Journal club, student seminar, laboratory work/interactive slide and gross sessions & symposia- frequency of teaching programme has been defined. • Postings to other departments- transplantation immunology and DOME (Optional) has been added • Posting under “District Residency Programme” (DRP): 3/4/5th semester-3 months added • Teaching research skills- PG’s should participate in at least one additional research project, preferably in area different from thesis work • Training in teaching skills for PG’s by MEU • Logbook- should be used in internal assessment of students, reflections to be recorded in log book, at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG • Course in Research Methodology • The Postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department. 	NMC recommendations	The same will be implemented from 2023 batch

		<ul style="list-style-type: none"> PG's should attend accredited CME, symposia, and conferences at least once a year. Training in-Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS), information technology and use of computers. 		
5	Assessment			
	Formative Assessment	PGs should be assessed frequently every week or fortnight depending on the activity being assessed as per the regulations	NMC recommendations	The same will be implemented from 2023 batch
		Attendance at Scientific meetings, CME programmes (at least 02 each) Assessment should be reflected in Student appraisal form	NMC recommendations	The same will be implemented from 2023 batch
	Pre-requisites to appear for examinations	<ul style="list-style-type: none"> Submissions of logbook At least two presentations at state/national level conference. 	NMC recommendations	The same will be implemented from 2023 batch
	Theory Examinations	Paper1 to 4: Sub-Topics (Subjects) reshuffled and Paper 4 to be on Recent advances separately	NMC recommendations	The same will be implemented from 2023 batch
		The papers should have ideally one (01) structured long answer question which will evaluate comprehensive in-depth knowledge and 6-8 short answer questions.	NMC recommendations	The same will be implemented from 2023 batch
	Practical Examinations	Focusing mainly on the psychomotor domain Practical 500 marks (including 100 marks -internal assessment)	NMC recommendations	The same will be implemented from 2023 batch

	Viva-Voce	focusing on psychomotor and affective domain.	NMC recommendations	The same will be implemented from 2023 batch
	Practical Exercises	<p>Histopathology:</p> <ul style="list-style-type: none"> ● Slides (12-15) in place of 20 ● Long case and/or 2 biopsy cases with ancillary tests reporting <p>Immunopathology, OSPE, EM Hematology, Cytopathology and Histopathology techniques: OSPE added in all exercises</p>	NMC recommendations	The same will be implemented from 2023 batch
		<p>Basic Sciences added</p> <p>Pedagogy-Teaching a small topic for about 10 min or presentation of dissertation and research</p> <p>General Viva-Voce (Grand Viva) – structured viva may be done separately or combined with above exercises</p>	NMC recommendations	The same will be implemented from 2023 batch
		All Exercises have specified marks allotment	NMC recommendations	The same will be implemented from 2023 batch

GUIDELINES FOR COMPETENCY-BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN PHARMACOLOGY

Revised PG Curriculum

Preamble

The purpose of the postgraduate (PG) education is to create specialists who would provide high quality education, health care and advance the cause of science through research and training. Pharmacology consists of both experimental and clinical sciences. The experimental component is essential in understanding the drug action in diseases as well as for the research in drug discovery and development. Clinical application of pharmacology concepts is essential for rational prescribing practices, rational therapeutics, clinical trials, rational use of drugs including antimicrobials, pharmacovigilance and pharmacology consults.

The job prospects for a medical pharmacologist have evolved over time along with a congruent rise in the demand for trained pharmacologists in India, both in academics as well in other areas such as pharmacovigilance centres, regulatory bodies, national research institutes, pharmaceutical industry and as scientific writers or science managers. Hence, a PG student in Pharmacology should be competent to meet the growing challenges in job requirements at all levels in various fields and organizations. Considering the emerging trends in pharmacology & therapeutics, clinical applications of the subject, its role in national programs, evolving integrated course schedules while broadening the subject scope and number of students seeking to join the PG degree in pharmacology, there is huge demand to standardize and update PG curricular components including competencies, teaching learning methods and assessment methods in the MD pharmacology course in India. This requires integration of pharmacology with other sciences including basic, para-clinical and clinical disciplines.

A pragmatic approach to postgraduate pharmacology teaching in India is a key step towards addressing the aforesaid challenges and facilitating a fresh curriculum design. The purpose of this document is to provide teachers and learners comprehensive guidelines to achieve the defined competencies through various teaching-learning and assessment strategies. This document was prepared by various subject and education experts of the national Medical Commission. The subject Expert Group has attempted to render uniformity without compromising the purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

PHARMACOLOGY SPECIFIC LEARNING OBJECTIVES (GOALS)

At the end of the MD training programme in Pharmacology, the student should meet the following goals:

1. Acquisition of knowledge

The student should be able to clearly explain concepts and principles of pharmacology and therapeutics, drug development processes, the drugs and cosmetics act, rational use of drugs, antimicrobial resistance, pharmacovigilance, pharmacy, health economics, clinical trial processes and relevant national programs.

2. Acquisition of Skills

The student should be able to develop and apply skills in pharmacology-based services (e.g. rational prescribing), in self-directed learning for evolving educational needs and scientific information, in conduct of research and in managerial assignments in the department/institution.

3. Teaching and training

The student should be able to effectively teach and assess undergraduate medical students (MBBS) and allied health science courses (Dentistry, Nursing, Physiotherapy) so that they become competent healthcare professionals and are able to contribute to training of undergraduates (UG) and postgraduates.

4. Research

The student should be able to conduct a research project (in both basic and clinical pharmacology) from the planning to the publication stage and be able to pursue academic interests and continue life-long learning to become a more experienced teacher & mentor in all the above areas and to eventually be able to guide postgraduates in their thesis, research work and all other academic activities.

5. Professionalism, Ethics and Communication skills

The student should be able to learn and apply principles of professionalism, ethics and effective communication in conduct of research, pharmacology-based services, educational activities and day to day work.

PHARMACOLOGY SPECIFIC COMPETENCIES

The competencies will have a judicious mix of all domains of learning and usually are predominant in one domain. The postgraduate student during the training program should acquire the following competencies to achieve the defined five goals:

A. Predominant in Cognitive domain

The MD Pharmacology student after training in the course should be able to:

General Pharmacology:

1. Demonstrate an understanding of the basic principles of Pharmacology including molecular pharmacology.
2. Demonstrate an awareness of the historical journey and contributions of scientists in the drug development process.
3. Describe the process of new drug development including preclinical and clinical phases.
4. Describe principles of pharmacokinetics of drugs and apply these to prescribe medicines for individualization of pharmacological therapy, including use of medicines in special categories (Pediatrics, Geriatrics, Pregnancy and Pathological states).
5. Explain the principles of pharmacodynamics and apply these in different therapeutic situations.

6. Describe mechanisms of drug-drug interactions and their clinical importance.
7. Describe the principles of pharmacogenomics and its clinical significance.
8. Describe pharmacological principles underlying the effects of drugs used in diagnosis, prevention and treatment of common systemic diseases in man.
9. Demonstrate an understanding of the factors that modify drug action.
10. Define Therapeutic Drug Monitoring (TDM), describe the methods of TDM and importance in therapeutic decision making.
11. Describe the principles and importance of Pharmacoeconomics in healthcare delivery. Describe the methods in pharmaco-economic studies and the economic considerations in the use of medicines in individuals and in the community.
12. Describe the principles, methods and importance of pharmacoepidemiology, including drug utilization studies.
13. Define pharmacovigilance. Describe the importance of pharmacovigilance in ensuring patient safety and the various methods/procedures in pharmacovigilance.
14. Describe the role of Essential Medicines in rational therapeutics. Describe principles for selecting Essential Medicines for a defined healthcare delivery system.
15. Demonstrate an understanding of principles of rational prescribing.
16. Demonstrate an understanding of prescription analysis and be able to conduct prescription analysis in a healthcare facility.
17. Demonstrate an understanding of antimicrobial resistance, antibiogram, antimicrobial stewardship program and strategies for containment of antimicrobial resistance.

Systemic Pharmacology:

1. Apply and integrate knowledge of pathophysiology of diseases and pharmacological principles underlying the effects of drugs, for the purpose of diagnosis, prevention and treatment of common systemic diseases in man including disorders of:
 - a. Synaptic & neuroeffector junctional sites of the autonomic nervous system
 - b. Neuromuscular junction
 - c. Central nervous system
 - d. Cardiovascular system
 - e. Endocrine system
 - f. Gastrointestinal system
 - g. Respiratory system
 - h. Renovascular system
 - i. Hematological system
 - j. Immunological system
 - k. Autacoids

2. Describe the mechanism of action, pharmacological effects and therapeutic status of drugs used for prevention and management of microbial and parasitic infections/infestations and neoplastic disorders.
3. Describe the pathophysiological basis and management of common poisonings.
4. Demonstrate an awareness about the recent advances in pharmacology and therapeutics.
5. Demonstrate an understanding of the special considerations in pharmacokinetics, mechanism of action, pharmacological effects and therapeutic status of drugs used for dermatological and ocular disorders.

Research:

1. Demonstrate an understanding of the importance and ethical considerations of biomedical research in animals and man.
2. Describe the principles and methods of biomedical research in animals and man.
3. Describe the current principles of Good Clinical Practice (GCP) and Good Laboratory Practice (GLP) guidelines, as applicable.
4. Demonstrate an understanding of the different tools and methods for literature search.
5. Describe and apply the principles of biostatistics in the evaluation and interpretation of efficacy and safety studies of drugs in man. Apply and interpret the various statistical tools in biomedical research.
6. Demonstrate an understanding of the principles of Good Publication practices as applicable to publication of research studies.
7. Describe different methods of drug assays - biological, chemical, immune-assay including knowledge of analytical techniques like HPLC, TLC etc. and their applications in therapeutics.
 - Describe the methods for screening/evaluation of various pharmacological agents like analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs, antidepressants, antianxiety and antipsychotics, sedatives, muscle relaxants, antihypertensives, hypocholesterolemic agents, antiarrhythmic drugs, antidiabetics, local anaesthetics, antifertility agents, diuretics, adrenergic blocking drugs, drugs used in peptic ulcer diseases and drugs affecting learning and memory etc in animals and man.
8. Describe the regulatory and ethical issues involved in drug development and research.

Teaching and Assessment:

1. Demonstrate an awareness about the salient features of Undergraduate Medical Education Curriculum in India.
2. Demonstrate an awareness about Postgraduate Medical Education Curriculum and Guidelines in India.
3. Describe the principles of teaching-learning technology and apply these to conduct classroom lectures, self-directed learning (SDL) sessions, Case-Based Learning (CBL),

case discussions, integrated teaching, small group discussions, seminars, journal club and research presentations.

4. Describe the principles of assessment of learning and be able to use the different methods for assessment of undergraduate students in pharmacology.
5. Demonstrate knowledge about the utility of computer assisted learning and be able to use them efficiently to promote learning of pharmacology.

Note: A postgraduate student is expected to be knowledgeable about all aspects of the subject and be updated about the contemporary advances and research in the subject.

B. Predominant in Affective Domain

The students after training in the MD (Pharmacology) course should be able to:

1. Effectively explain to patients, the effects, appropriate use and adverse effects of drugs, including drug interactions and the need for medication adherence.
2. Communicate effectively with students, peers, staff, faculty and other members of the health care team about rational use of medicines and improving spontaneous reporting of adverse drug reactions, with pharmacological reasoning
3. Demonstrate respect in interactions with peers, patients and other healthcare professionals.
4. **Demonstrate professionalism**, ethical behavior and integrity in one's work.
5. Demonstrate ability to generate awareness about the use of generic drugs in various conditions.
6. Acquire skills for self-directed learning to keep up with advances in the subject and to improve the skills and expertise towards continuous professional development.

C. Predominant in Psychomotor Domain

a. Mandatory

i. The students after training in the MD (Pharmacology) course should be able to *perform the following procedures independently or as a part of a team and/or interpret the results:*

1. Predict, report, monitor and participate in the management and causality assessment of adverse drug reactions associated with use of drugs, as per national program.
2. Demonstrate skills for writing rational prescriptions and prescription analysis.
3. Demonstrate proper use of equipment following the SOPs e.g. organ bath, analgesiometer, physiograph, convulsimeter, plethysmograph, equipment for testing/measuring learning and memory, affective disorders, muscle relaxants, blood pressure, ECG, respiration and pain.
4. Prepare drug solutions of appropriate strength and volume.
5. Determine EC_{50} , ED_{50} , pD_2 and pA_2 values of drugs.
6. Demonstrate presentation skills in a classroom setting as well as in academic meetings at local and national levels.

7. Provide critical appraisal of a research paper.
 8. Perform experiments to demonstrate and interpret the dose response curve and effect of agonists (in the presence or absence of an antagonist) on simulations.
 9. Perform the following:
 - Design protocol for evaluation of a given drug for various phases of clinical trials.
 - Prepare Informed Consent Form and Participant Information Sheet for clinical trials/research.
 - Administer Informed Consent Form
 - Evaluate promotional drug literature
 - Prepare “Package insert”
 - Calculate and interpret pharmacokinetic parameters of a drug from a given data
 - Demonstrate skills to prepare material for teaching-learning and assessment.
- ii. The students after training in the MD (Pharmacology) course should be able to *do/perform following procedures under supervision:*
10. Test and predict efficacy of drugs following appropriate guidelines and regulations e.g. drugs affecting memory and psychomotor functions (e.g. critical flicker fusion tests in human volunteers), pain, cardiovascular functions, respiratory functions etc.
 11. Observe and understand basic principles of working of important contemporary drug analytical techniques, interpret the observations about the drug levels and their therapeutic applications.
 12. Demonstrate skills for contributing to antibiotic stewardship program of the institute to manage antimicrobial resistance.
 13. Demonstrate Standard Operating Procedures (SOPs) for various methods and techniques used in pharmacology including SOPs in clinical trials and research.
 14. Administer drugs by various routes (subcutaneous, intravenous, intraperitoneal) in simulations and hybrid models.
 15. Demonstrate acquisition of writing skills for scientific publications and research projects for funding agencies and approval by Ethics Committee.
 16. Demonstrate scientific writing skills.
- b. Desirable:** The students after training in the MD (Pharmacology) course should be able to:
17. Collect blood samples and oral gavage from experimental animals.
 18. Administer drugs by various routes (subcutaneous, intravenous, intraperitoneal) in experimental animals.
 19. Perform in vivo and in vitro screening/evaluation of various pharmacological agents like analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs, antidepressants, antianxiety and antipsychotics, sedatives, muscle relaxants, antihypertensives, hypocholesterolemic agents, antiarrhythmic drugs, antidiabetics, local anaesthetics,

antifertility agents, diuretics, adrenergic blocking drugs, drugs used in peptic ulcer diseases and drugs affecting learning and memory etc in animals or simulated experiments and interpret the observations and relate these to potential clinical applications of the experimental drug and man

20. Perform experiments to demonstrate and interpret the dose response curve and effect of agonists (in the presence or absence of an antagonist) on various biological tissues.

Note: All animal experiments shall be compliant with the Regulations of Government of India, notified from time to time. Amphibian/Dog/Cat experiments shall be conducted by computer assisted simulation models/facilities. Other experiments shall be performed as permissible by existing 'Committee for the Control and Supervision of Experiments on Animals (CCSEA)' guidelines and other Government regulations.

Syllabus

Course content

Theory:

❖ Basic and General Pharmacology:

Basic Principles of Pharmacodynamics and Pharmacokinetics, Molecular Pharmacology, Historical aspects of drug discovery, Evaluation of new drug in animals and man, Gene based therapy and drug abuse, Pharmacoepidemiology, Pharmacogenomics, pharmacogenetics, P-drug, Drug delivery systems, Over the counter drugs, generic drugs, drugs banned in India, Dietary supplements and herbal medicines

Toxicology:

General principles of toxicology including pathophysiological basis and management of common poisonings, Heavy metal poisoning, non-metallic toxicants like air pollutants, pesticides etc.

❖ Clinical Pharmacology :

- Principles of rational use of drugs and rational prescribing, Essential drug concept
- Principles of Clinical Pharmacokinetics and their application in drug treatment, including use of drugs in special population like different age groups, Pregnancy, lactation and Disease conditions
- Clinical trials –conduct of clinical trials, ethical issues in clinical trials, informed consent and SOP-Standard operating procedures of clinical trials
- Therapeutic drug monitoring, Adverse drug event monitoring and reporting (Pharmacovigilance), Adverse drug interactions, Drug information
- Pharmacometrics- methods of drug evaluation
- Pharmacoeconomics

- Functioning of the Drugs and Therapeutics Committee.
- Hospital formulary development
- Drug information services.
- Medication error detection and mitigation advice.
- Antimicrobial resistance and antibiotic stewardship.
- Prescription auditing
- Drug counselling - explain to patients, the effects and adverse effects of drugs, including the need for medication adherence
- Emergency drugs used in crash cart/ resuscitation

❖ **Systemic Pharmacology and Therapeutics:**

Pharmacology of drugs acting on various organ system & drug treatment of disease conditions :

- Autonomic Pharmacology
- Drugs acting on Smooth muscles
- Drugs acting on Synaptic and Neuro effector Junctional sites
- Drugs acting on Central Nervous System (Sedative, Hypnotics, Antiepileptics, General Anesthetics, Local Anesthetics, Skeletal Muscle Relaxants, Antipsychotic, Antidepressants, Drugs used in Parkinson's disease and other neurodegenerative disorders, opioid agonists and antagonists, Drugs of abuse)
- Drugs modifying renal function
- Drugs acting on cardiovascular system and haemostatic mechanisms (Antihypertensives, Antianginal, Antiarrhythmics, Drugs used in heart failure, Drugs used in Dyslipidemias, Fibrinolytics, Anticoagulants, Antiplatelets)
- Reproductive Pharmacology
- Agents effecting calcification and bone turnover
- Autacoids and related pharmacological agents (NSAIDs) and drugs used in Rheumatoid arthritis and Gout
- Gastrointestinal drugs
- Pharmacology of drugs affecting the respiratory system (drugs used in Bronchial Asthma and COPD)

- Chemotherapy: General principles and various Antimicrobials
- National programmes for infectious and vector borne diseases including the regimes
- Chemotherapy of neoplastic disease
- Drugs used in Autoimmune disorder and Graft versus Host Disease
- Dermatological pharmacology
- Ocular pharmacology
- Immunomodulators - immunosuppressants and immunostimulants
- Pharmacology of drugs used in endocrine disorders (drugs used in diabetes mellitus, hypothalamic and pituitary hormones, thyroid and antithyroid drugs, adrenocorticotrophic hormones and their antagonists, gonadal hormones and their inhibitors)
- Screening procedures for various drug categories in humans and animals.
- Antiparasitics, disinfectants, antiseptics

❖ Biomedical research (in humans and animals) and related Regulations

- Literature search
- Principles of Good Clinical Practice (GCP)
- Good Laboratory Practice (GLP) guidelines Good publication practices
- Recent regulatory guidelines for drugs/research and clinical trials
- Drug development and research and ethical issues involved in it
- Research protocol development, research study conduct, experimental observations, analysis of data using currently available statistical software
- Emergency use authorization for drugs eg., vaccine development
- Ethical issues related to research on animals, humane animal research (principles of 3Rs) and alternatives to animal experimentation
- Ethical guidelines of ICMR, INSA for Breeding and conducting Experiments on Animals (Control and Supervision) Rules 1998.
- Animal experiments: Regulatory Guidelines (CPCSEA), humane animal research (principles of 3Rs) and alternatives to animal experimentation.
- Anaesthetics used in laboratory animals

❖ **Experimental Pharmacology:**

- Describe the methods for screening/evaluation of various pharmacological agents like analgesics, antipyretics, anticonvulsants, anti-inflammatory drugs, antidepressants, antianxiety and antipsychotics, sedatives, muscle relaxants, antihypertensives, hypocholesterolemic agents, antiarrhythmic drugs, antidiabetics, local anaesthetics, antifertility agents, diuretics, adrenergic blocking drugs, drugs used in peptic ulcer diseases and drugs affecting learning and memory etc in animals and man.

❖ **Biostatistics:**

- Basic principles and their application in drug research.
- Recent advances in Pharmacology

❖ **Biochemical Pharmacology**

- Basic principles and applications of simple analytical methods
- Principles of quantitative estimation of drugs, endogenous compounds and poisons using Colorimetry, Spectrophotometry, flame photometry, High Performance Liquid Chromatography (HPLC) and enzyme-linked immunosorbent assay (ELISA).

❖ **Education**

- Salient features of Undergraduate Medical Education Curriculum in India.
- Postgraduate Medical Education Curriculum and Guidelines in India.
- Principles of teaching - learning methods and technology
- Principles of assessment of learners

Practicals :

1) Experiments on Laboratory Animals:

A. Isolated tissue experiments: (BIOASSAY)

- a) Rat – uterus, phrenic nerve diaphragm, fundus, vas deferens, colon, etc.
- b) Guinea Pig – ileum, vas deferens, heart (Langendorff's preparation), tracheal chain, duodenum etc.

c)Rabbit – heart (Langendorff's preparation), jejunum, duodenum, aortic strip etc

B. Principles of EC50, ED50, pD2 and pA2 values of drugs

C. General screening and evaluation of whole animal experiments:

- i. Screening of the drugs for the following activities:
 - Anti-anxiety
 - Anti depressant
 - Anti – convulsant
 - CNS stimulants
 - Sedative and hypnotic
 - Muscle relaxants
 - Anti-inflammatory
 - Analgesic, Antipyretics
 - Anti-diabetic
 - Antihypertensive
 - Anti-arrhythmic
 - Anti adrenergic
 - Antipsychotics
 - Hypocholesterolemic agents
 - Diuretics
 - Drugs used in peptic ulcer diseases/Prokinetic agents/ antiemetics
 - Antitussives, /anti-asthma agents
 - Oxytocics, antifertility agents
 - Behavioral pharmacology models and evaluation of drugs affecting learning and memory
- ii. In rabbit & guinea pig to screen the drugs for their :
 - Local anesthetic activity
 - Mydriatic and miotic activity

iii. In cat / dog (Computer Aided) to identify the nature of the drug by observing its effect on:

- Blood pressure
- Respiration
- Nictitating membrane
- Intestinal movement

2) Technique demonstration:

- i) Blood withdrawal :
 - Rat– Tail vein, retro-orbital sinus puncture, cardiac puncture.
 - Rabbit – Marginal ear vein.
- ii) Intravenous/intraperitoneal/subcutaneous/oral drug administration in rat, rabbit and mouse
- iii) Measuring pedal volume
- iv) Rat vaginal smear preparation & interpretation.
- v) Anesthetics used in laboratory animals

3. Clinical Pharmacology

- Demonstration of drug administration through various routes on Mannequines
- Demonstration of effects of drugs/interpretation of results in humans
- Protocol Writing for various phases of clinical trials
- ADR reporting (Pharmacovigilance)
- Analysis of Prescriptions
- Calculation of kinetic parameters
- Selection of P-drug
- Estimation of Pharmacoeconomic parameters

4. Biochemical Pharmacology Experiments

- Immunoassays: Concept and their application/s
- Simple tests for detecting the chemical nature of drugs (alkaloids, glycosides, steroids, lead, fluoride etc).

- Principles of quantitative estimation of drugs, endogenous compounds and poisons using Colorimetry, Spectrophotometry, flame photometry, High Performance Liquid Chromatography (HPLC) and Enzyme-Linked Immunosorbent assay (ELISA).

TEACHING AND LEARNING METHODS

All students joining the postgraduate courses shall work as full-time (junior) residents during the period of training, **attending not less than 80% of the training activity during the calendar year**, and participating in all assignments and facets of the educational process. They shall maintain a log book for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Theory:

a) Lectures:

A minimum of 10 lectures per year on certain selected topics shall be taken as lectures.

b) Journal Club

Journal club shall be conducted once a week. Topics shall include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

A time table for the subject with names of the students and the moderator shall be announced in advance.

c) Subject Seminar

Recommended to be held once a week. Important topics shall be selected and allotted for in- depth study by a postgraduate student. A teacher shall be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student shall be graded by the faculty.

d) **Student Symposium/ Interdepartmental colloquium** Minimum once every 6 months.

A broad topic of significance shall be selected, and each part shall be dealt by one postgraduate student. A teacher moderator shall be allocated for each symposium and moderator shall track the growth of students during moderation. Such **Symposium** shall aim at complete evidence-based review of the topic. All participating postgraduates shall be graded by the faculty. Alternately, post graduates shall attend **Interdepartmental colloquium** meetings between the Department of Pharmacology and other departments on topics of current/common interest or clinical cases.

e) PG students shall attend additional sessions in the form of workshops on basic sciences, biostatistics, research methodology, teaching methodology & assessment and salient features of Undergraduate/Postgraduate medical curriculum with relevant entries in the log book.

-
- f) UG Teaching : Post graduate students shall teach undergraduate students by taking lectures, small group teaching and demonstrations using Computer Animal Simulation Laboratory(CAL)
- g) PG students shall attend accredited scientific meetings (CME, symposia, and conferences)

PRACTICAL/CLINICAL TRAINING:

- 1) **Research Activities: The Post-graduate students should conduct dissertation** work and in addition carry out a short research project in the department other than dissertation work.
- 2) **Experimental Pharmacology-** In vitro (including bioassays), in vivo (including common methods of evaluation), computer simulation and toxicity tests
- 3) **Clinical Pharmacology-**
 - (1) Evaluation of drugs in healthy volunteers as well as patients
 - (2) Critical evaluation of drug literature, Pharmacoeconomics, pharmacovigilance and Pharmacoepidemiology
 - (3) Short project
 - (4) Rotational Postings in other Departments:

A candidate of the M.D Degree Course in Pharmacology needs to be well versed in the applied aspects of pharmacology and therapeutics by attending rounds during clinical postings and learn about the recent drugs used presently in clinical practice, also discuss the rationality of the prescription with the staff. Postings in the wards of the Clinical departments will help the candidate get acquainted with the patterns of drug use, adverse drug reactions and interactions etc. Such postings will also help them to improve their communication skills. Every posting shall have defined learning objectives derived in conjunction with the collaborating department/s or unit/s.

The following clinical postings are recommended:

Clinical Postings	REVISED (duration)
Medicine	2 weeks
Anaesthesia	2 weeks
Dermatology	1 week
Pediatrics	1 Week
Psychiatry	2 weeks
Microbiology/ Infection control unit or dept	2 weeks
Biochemistry / BSRC	2 weeks
Clinical trial unit (SMO) /Research unit / Pharmaceutical industry	2-8 weeks (as per availability)
Pharmacovigilance	2 weeks
DRP	3 months
Total Duration of postings	8 1/2 months

(Monitoring of clinical postings, would be through weekly discussions about interesting cases with critical appraisal of prescriptions).

In addition candidate shall be posted for Pharmacovigilance posting in hospital to get

acquainted to procedures involving in reporting adverse drug reactions

Biochemical Pharmacology-

- Candidate shall be posted at BSRC (Basic Science Research Centre)/ Department of Biochemistry to get acquainted to procedures like Identification of drugs/toxins by using chemical, biological and analytical tests and Quantitative estimation – use of colorimeter, spectrophotometer and/or other advanced analytical equipments.
- Microbiology/ Infection control unit or dept: Candidate shall be posted to Department of Microbiology to get acquainted to infection control measures and antimicrobial stewardship

Candidate shall be posted at **SMO (Site Management Office)** to get acquainted to procedures or skills for conducting clinical trials. Alternately, candidate desirous to attend industrial posting shall be posted at renowned pharmaceutical industries to get hands on experience of the working culture and skills of the industries.

Posting under “District Residency Programme” (DRP):

All postgraduate students pursuing MD in Pharmacology shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020).

Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate programme and the rotation shall be termed as “District Residency Programme” and the PG medical student undergoing training shall be termed as “District Resident”.

Common Course work

The following course work is made mandatory to be eligible to appear for University Examination

Course in Research Methodology

All postgraduate students shall complete an online course in Research Methodology. The students shall have to register on the portal of the designated training institutions. The students have to complete the course within one year of the commencement of the course. The online certificate generated on successful completion of the course and examination thereafter, will be acceptable evidence of

having completed this course. The above certification shall be a mandatory requirement to be eligible to appear for the final examination of the respective postgraduate course.

Training Course in teaching skills

Medical Education Unit (MEU)/ Department of Medical education (DOME) shall train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and will be assessed by faculty .

Course in Good Clinical Practice and Good Laboratory Practice

All postgraduate students shall complete course in Ethics including Good Clinical Practices and Good Laboratory Practices, whichever is applicable to them, to be conducted by Institutes themselves or by any other method. The students have to complete the course within one year of the commencement of the course. No Postgraduate Student shall be permitted to appear in the examination without completing the above course.

Course in Basic Cardiac Life Support Skills (BCLS) and Advanced Cardiac Life Support (ACLS)

All postgraduate students shall complete a course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills and get duly certified. The students have to complete the course within one year of the commencement of the course. No Postgraduate Student shall be permitted to appear in the examination without the above certification.

The postgraduate trainees must participate in the teaching and training program of undergraduate students attending the department.

PG students shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.

The postgraduate trainees must undergo training in information technology and use of computers.

COURSE DURATION: 3 Years (6 Terms of 6 months each) WORK SCHEDULE

Terms:

I. TERM

- Search and identify dissertation topic in consultation with guide and collect the relevant literature. Preparation of synopsis and submission of the same to the university for registration.
- Participation in undergraduate teaching programmes
- Journal review meetings
- Seminars
- Experimental pharmacology practical
- Student Symposium/Interdepartmental seminars

II. TERM

- Journal review meetings
- Seminars
- Participation in undergraduate teaching programmes.
- Experimental pharmacology practical
- Preparation for dissertation experiment
- Student Symposium/Interdepartmental seminars
- Biochemistry/BSRC posting
- Microbiology posting

III. TERM

- Journal review meetings
- Seminars
- Participation in undergraduate teaching programme
- Clinical postings
- Dissertation experiments
- Experimental pharmacology practical
- Clinical pharmacology practical
- Student Symposium/Interdepartmental seminars

- District Residency Programme

IV. TERM

- Journal review meetings
- Seminars
- Participation in undergraduate teaching programme.
- Clinical postings
- Dissertation experiments
- Dissertation writing
- Test on CNS and chemotherapy
- Clinical pharmacology practical
- Student Symposium/Interdepartmental seminars
- District Residency Programme

V. TERM

- Dissertation writing and submission to university
- Journal review meetings
- Seminars on selected topics.(Recent advances)
- Participation in undergraduate teaching programme.
- Experimental pharmacology practicals.
- Visit to pharmaceutical industry/SMO
- Clinical pharmacology practical.
- Student Symposium/Interdepartmental seminars
- Test on Endocrinology, Blood and Autacoids
- District Residency Programme

VI. TERM

- Journal review meetings
- Seminar on selected topics (Recent advances)
- Experimental pharmacology practicals

- Student Symposium/Interdepartmental seminars
- Clinical pharmacology practical

ASSESSMENT

Formative Assessment

During the training, Formative assessment shall be continual and shall assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self- directed learning and ability to practice in the system.

Annual Internal Assessment (IA) shall be conducted at the end of each year to assess Theory and **Practical skills through OSPE** The third annual examination (Preliminary Examination) will be according to the University Summative Assessment format.

In addition, quarterly assessment shall be conducted to cover all domains of learning including professionalism and communication skills. Such assessment shall be used to provide feedback to improve learning.

Quarterly Assessment during the MD training programme shall be based on:

Case presentation, case work up, case handling/management	once a week
Laboratory performance	once a week
Journal club	once a week
Seminar	once a week
Case discussions	once a fortnight/month
Interdepartmental case or seminar	once in 6 months
Attendance at Scientific meetings, CME programmes	at least 01 each in a year

Log book

During the training period, the postgraduate student shall maintain a Log Book indicating the work done in Departmental teaching programmes including Seminars, Journal clubs, Case discussions etc/Laboratory/Research/ Clinical and other postings. In addition, **components of good teaching practices shall be assessed for at least two teaching sessions.** The log book entries shall be done in real time. Log Book shall be used for the formative assessment of the student, that shall be checked and assessed periodically by the faculty members. The PG students shall be required to produce completed log book in original at the time of final practical examination. It shall be signed by the Head of the Department.

[The teaching faculty are referred to the MCI Logbook Guidelines uploaded on the Website.](#)

SUMMATIVE ASSESSMENT

The summative examination would be carried out as per the Rules given in

POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.

The post-graduate examinations should be conducted in 3 parts:

1.Thesis

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognized Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

A postgraduate student would be required to **present atleast two poster/oral paper presentation at a national level conference.** One research paper shall be published / accepted in an indexed journal.

2.Theory Examination

The examinations shall be organized on the basis of 'Grading 'or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the four papers for degree examination shall be mandatory. Obtaining of

50% marks in Practical examination shall be mandatory for passing the examination as a whole in the said degree examination as the case may be. Hence a candidate shall secure not less than 50% marks in each head of examination which shall include Theory and Practical including Viva voce examination. No grace mark is permitted in Postgraduate Examination either for Theory or for Practical.

There should be 4 theory papers:

Paper I	Basic sciences as applied to Pharmacology and General Pharmacology including Toxicology
Paper II	Systemic & Clinical Pharmacology: Autonomic Nervous System Central Nervous System Peripheral Nervous System Autacoids Cardiovascular System Blood Renal System
Paper III	Systemic & Clinical Pharmacology: Endocrinology Chemotherapy Gastrointestinal System Respiratory System Immunomodulators Miscellaneous
Paper IV	Experimentation, Research, Biostatistics Medical Education and recent advances in Pharmacology

3. Practical and oral examination

Practical examination shall be spread over for two days and Viva should be conducted on 2nd day.

Practical Examination Exercises:

a) Long exercises:

- Perform experiments or simulated experiments (as per PG Regulations)
- Protocol design for a given scenario
- Case audit for a given case

b) Short exercises:

- Interpretation of results of a previous tracing - Table exercise
- Demonstration of effects of drugs/interpretation of results in human
- Demonstration of effects of drugs/interpretation of results in small, animals - optional (as per Regulations notified)

c) Objective Structured Practical Examination (OSPE) Exercises:

OSPE shall be conducted for 80 marks and shall include exercises selected from the following:

- Various drug delivery systems
- Calculating pharmacokinetic parameters
- Pharmaceutical calculations
- Statistical exercise
- Pharmacoeconomics
- Critical appraisal of a published paper
- Abstract writing of a published paper
- Evaluation of drug promotional literature.
- Adverse Drug Reaction (ADR) reporting and causality assessment
- Assessment of preclinical toxicity data
- Analysis of rational and irrational formulations
- Selecting a P-drug and writing rational prescriptions
- Analytical instruments - use and interpretation
- Identifying ethics related dilemmas / mistakes in clinical trial documents

d) Oral Viva

Grand viva

Pedogogy: Assessment of presentation of a UG lecture (Candidate shall make a presentation for 8-10 minutes on a topic given in the beginning of the Practical examinations)

Discussion on dissertation: (Candidate shall make a presentation for 8-10 min on the dissertation of topic)

SCHEME OF EXAMINATION

The post-graduate examinations should be conducted in 3 parts:

Candidates will be allowed to appear for examination only if attendance (Minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

A. Theory : 400 Marks

The format of each paper will be same as shown below.

Type of Questions	No. of Questions	Marks for each question	Total marks.
Essay Question	10	10	100
Grand Total			100

Note : The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

B) Practical Examination – 300 marks

	Experiments	Marks
1	Long experiment <ul style="list-style-type: none"> • Bio assay using isolated tissue • Protocol writing • Case discussion • Computer Animal Simulator Experiments (CAL) 	60 30 20 20
2	Short experiment <ul style="list-style-type: none"> • Interpretation of results of a previous tracing • Demonstration of effects of drugs/interpretation of results in human • Short Techniques <ul style="list-style-type: none"> ➤ Demonstration of effects of drugs/interpretation of results in small animals ➤ Technique Demonstration • Journal Critiquing 	10 10 30 20 20
3	Objective Structured Practical Examination (OSPE)	80
	Log book	10
TOTAL		300

C) Viva – Voce Examination: 100 Marks (There shall be 4 tables for each examiner & the marks distributed shall be 25 Marks for each examiner)

Grand Viva -The Viva-voce would be on all components of all syllabus.	80 marks
Pedagogy/Microteaching exercise and Dissertation	10 marks 10 marks
TOTAL MARKS	100

All examiners shall conduct viva-voce conjointly on candidates comprehension, analytical approach, expression and interpretation of data. It shall include all components of course contents and discussion on dissertation also.

D) MAXIMUM MARKS

Maximum marks for M.D. Pharmacology	Theory	Practical	Viva	Grand Total
	400	300	100	800

VII. RECOMMENDED BOOKS (LATEST EDITIONS):

Sl.No	Name of the textbook	Authors	Publishers
1	The Pharmacological Basis of Therapeutics	Goodman & Gilman's	Mc Graw Hill
2	Pharmacology	Rang H P & Dale M M	Churchill Livingstone
3	Clinical Pharmacology	Laurence D R, Bennett P N & Brown M J	Churchill Livingstone
4	Basic and Clinical pharmacology	Katzung B G	Mc Graw Hill
5	Lewis's Pharmacology	Crossland J	Churchill Livingstone
6	Fundamentals of Experimental Pharmacology	Ghosh M N	Hilton and company
7	Screening methods in Pharmacology	Turner R A	Academic Press Inc Ltd
8	Evaluation of Drug Activities: Pharmacometrics" Volume - 1 & 2	Laurence D R & Bacharach A L	Academic Press Inc Ltd
9	Essentials of Medical Pharmacology	K D Tripathi	JAYPEE Brothers Medical Publishers Ltd
10	Pharmacology and Pharmacotherapeutics	R S Satoskar Nirmala Rege	ELSEVIER

		Raakhi Tripathi Sandhya Kamat	
11	Lippincott Illustrated Reviews Pharmacology	Sangeetha Sharma and Dinesh K Badyal	Wolters Kluwer

VIII. RECOMMENDED JOURNALS:

Sl. No.	Name of the Journal
1	Annual Review of Pharmacology and Toxicology
2	Journal of Pharmacology and Experimental Therapeutics (Monthly).
3	Indian Journal of Pharmacology (Bimonthly).
4	Clinical Pharmacology and Therapeutics (Monthly)
5	Journal of Pharmacy and Pharmacology (Monthly).
6	Indian Journal of Experimental Biology (Monthly)
7	Other relevant periodicals available in the library or internet.

Sl. No.	Additional reading
1	Compendium of recommendations of various committees on Health and Development (1943-1975). DGHS, 1985 Central Bureau of Health Intelligence, Directorate General of Health Services, Ministry of Health and Family Welfare, Govt. of India, Nirman Bhawan, New Delhi.
2	National Health Policy, Ministry of Health & Family Welfare, Nirman Bhawan, New Delhi.
3	Indian Council of Medical Research, "Policy Statement of Ethical considerations involved in Research on Human Subjects, 1982, I.C.M.R, New Delhi.
4	Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956. Medical Council of India, Kotla Road, New Delhi.
5	Francis C M, Medical Ethics, J P Publications.

6	Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, New Delhi.
7	Mahajan B K, Methods in Bio statistics for medical students, 5 th Ed.

Websites:

1. National Guidelines on national programs e.g. <https://cdsco.gov.in/opencms/opencms/en/Home>
2. MOHFW Website <https://www.mohfw.gov.in/>
3. WHO Website <https://www.who.int/>

JOURNAL REVIEW SHEET

Name of the student:

Name of the faculty:

Sl.No	Parameters to assess	Date				
	Title of the paper:					
	Journal Name:					
	Moderator:					
1	Preparation					
	a) Purpose for choosing					
	b) Identifies learning issues					
	c) Reviews relevant information					
	d) Slides					
2	Presentation					
	a) Clarity					
	b) Confidence					
	c) Use of audio visual aids					
3	Critical appraisal					
4	Ability to respond questions					
5	Overall performance					
TOTAL SCORE						

Total points: 50

(SCALE= Poor/ satisfactory-1, Average-2, Good- 3, Very Good - 4, Excellent-5)

SEMINAR EVALUATION SHEET

Name of the student:

Name of the faculty:

Sl.No	Parameters to assess	Date				
	Topic:					
	Moderator:					
1	Preparations					
	a) Depth					
	b) Extent					
	c) Slides					
2	Presentation					
	a) Order					
	b) Clarity					
	c) Use of audio visual aids					
3	Ability to respond questions					
4	Overall performance					
TOTAL SCORE						

Total points: 40

(SCALE= Poor/ satisfactory-1, Average-2, Good- 3, Very Good-4, Excellent-5)

Annexure 1

Pre/ Para / Clinical **Name of the Department / Unit :**

Name of the PG Student :

Period of Training : FROM.....TO.....

Student appraisal form for MD in Pharmacology										Comments	
	Elements	Less than Satisfactory			Satisfactory			More than Satisfactory			
		1	2	3	4	5	6	7	8	9	
1	Scholastic aptitude and learning										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Poster publications etc.)										
1.4	Documentation of acquisition of competence (e.g. Logbook)										
1.5	Performance in work-based assessments										
1.6	Self-directed Learning										

2	Work related to training										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional attributes										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										

4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee	Yes	No								
	If not explain										
	Name and signature of the assessee										
	Name and signature of the assessor Date:										

Clinical Postings	OLD (duration)	REVISED (duration)
Medicine	1 Month	2 weeks
Pediatrics	2 Weeks	
Anaesthesia	2 Weeks	2 weeks
Dermatology	2 Weeks	1 week
Psychiatry	2 Weeks	
O.B.G.	2 Weeks	
Medical oncology		2 weeks (if available)
Microbiology/ Infection control unit or dept		2 weeks
Biochemistry		2 weeks
Clinical trial unit/Research unit/ Pharmaceutical industry		2-8 weeks (as per availability)
Medical Education Unit (MEU) or Department of Medical Education (DOME)		1 week (optional)
Hospital Pharmacy		1 week (if available)
DRP		3 months
SMO (Site Management Office)	2 months	
BSRC (Basic Science Research Centre)	2 weeks	
Total Duration of posting	5 months + 3 months DRP= 8 months	

A. Rotational clinical / community / institutional postings

FORMATIVE ASSESSMENT

Quarterly assessment during the MD training should be based on:

Sl. No.	PG Teaching Activities	Duration
1	Case presentation, case work up, case handling/management	once a week
2	Laboratory performance	twice a week
3	Journal club	once a week
4	Seminar	once a fortnight
5	Case discussions	once a fortnight/month
6	Interdepartmental case or seminar	once a month

SUMMATIVE ASSESSMENT

	OLD	NEW
Paper I	Basic and General Pharmacology including Bio-statistics , Toxicology	Basic sciences as applied to Pharmacology
Paper II	Clinical Pharmacology	Systemic Pharmacology
Paper III	Systemic Pharmacology	Clinical Pharmacology, Experimentation , Research , Biostatistics and Education
Paper IV	Recent Advances, Therapeutics & experimental Pharmacology	Recent advances in the Pharmacology

Practical Examination – 300 marks (OLD)

	Experiments	Marks
1	Long experiment (bio assay using isolated tissue)	80
2	Short experiment (identification of unknown drug using chemical test/intact animal)	60
3	Technique demonstration	30
4	Interpretation of Graph	20
5	Clinical pharmacology: <ul style="list-style-type: none"> • Calculation of kinetic parameters • Clinical Trial protocol writing • Case discussion pertaining to drug usage 	20 20 20 } 60
6	Computer Animal Simulator Experiments	20
7	Journal Critiquing	20
8	Log book	10
TOTAL		300

NEW

Practical Examination Exercises:

a) long exercises:

- Protocol design for a given scenario
- Case audit for a given case
- Perform experiments or simulated experiments (as per PG Regulations)

The exercises should be observed, response of student noted and assessed. The question related to these exercises can be asked.

b) short exercises:

- Interpretation of results of a previous tracing - Table exercise
- **Demonstration of effects of drugs/interpretation of results in human**
- Demonstration of effects of drugs/interpretation of results in small, animals - optional (as per Regulations notified)

The exercises should be observed and assessed.

c) **OSPE exercises: Objective Structured Practical Examination (OSPE)**

OSPE should have 10-15 stations. Stations should be mixture of observed (observer present) and unobserved stations (without an observer). Few examples are given below:

- Various drug delivery systems
- Calculating pharmacokinetic parameters
- Pharmaceutical calculations
- Statistical exercise
- Pharmacoeconomics
- Critical appraisal of a published paper
- Abstract writing of a published paper
- Evaluation of drug promotional literature.
- Adverse Drug Reaction (ADR) reporting and causality assessment
- Assessment of preclinical toxicity data
- Analysis of rational and irrational formulations
- Selecting a P-drug and writing rational prescriptions
- Analytical instruments - use and interpretation
- Identifying ethics related dilemmas / mistakes in clinical trial documents

d) **Assessment of teaching/presentation skills**

- e.g., presentation of a UG lecture, making Question paper, Learning Objectives
- Discussion on dissertation

**POST GRADUATE DEGREE COURSE
M.D IN MICROBIOLOGY**

I.GOALS:

The main aim of this course is to train students of Medicine in the field of Medical Microbiology. Theoretical and Practical is given in the sub-specialties viz, Bacteriology, Virology, Parasitology, Immunology and Mycology so that they can participate in good patient care and prevention of infectious diseases in the Community. They are introduced to basic research methodology so that they can conduct fundamental and applied research. They are also trained in teaching methods which should enable them to take up teaching assignment in Medical Colleges/Institutions.

II. OBJECTIVES:

A candidate upon successfully qualifying in the MD (Microbiology) examinations, should be able to:

- a. Be a competent Clinical Microbiologist.
- b. Conduct such clinical/experimental research as would have significant bearing on human health and patient care.
- c. Interact with the allied departments by rendering services in advanced laboratory investigations.
- d. Conduct collaborative research in the field of Microbiology and Allied Sciences.
- e. Demonstrate to the students how the knowledge of Microbiology can be used in a variety of clinical settings to solve diagnostic and therapeutic problems.
- f. Undertake teaching assignment of Microbiology in a medical college **as per CBME.**
- g. Play a Pivotal role in Hospital infection control, including

formulation of antibiotic policy and management of Biomedical waste.

- h. **Demonstrate ability to plan, execute and evaluate teaching and training assignments efficiently and effectively in Microbiology for undergraduate students as per Competency Based Medical Education (CBME).**
- i. **. Identify public health epidemiology, global health patterns of infectious diseases and effectively participate in community outreach and public health programs for investigation, prevention and control of infectious diseases.**
- j. **. Demonstrate self-directed learning skills and keep updated with recent advances in the field of clinical microbiology.**

The following specific objective are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. The objectives may be considered under the following subheadings.

1. Knowledge
2. Skills
3. Human values, ethical practice and communication abilities.

SUBJECT SPECIFIC COMPETENCIES

A.Cognitive Domain:

At the end of the course, the student should have acquired knowledge in the following theoretical competencies:

Paper I- General Microbiology(GM)+Immunology(IG)

General Microbiology(GM):

1. Understand the contributions of various pioneers in Microbiology.

2. Describe the types, working principles and applications of Compound microscope, Phase contrast microscope, Dark ground, Fluorescent Polarised microscope & Electron Microscope.
3. Identify various morphological forms of bacteria and other micro-organisms.
4. Understand nomenclature and classification of microbes.
5. Describe the physiology of growth, metabolism and nutrition of bacteria.
6. Understand various sterilization methods, disinfection and lyophilization.
7. Describe various mechanisms of virulence in bacteria and understand their clinical applications.
8. Understand the principles and applications of bacterial genetics and gene cloning.
9. Understand and apply various antibacterial substance used in the treatment of infection and drug resistance in bacteria.
10. Learn normal flora of human body, ecology of hospital environment, air, water, food & milk.
11. Discuss/ Describe host parasite relationship
12. Various Bio-safety issues including physical & biological containment, universal containment, personal protective equipment for biological agents.
13. Various isolation precautions including standard and transmission based precautions.
14. Applications of quality assurance, quality control in microbiology and accreditation of laboratories.
15. Explain the concept and use of information technology (LIS, WHO NET etc.) in microbiology laboratory effectively.
16. Describe types and applications of Bacteriophages in

diagnostic and therapeutic of infections

17. Explain the principles and application of recent technological advances, automation, and application of Artificial Intelligence, nanotechnology, biosensors, bioinformatics, etc. in diagnosis & research in Microbiology.

Immunology (IG)

1. Describe the anatomy and physiology of innate immunity.
2. Differentiate between innate and acquired immunity.
3. Discuss structure and function of antigen and antibodies.
4. Understand the function of complement in health and disease.
5. Describe various antigen and antibody reactions with their applications in the diagnosis of various diseases.
6. Understand the mechanisms of cellular and humoral immunity.
7. Classify various types of hypersensitivity reactions and describe their role in various diseases.
8. Recognize various immunodeficiency disorders & autoimmune diseases.
9. Describe the mechanisms of immunotolerance and surveillance.
10. Describe various types of transplants and mechanisms in graft versus host reactions.
11. Understand the role of immunity in tumours and describe various tumour antigens / markers.
12. Understand and apply the role of immunoprophylaxis and immunotherapy in various diseases / disorders.
13. Discuss the scope of qualitative / quantitative estimation of various antigen & antibodies in health & disease.
14. Measurement of immunological parameters

15. Mechanisms and significance of immune-potential and Immune-modulation

16. Explain the role of animals in immunology.

Paper II : Clinical/Systemic Microbiology-I (CM-I)

Discuss in depth about the etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national, international guidelines in the situations/ scenario given below:

National and international guidelines in infections caused by below infections.

- Infections of various organs and systems of the human body

Microbiological basis of infective syndromes of various organs and systems of human body viz.

1. CVS and blood,
2. Respiratory Tract Infections,
3. Urinary Tract Infections,
4. Central Nervous System infections,
5. Reproductive Tract Infections, Gastrointestinal Tract infections,
6. Hepatobiliary System,
7. Skin and Soft tissue infections,
8. Musculoskeletal system,
9. infections of Eye, Ear and Nose etc

Paper III: Clinical/Systemic Microbiology-II (CM-II)

Discuss in depth about the etiological agents, source, transmission, host-parasite interaction, clinical manifestations, laboratory diagnosis, treatment, prevention, epidemiology, national, international guidelines in the situations/ scenario given below:

- Infectious diseases as per the source/risk
- **Opportunistic Infections** in special and high risk host
- Infections in special situations/ scenario.

Microbiological basis of infective syndromes as per the source/risk e.g. Blood borne, sexually transmitted infections congenital, vector borne, food, air & water borne, zoonotic, laboratory acquired, occupational infections etc. Opportunistic Infections in special and high risk host eg Pregnancy, neonates, geriatrics, diabetics,

immunocompromised host due to any reason, patients with Implants/Devices, dialysis etc, Infections in special situations/ scenario -Tropical, Travel related, Emerging/ Remerging Infectious diseases seen commonly, agents of bioterrorism etc.

- Elicit relevant history, interpret laboratory results with clinic-microbiological correlation and develop diagnostic and treatment algorithms.

BACTERIA:

1. Describe the morphology, cultural characteristics, biochemical reactions, antigenic structure, virulence factors, pathogenicity, laboratory diagnosis epidemiology of the disease caused, preventive and control measures and recent advances in detail of all the pathogenic bacteria.

2. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis treatment and prevention of major bacterial pathogens of medical importance given below

- a. Gram positive cocci including Staphylococcus, Micrococcus, Streptococcus, Anaerobic Cocci etc.
- b. Gram negative cocci including Neisseria, Branhamella, Moraxella etc.
- c. Gram positive bacilli including Lactobacillus, Coryneform

bacteria,

Bacillus and aerobic bacilli, Actinomyces, Nocardia, Actinobacillus and

other actinomycetales, Erysipelothrix, Listeria, Clostridium and other

spore bearing anaerobic bacilli etc.

d. Gram negative bacilli including Vibrios, Aeromonas, Plesiomonas, Haemophilus, Bordetella, Brucella, Gardnerella, Pseudomonas and other non-fermenters, Pasteurella, Francisella, Bacteroides, Fusobacterium, Leptotrichia and other anaerobic gram negative bacilli etc.

e. Helicobacter, Campylobacter, Calymmatobacterium, Streptobacillus,

Spirillum and miscellaneous bacteria

f. Enterobacteriaceae

g. Mycobacteria

h. Spirochaetes

i. Chlamydia

j. Mycoplasmatales; Mycoplasma, Ureaplasma, Acholeplasma and other

Mycoplasmas.

k. Rickettsiae, Coxiella, Bartonella etc.

l. Any newly emerging bacteria.

Virology

I. Systemic virology

a. Knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major DNA viruses of medical importance including Pox viruses, Herpes

viruses, Adeno viruses, Hepadna virus, Papova viruses and Parvo viruses etc.

- b. Knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major RNA viruses of medical importance including Entero viruses, Toga viruses, Flavi viruses, Orthomyxo viruses, Paramyxo viruses, Reoviruses, Rhabdo viruses, Arena viruses, Bunya viruses, Retro viruses, Filo viruses, Human Immunodeficiency Virus, Arbo viruses, Corona viruses, Calci viruses etc.
- c. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of major Hepatitis viruses
- d. Demonstrate knowledge about epidemiology, morphology, genetics, antigenic nature, pathogenesis, complications, laboratory diagnosis, treatment and prevention of unclassified viruses and slow viruses including prions
- e. Demonstrate knowledge **about any newly emerging virus.**

Parasitology

Describe the geographical distribution, habitat, morphology, life cycle, immunology, pathogenicity, clinical features, complications, laboratory diagnosis, treatment and prophylaxis of all the Protozoan and Helminthic parasites of medical importance including the recent advances in the field of parasitology.

- a. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of Protozoan parasites of medical importance including *Entamoeba* Free living amoebae, *Giardia*, *Trichomonas*, *Leishmania*, *Trypanosoma*, *Plasmodium*, *Toxoplasma*, *Sarcocystis*, *Cryptosporidium*, *Microsporidium*, *Cyclospora* *Isospora*, *Babesia*, *Balantidium*, etc.
- b. Demonstrate knowledge about epidemiology, morphology, antigenic nature, life cycle, pathogenesis, complications, laboratory diagnosis, treatment and prevention of helminthes of medical importance including those belonging to Cestoda (*Diphyllobothrium*, *Taenia*, *Echinococcus*, *Hymenolepis*, *Dipylidium*, *Multiceps* etc.), Trematoda (*Schistosomes*, *Fasciola*, *Fasciolopsis*, *Gastrodiscoides*, *Paragonimus*, *Clonorchis*, *Opisthorchis* etc.) and Nematoda (*Trichiuris*, *Trichinella*, *Strongyloides*, *Ancylostoma*, *Necator*, *Ascaris* *Toxocara*, *Enterobius*, *Filarial worms*, *Dracunculus* etc.)
- c. Demonstrate knowledge about common arthropods and other vectors viz. mosquito,

sand fly, ticks, mite, cyclops, louse, myiasis of medical importance.

b. Neglected tropical parasitic diseases

c. Any newly emerging parasite

Mycology

Describe the structure, classification, morphology, reproduction, pathogenesis, clinical features, laboratory diagnosis and epidemiology of all the fungi of medical importance including the recent advances in the field of mycology.

d. Demonstrate knowledge about epidemiology, morphology, biochemical properties, antigenic nature, pathogenesis, complications, laboratory diagnosis

treatment and prevention of major fungal pathogens of medical importance given below.

- i. Yeasts and yeast like fungi including *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*, *Geotrichum*, *Saccharomyces* etc.
- ii. Mycelial fungi including *Aspergillus*, *Zygomycetes*, *Pseudallescheria*, *Fusarium*, *Piedra*, other dematiaceous hyphomycetes and other hyalohyphomycetes etc.
- iii. Dimorphic fungi including *Histoplasma*, *Blastomyces*, *Coccidioides*, *Paracoccidioides*, *Sporothrix*, *Penicillium marneffeii* etc.
- iv. Dermatophytes
- v. Fungi causing Mycetoma, Chromoblatomycosis,

Occulomycosis and

Otomycosis.

vi. *Pneumocystis jirovecii* infection

vii. *Rhinosporidium seeberi* and *Lacazia loboi* (formerly named
Loboa
loboi)

viii. *Pythium insidiosum*

ix. *Prototheca*

e. Able to identify laboratory contaminant fungi

f. Explain Mycetism and mycotoxicosis along with agents involved

Any newly emerging fungi

Paper IV: Applied Microbiology(AM)& Recent advances:

a. Demonstrate knowledge about epidemiology of infectious diseases

b. Demonstrate knowledge about antimicrobial prophylaxis and therapy

c. Demonstrate knowledge about hospital acquired infections

d. Demonstrate knowledge about management of biomedical waste

e. Effectively investigate an infectious outbreak in hospital and community

f. Demonstrate knowledge about infections of various organs and systems of human body viz. respiratory tract infections, urinary tract infections, central nervous system infections, congenital infections, reproductive tract infections,

gastrointestinal infections, hepatitis, pyrexia of unknown origin, infections of

eye, ear and nose, septicaemia, endocarditis, haemorrhagic fever etc.

g. Demonstrate knowledge about opportunistic infections

- h. Demonstrate knowledge about various sexually transmitted diseases
- i. Demonstrate knowledge about principles, methods of preparation, administration and types of vaccines
- j. Effectively use information technology (Computers) in microbiology
- k. Demonstrate knowledge and applications of Automation in Microbiology
- l. Demonstrate knowledge and applications about molecular techniques in the laboratory diagnosis of infectious diseases
- m. Demonstrate knowledge in statistical analysis of microbiological data and research methodology
- n. Demonstrate knowledge in animal and human ethics involved in microbiology
- o. Demonstrate knowledge in safety in laboratory and Laboratory management
- p. **Role of microbes in non-communicable diseases - infectious agents in origin and progression of non-communicable diseases like cancer, diabetes, musculoskeletal disorder and influence of these microbes on mental health.**

B. Affective Domain:

- a. Adopt ethical principles in all aspects of his/her practice; professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- b. Develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient.
- c. Provide leadership and get the best out of his team in a congenial working atmosphere.
- d. Apply high moral and ethical standard while carrying out human or animal research.

- e. Be humble and accept the limitations in his knowledge and skill and to ask for help from colleagues when needed.
- f. Respect patient's rights and privileges including patient's right to information and right to seek a second opinion.
- g. Communicate effectively with peers, and consultants for better clinical correlation of laboratory findings as well as research.
- h. Demonstrate effective communication and attitudinal skill while teaching undergraduate students.
- i. Demonstrate altruistic professional behavior with respect, discipline, responsibility, accountability, punctuality and integrity at all times while dealing with patients and their relatives.

C. Psychomotor domain:(skills)

C1 :The postgraduate student should be able to *perform the following and/or interpret the results independently or as a part of a team*:

Laboratory skills:

- a. Collect, transport and store appropriate specimens for microbiological investigations.
- b. Receive and process clinical specimens after appropriate preparation of samples for the appropriate investigation (centrifugation, extraction, mincing concentration etc.)
- c. Processing of samples by various methods like:
 - i. Macroscopic/gross examination of samples.
 - ii. Choose the most appropriate microscopic method for demonstration of pathogens.
 - iii. Prepare, examine, and demonstrate microbes in direct smears for diagnosis of infectious disease/s.
 - iv. Isolate and identify pathogenic microbe from clinical specimens (by conventional & automated methods).
 - v. Perform, interpret & record antimicrobial susceptibility testing of the isolate.
 - vi. Perform rapid, conventional and automated serological techniques for diagnosis of infectious diseases and immunological diseases.
- d. Maintain records and ensure quality control in microbiology.

- e. Maintain and preserve microbial cultures.
- f. Operate and maintain instruments used in the laboratory for sterilization and disinfection and patient care with quality control.
- g. Operate and maintain common laboratory equipment like microscopes, water bath, centrifuge, incubator, automated culture system, micro-centrifuge, ELISA washer and reader etc.
- h. Perform and assess significance of microbial contamination of food, water and air.
- i. Biosafety measures - biosafety cabinets, chemical material safety data sheet (MSDS), fire safety, needle stick injury management.

Organisms (Bacteria, Fungi, Virus and Parasites) based Laboratory skills:

• **Direct microscopic methods for demonstration of infectious agents:**

- a. Wet mount examination for - looking for cells and organisms (bacteria, fungi, parasite)
 - i. Saline mount stool sample - parasitic morphology
 - ii. Iodine mount-parasitic morphology
 - iii. KOH for fungi
 - iv. Negative staining
- b. Staining methods
 - i. Preparation of stains & quality check
 - ii. Preparation of peripheral blood smears from various samples
 - iii. Staining techniques - simple, differential, special staining methods - capsule, spore, flagella etc.
 - iv. Gram Staining
 - v. Acid Fast staining (with modifications).
 - vi. Leishman & Giemsa for demonstration of intracellular pathogen bacteria, parasite, fungi etc.
 - vii. Albert staining.
- c. Fluorescent staining
 - i. Auramine staining - Mycobacterium tuberculosis.

- ii. QBC – for malaria.
- iii. Calcoflor white staining for fungus
- d. Isolation of pathogens
 - i. Preparation of glass wares
 - ii. Sterilization procedures
 - iii. Media preparation-required for isolation & identification
 - iv. Quality check of all media - functional as well as sterility check and maintenance of the record
 - v. Inoculation methods of various samples – surface, streak, stab etc depending on sample
 - vi. Incubation methods - aerobic, anaerobic, microaerophilic, capnophilic depending on the pathogens.
- e. Identification of pathogen
 - i. Colony characters – various characters to be noted in different media.
 - ii. Staining to identify – Gram’s / Alberts / Acid Fast/ Lactophenol cotton blue depending on pathogen.
 - iii. Motility by hanging drop preparation and other methods.
 - iv. Biochemical reactions - phenotypic-enzymatic, oxidative fermentative, sugar fermentation, other special tests helping to identify up to species level.
 - v. Serotyping.
- f. Antibiotic Susceptibility Testing
 - i. Selection of antibiotic disks as per CLSI/EUCAST based on the probable identification of organism - bacteria, fungi.
 - ii. Detection of drug resistant strains - MRSA, VISA, VRE, ESBL, MBL, CRE etc.
 - iii. Broth microdilution methods for bacteria and fungi.
- Immunological tests
 - i. i. Collection, preparation and storage of samples
 - ii. ii. Perform Rapid tests //Latex agglutination/ ICT/ELISA etc

- Molecular tests
 - i. PCR/RTPCR – all steps till interpretation
 - ii. CBNAAT
- Biomedical waste management skills.
- **Quality control skills in all areas.**

Clinical Microbiology Skills (Infectious Disease Case Based Skill)

- i. Demonstrate ability to take and interpret the history of infectious disease case.
- ii. Be able to clinically examine the case and diagnose.
- iii. Take decision for choice of samples to be collected for diagnosis
- iv. Suggest optimum choice of antimicrobial agent to be prescribed with reasons.

Infection Prevention and Control Skills-

- i. Hand hygiene skills
- ii. Donning and doffing of PPE
- iii. Transmission based precautions in patient care
- iv. Segregation and disposal of biomedical waste in laboratory and hospital
- v. Handling of sharps
- vi. Post-exposure prophylaxis when exposed to blood and body fluids
- vii. Spillage management
- viii. Sterilization policy of environment and devices in the hospital as per the latest guidelines.
- ix. Calculation of HAI infection rates.
- x. Plan & conduct HAI surveillance & infection control audits

C 2. Should be able to **perform under supervision** and/or interpret the results of the following desirable procedures independently or as a part of a team:

1. Demonstration of microbe by:
 - i. IF – autoimmune diseases
 - ii. IF – antigen demonstration in fungi/viral infection /cellular changes
2. Isolation & Identification using newer automated systems for bacterial identification, Mycobacterial culture and Mycobacterial susceptibility

3. Immunological test

- i. Nephelometry/ turbidometry method for quantitative CRP/ASO/RA test
 - ii. Chemi-Luminiscence Immuno Assay
4. Perform molecular & newer diagnostic tests for diagnosis of infectious disease.

C 3. Should observe the following procedures independently or as a part of a team and/or interpret the results of: (optional)

1. Demonstration of microbes by Electron microscope
2. Viral culture & identification of growth of viruses
3. Immunological test
 - iii. Quantiferon
 - iv. Flowcytometry
 - Molecular -
 - i. Genome Sequencing methods
 - ii. Molecular typing.

TRAINING/TEACHING AND LEARNING ACTIVITIES

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a logbook for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation- based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used.

A. Theoretical Teaching:

1. Lectures:

Lectures are to be kept to a minimum. Certain selected topics can be taken as lectures. Lectures may be didactic or integrated there should be a minimum of **10 lectures per year**

2. Journal Club:

Journal clubs are held **Min of once in 1-2weeks is suggested.** All the PG students are expected to attend and actively participate in the discussion and enter in the log book relevant details. The presentations are evaluated using check list and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator is announced well in advance.

3. Subject Seminar:

Seminars shall be conducted **min of once every 1-2 weeks is suggested** on the theory question topic. All the PG students are expected to attend and actively participate in the discussion and enter in the log book relevant details. The presentations are evaluated using check list and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator is announced well in advance. **The student should be graded by faculty and peers.**

4. Teaching Skills:

Post Graduate students teach undergraduate students (eg. Medical, BDS, Nursing, BPT, Allied Courses) by taking demonstrations and lectures. Assessment is made using checklist by medical faculty as well as by the students. Record of their participation is to be kept in log book. Training of Post Graduate students in educational science and technology is recommended. **Training by medical education unit.**

5. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

6. Laboratory work / Bedside clinics: Minimum- once every 1-2 weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department where a student is posted shall moderate the teaching-learning sessions during clinical rounds.

7. Interdepartmental colloquium/scientific society meetings:

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest or clinical cases.

8. Continuing Medical Education Programmes (CME):

All Post Graduate students should attend at least 1 state CME programmes.

9. Conferences:

Attending conference is compulsory. Post-graduate student should attend one national and one state level conference during the course.

10. Research Activities:

The Post-graduate students are encouraged to carry out research activities in the department other than dissertation work.

8. A. Rotational clinical /community/institutional Postings.(as per table)

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions. The aim would be to acquire more in- depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based Guidelines.

The period of such assignments/ postings is recommended for **33 weeks**. Posting schedules may be modified depending on needs, feasibility and exigencies. For facilities not available in the parent institution as well as for additional knowledge and skill, extramural postings may be undertaken.

Suggested specific learning objectives are to be added in the log book. Each candidate is posted to different sections on rotation.

The three-year training programme in microbiology is arranged in the form of rotational postings to different sections/laboratories/departments/disciplines for specified periods.

Student must be posted for various duration in different sections of Microbiology (like Bacteriology, Serology, Virology, Parasitology, Immunology, Mycobacteriology, Mycology and Hospital infection control), patient care areas in hospital (like emergency, OPDs, critical care areas, surgical and medical wards etc) as well as in community outreach programs, so that they can learn specific requirements of each section and participate in patient care and prevention of infectious diseases in the hospital as well as community.

a. Culture seminars and discussions:

Culture seminars and discussions are held once a week.

Which helps in systematic way of identification of all the routine bacteria for first few months followed by identification of rare cultures.

b. Clinical Case/Bed side clinics:

Clinical case seminars are held once a month by processing the clinical samples for isolation and identification of the microbes causing that condition.

Following is the plan of Rotation for Postgraduate students Postings to Diagnostic Laboratories/Hospital/ Community-

Sr no	Schedule of Rotation	Duration	Specific Learning Objectives
1	Microbiology laboratory i. Different sections of Bacteriology ii. Media preparation iii. Mycobacteriology iv. Serology/ Immunology v. Mycology vi. Virology vii. Parasitology viii. Molecular lab Hospital Infection Control including BMW management	Distributed in various section depending upon training & departmental needs	As per the specific objectives in each section, a student is expected to acquire skills from basic to the most recent ones in diagnostic microbiology*. Objectives:
2	Sample Collection area	Two weeks	To learn pre-analytical parameters & procedures at sample collection area. <ul style="list-style-type: none"> • To communicate effectively with patients at sample collection area. • Learn to demonstrate respect, empathy &

			<p>confidentiality when dealing with patients, samples and reports.</p> <p>Demonstrate leadership skills in managing the functioning of the lab (staff management, preparing duty roster)</p>
3	<p>Clinical Pathology</p> <p>i. Hematology</p> <p>ii. Histopathology</p> <p>Blood Bank</p>	Two weeks	<ul style="list-style-type: none"> • Basic knowledge of clinical pathology (as applied to Microbiology) • Inflammation and repair • Intercellular substances and reaction • Pathological changes in the body in bacterial, viral, mycotic and parasitic infections <p>Clinical Pathology skills:</p> <ul style="list-style-type: none"> • Peripheral smear examination • CBC interpretation • Urine examination <p>Pathological investigations and their significance in infectious disease diagnosis.</p> <p>Blood Bank skills:</p> <ul style="list-style-type: none"> • Transfusion transmitted infection Blood grouping • Screening of blood & blood donors • Counseling skills <p>Histopathology skills:</p> <ul style="list-style-type: none"> • Various stains and staining techniques used in histopathological examination of

			<p>infectious agents</p> <p>Identification of pathogen and/or pathological changes in tissue sections in infectious diseases.</p>
4.	Clinical Biochemistry	One week	<ul style="list-style-type: none"> • Basic understanding of biochemistry as applied to immunological/ molecular methods for study of microbial diseases and pathogenesis of infections. <p>Significance of biochemical markers/profile in diagnosis, prognosis and monitoring of infective syndromes like sepsis</p>
5	ICTC /PPTCT/ART	Two weeks	<ul style="list-style-type: none"> • HIV counseling skills • HIV Testing strategies • HIV Surveillance strategies • Treatment regimens in HIV positive • case, management of drug resistance, and prophylaxis PEP, prevention & management of opportunistic infection
6	Tuberculosis and RNTCP	Two weeks	<ul style="list-style-type: none"> • Diagnosis of Pulmonary and extra pulmonary TB • Fluorescent Microscopy for TB • Molecular diagnosis • National tuberculosis Elimination Program • Treatment regimens in susceptible and drug resistant TB cases
7	District hospital postings (mandatory) 3rd or 4th semester for 3 months*	Three months*	<ul style="list-style-type: none"> • Identify types of infections seen in community • Identify lacuna in KAP in community that promote development of infections

			<ul style="list-style-type: none"> • Choice of antimicrobials and treatment plan for infections in community • Infection control in community • Should contribute to strengthen the services of the district health system, the diagnostic laboratory services. • Participate in public health programs & research activities
8	<p>Clinical locations –</p> <p>i. Medicine & allied (General Medicine, Respiratory Disease, Skin & Venereal Disease)</p> <p>ii. Pediatrics</p> <p>iii. Surgery & allied (General Surgery, Orthopedic)</p> <p>Obstetric and Gynecology</p>	<p>Two months</p> <p>Posting to be done for morning half of the day</p>	<p>Depending on the area of posting-</p> <ul style="list-style-type: none"> • History taking and physical examination skills • Sample collection and transportation skills • Identification of common infections and make a differential diagnosis • Choose the appropriate laboratory investigations required for confirmation of diagnosis • Interpret the laboratory results and correlate them clinically. • Learn common treatment plan, particularly choice of antimicrobials and identify factors that influence choice of antimicrobials. • Acquire reasoning and critical thinking required in decision making when

			<p>dealing with an infectious disease case</p> <ul style="list-style-type: none"> • Infection control practices
9	<p>Critical care units-</p> <p>i. Medical ICU ii. Surgical ICU</p> <p>Neonatal/Pediatric ICU</p>	<p>Three weeks</p> <p>(in morning half day)</p>	<ul style="list-style-type: none"> • All above in a critical setting along with <p>Availability and choice of specialized investigations necessary for optimum management of a critical patient with ID.</p> <p>Significance and adherence to antibiotic policy and antibiotic stewardship program Infection control in ICU</p>
10	<p>Institutional Super specialty wing if available Dialysis, Oncology, Cardiology etc</p>	<p>One week</p> <p>(morning half day)</p>	<ul style="list-style-type: none"> • To study infections seen in special situations along with their management & prevention approach
	<p>Total duration of posting outside microbiology laboratory</p>	<p>33 weeks</p>	

***Posting under “District Residency Programme”**

During the clinical posting, opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with clinicians in different hospital setting must be scheduled.

The PG student must be tagged along with the resident of the clinical department for bedside case discussion, under the guidance of an assigned faculty. A minimum of five case histories shall be recorded by a student during course of study. The case history must be representative of different type of Infectious Disease (ID) cases likely to be encountered eg., those caused by different microbes in community and hospital setting, HAI, infections in critical care/ ward

setting, infection in different age groups, infections in special host like Immunocompromised host, traveler, specific occupations etc.

The process of recording case histories can begin in first half of 2nd year of PG program, after students have learnt about various infective syndromes. The severity and complexity of cases must progress gradually, with simple community-based infection to begin with. At least one fourth of the cases recorded must have been discussed with the ID specialist or a clinician and their feedback/remarks documented in log book/ portfolio with their signatures.

Documentation of students learning at the end of each posting is required.

Emergency duty

The student is posted for managing emergency laboratory services in Microbiology.

He/she should deal with all the emergency investigations in Microbiology.

8.b.Posting under “District Residency Programme” (DRP):

All postgraduate students pursuing MD/MS in broad specialties in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate programme and the rotation shall be termed as “District Residency Programme” and the PG medical student undergoing training shall be termed as “District Resident”.

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

Opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with specialists / clinicians in different hospital settings must be scheduled to address antimicrobial resistance issues and strategies to deal with it.

9. Dissertation:

Every candidate pursuing MD degree course is required to carry out work on a selected research project under the guidance of a recognized post graduate teacher. The results of such a work shall be submitted in the form of a dissertation.

For details regarding DISSERTATION Refer 9.1 to 9.11 of Chapter –I.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. If a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work to re-inforce the Diversity of knowledge and skills.

10. Training in teaching & learning skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

11. Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in Wards, OPDs, Casualty and other areas of posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The logbook is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The log book is to:

- a) Help maintain a record of the work done during training.

- b) Enable Faculty/Consultants to have direct information about the work done and intervene, if necessary.
- c) Provide feedback and assess the progress of learning with experience gained periodically.

The Log Book should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in logbook particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program.

12.Course in Research Methodology: All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

Other aspects

- The Postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department should take part in e-learning activities.
- The Postgraduate trainees should undergo training in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS).
- The Postgraduate trainees must undergo training in information technology and use of computers.

Assesment

Candidate will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

1. Formative Assesment

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self-directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs
6. professionalism and communication skills(At least five clinical cases shall be assessed through discussion of case histories recorded by the students while posted in clinical setting and recorded along with feedback (preferably by ID specialist if available/clinician).

The students are assessed periodically as per categories listed in postgraduate student appraisal form (Annexure II).

2. SUMMATIVE ASSESSMENT:

i.e., assessment at the end of training

Essential pre-requisites for appearing for examination include:

1. **Log book** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.
2. At least **two presentations** at national level conference. One research paper should be published / accepted in an indexed journal.

The post-graduate examinations is conducted in three parts:

I. Essential pre-requisites for appearing for examination include:

1. **Log book** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.
2. At least **two presentations** at national level conference. One research paper should be published / accepted in an indexed journal. **(It is suggested that the local or University Review committee assess the work sent for publication).**

1. Thesis.

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognized Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is

aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory Examination

‘Theory’ as well as ‘Practical’ separately 50% is mandatory for passing examination as a whole. The examination for M.D./ MS shall be held at the end of 3rd academic year. An academic term shall mean six month's training period. Candidate will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

Theory: 400Marks

There shall be four question papers, each of three hours’ duration. Total marks of each paper will be 100. Questions on recent advances may be asked in any or all the papers. The format of each paper will be same as shown below.

Type of Questions	No. of Questions	Marks for each question	Total marks
Essay	10	10	100
Grand total			100

Details of distribution of topics for each paper will be as follows:

Paper I- General Microbiology and Immunology (GM & IG).

Paper II- Clinical / Systemic Microbiology (CM I).

Paper III- Clinical / Systemic Microbiology (CM II).

Paper IV- Recent Advances & Applied Microbiology (AM).

Note: The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

3. Practical and Oral / Viva voce Examination: 400 Marks.

Practical should be spread over TWO days and include the following components:

To elicit competence in practical skills and to discuss differential diagnostic followed by therapeutic

aspects.

Sl. No.	Exercise	Marks
1	Clinical Microbiology exercise	35
2	Bacteriology exercise I	40
3	Bacteriology exercise II	50
4	Mycology exercise	35
5	Virology exercise	30
6	Serology exercise	35
7	Parasitology	25
8	Reporting on slides	50
Total		300

Ex. No	Day -1	Ex. No	Day-2
1	Clinical Microbiology exercise (Give a real clinical case /paper based scenario addressing commonly seen cases in bacteriology/mycobacteriology/virology/mycology/parasitology/HAI/AMR/out break /national project based etc of infectious diseases to the PG for workup and evaluation with respect to case history, basic physical examination, required investigations, interpretation of diagnostic test results, and therapeutic management decisions including prescription of antibiotics,, along with IC practices)	1 cont	Clinical Microbiology exercise - Conclusion
2	Long Exercise- Bacteriology (Mixed culture given with a clinical history representing any specimen collected from respective systemic infection)	2 cont	Long Exercise - Bacteriology conclusion
3	Short Exercise – Bacteriology (Identification of a pure culture)	3 cont	Short Exercise - Bacteriology conclusion
4	Serology Exercise (In a clinical case, choice of test & technique with interpretation of test results)	4 cont	Serology cont. if required
5	Virology techniques (In a clinical case, choice of test & technique with interpretation of test results. Viral serology/ Molecular techniques depending upon availability)	5 cont	Virology cont. if required
6	Mycology (Identification of fungi in a clinical case)	6 cont	Mycology cont. if required
7	Parasitology (In a clinical case, choice of test & technique with interpretation of test results Stool examination, Examination of Peripheral blood smear etc)	9	Pedagogy (10-15minutes)

8 Slides (Slides including histopathology for microscopic identification & discussion

10 Log book, Dissertation Viva, Grand-Viva

Viva-voce - Marks: 100

The Viva – Voce examination consists of question on Bacteriology, Mycology, Virology, Immunology, and Parasitology topics, it will also include recent advances, history and scope of Microbiology.

1. Viva-Voce Examination:

Marks: 80

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. Student shall also be given case reports, charts for interpretation. It includes discussion on dissertation.

2. Pedagogy Exercise and Log Book:

(20 Marks)

i. Candidate is asked to make a presentation for 8 – 10 minutes on a topic given in the beginning of practical examination. **(10 Marks)**

ii. Candidate is asked to make a presentation for 8-10 minutes on the dissertation topic and the review of Log Book. **(10 Marks)**

A. Maximum Marks:

Maximum marks for M.D.	Theory	Practical	Viva	Grand Total
Microbiology	400	300	100	800

I. RECOMMENDED BOOKS (REFER LATEST EDTIONS):

Sl.No.	Name of the Textbook	Authors	Publishers
1	Medical Microbiology, 3 rd Edn, 1991.	Samuel Baron	Churchill Livingstone Inc.
2	Laboratory Diagnosis of Viral Infections, 2 nd Edn, 1992.	Edmin H Lennette	Newyork Marcel Dekker, Inc.
3	Manson's Tropical Diseases, 20 th Edn, 1996.	Gordon Cook	London, ELBS.
4	Bergey's Manual of Determinative Bacteriology, 9 th Edn, 1994.	John G Holt et al	Maryland, Williams & Wilkins.
5	Manual of Clinical Microbiology, 5 th Edn, 1991.	Albert Balows	Washington D.C, American Society for Microbiology.
6	Bailey & Scott's Diagnostic Microbiology, 12 th Edn, 2007.	Ellen Jo Baron et al	Missouri, Mosby.
7	Clinical Virology, 1997	Douglas D. Richman	Newyork, Churchill Livingstone.
8	Burrows Textbook of Microbiology, 21 st Edn, 1979.	Bob A Freeman	W.B. Saunders.
9	Anaerobes in Human Disease, 1991.	Brian I Duerden & B. S. Drasar	Great Britain, Edward Arnold.
10	Introduction to Diagnostic Microbiology, 6 th Ed. Colour Atlas and Textbook of Diagnostic Microbiology. 2006.	Elmer W Koneman et al	Philadelphia, J.B. Lippincott Company.
11	Field Virology, Vol. 1, 3 rd Edn, 1996.	Bernard N Fields et al	Philadelphia, Lippincott-Ramen.
12	Medical Microbiology, A guide to Microbial Infections, Pathogenesis, Immunity, Laboratory Diagnosis and Control, 16 th Edn, 2002.	Danial Greenwood et al	London, Churchill Livingstone.
13	Mackie & McCartney Practical Medical Microbiology, 14 th Edn, 1996.	J.G. College et al	London, Churchill Livingstone.
14	Hospital Infections, 5 th Edn, 2006	John V Bennett & Philip S Brachman	Little Brown.

15	Manual of Clinical Laboratory Immunology, 4 th Edn, 1992.	Noel R Rose et al	Washington D.C, Americal Society for Microbiology.
16	Fundamental Immunology, 3 rd Edn, 1993.	William E Paul	Newyork, Raven Press.
17	Medical Immunology, 11 th Edn, 2008.	Stites D. P. Terr AI, Parslow T.G.	Appleton & Lange, USA
18	Cellular and Molecular Immunology, 6 th Edn, 2007.	Abbas A.K., Lichtman Att	Saunders.
19	Manual of Clinical Laboratory Immunology, 4 th Edn, 1992.	Rose N.R., Macario EC	American Society for Microbiology.
20	Essential Immunology, 10 th Edn, 2001.	Roitt IM, Delves PJ, Roitts	Blackwell Scientific Publisher.
21	Microbiology and Microbial infections, 10 th Edn, 2006.	Topley & Wilson's	Arnold.

VIII RECOMMENDED JOURNALS:

Sl.No.	Name of the Journal
1	Journal of Medical Microbiology. 2008. Lippincott-Raven Publishers, Pathological Society of Great Britain & Ireland,
2	Clinical Infectious Diseases. 2008. Pub : The University of Chicago Press, Chicago Illinois 60637,
3	Clinical Microbiology Reviews. Pub : The American Society for Microbiology.
4	Microbiology & Molecular Biology Reviews. (mibr). 2008. Pub : American Society for Microbiology,
5	Journal of Clinical Microbiology (JCM). 2008. Pub : American Society for Microbiology,

6	The Journal of Infectious Diseases. 2008. Pub : The University of Chicago Press,
7	Journal of Communicable Diseases. 2008. Pub : The Indian Society for Malaria and other communicable disease.
8	Infectious Disease Clinics of North America. 2008. Pub : W.B. Saunde Company, A Division of Harcourt Brace & Company,
9	Indian Journal of Medical Microbiology, 2008. Pub : Indian Associates of Medical Microbiologists,
10	The Indian Journal of Medical Research. 2008. Pub : Indian Council of Medical Research, New Delhi.
11	Annual Review of Microbiology, 2008. Pub : Annual Reviews Inc. Palo Alto. California, USA.

ADDITIONAL READING:

Sl.No.	Name of the Textbook	Authors	Publishers
1	* Compendium of recommendations of various committees on Health and Development (1943-1975). DGHS, 1985		Central Bureau of Health Intelligence, Directorate General of Health Services, min. of Health and Family Welfare, Govt. of India, Nirman Bhawan, New Delhi. P – 335.
2	*National Health Policy, Min. of Health & Family Welfare,		Nirman Bhawan, New Delhi, 1983.
3	The elements of Research, writing and editing 1994,	Santosh Kumar.	Dept. of Urology, JIPMER, Pondicherry.
4	Medical Education Principles and Practice, 1995.	Srinivasa D K et.al.	National Teacher Training Centre, JIPMER, Pondicherry.
5	*Indian Council of Medical Research, — Policy Statement of Ethical considerations involved in Research on Human Subjects, 1982		I.C.M.R, New Delhi.

6	*Code of Medical Ethics framed under section 33 of the Indian Medical Council Act, 1956.		Medical Council of India, Kotla Road, New Delhi.
7	Francis C M, Medical Ethics, 1993.		J P Publications, Bangalore.
8	*Indian National Science Academy, Guidelines for care and use of animals in Scientific Research, 1994.		New Delhi,
9	Internal National Committee of Medical Journal Editors, Uniform requirements for manuscripts submitted to biomedical journals, N Engl J Med 1991; 424-8		
10	Essentials of Medical Statistics , 1 st Ed., 1988.	Kirkwood B R.	Oxford : Blackwell Scientific Publications
11	Methods in Bio statistics for medical students. 6 th Ed. 1989.	Mahanjan B.K.	New Delhi, Jaypee Brothers Medical Publishers.
12	A Practical approach to PG dissertation.	Raveendran B. Gitanjali	New Delhi, J P Publications, 1998.

Annexure I:

Following are the competencies to be achieved under Antimicrobial Resistance Detection and Prevention:

1. Demonstrate in depth knowledge of classification, mechanism of action and drug resistance of antimicrobials (antibacterials, antiviral, antifungal, antimycobacterial and antiparasitic agents).
2. Explain various phenotypic and genotypic methods used in laboratory for detection of drug resistant strains and their implications in patient care.
3. Demonstrate skills in performing antimicrobial susceptibility testing with calculations of MIC/MBC by various phenotypic and genotypic methods and interpret results as per standard guidelines (CLSI, EUCAST etc).
4. Detect and report bacterial drug resistance by identification of the commonly isolated drug resistant strains (MRSA, VRSA, VRE, CRE, MBL, AMP-C etc) and choose the most appropriate agent for therapeutic use in a specific clinical scenario.
5. Explain the implications of AST result on antimicrobial therapy to clinicians/colleagues.
6. Communicate effectively with clinicians to guide and create an antimicrobial treatment plan based on organism identification and susceptibility test.
7. Explain the concept of narrow/broad spectrum of antimicrobials, PK/PD parameters and their significance on response to antimicrobial therapy.
8. Explain significance of monitoring of antimicrobial therapy in patient care.
9. Explain the concept of empiric, syndromic and culture-based treatment strategies for treating infections.
10. Explain the need to de-escalate from empirical broad-spectrum therapy to targeted narrow-spectrum therapy.
11. Explain the importance of appropriate use of antimicrobial agents, risk of antimicrobial resistance and spread of AMR in the health care environment and the community.
12. Explain the concept of normal microbial flora, colonization, contamination and infection with its role in deciding antimicrobial therapy.

13. Demonstrate knowledge about antimicrobial prophylaxis including peri-operative surgical prophylaxis regimens.
14. Describe the concept of first-, second- and third-line antimicrobial therapy for infections.
15. Explain the importance of restricted reporting of susceptibility data by the laboratory to control antimicrobial use.
16. Explain the concept and application of WHO tool for optimizing use of antimicrobial agents: Access, Watch and Reserve (AWaRe).
17. Explain the importance of antimicrobial formularies, consumption data and prescribing policies and processes to monitor use of antimicrobials in hospitals.
18. Effectively use information technology (LIS, WHO NET etc.) for data collection and surveillance of AMR in microbiology laboratory.
19. Explain significance of collecting local antimicrobial resistance data and its use in deciding direct empirical antimicrobial therapy.
20. Demonstrate knowledge and skills to develop antibiotic policy by using local AMR data in hospital.
21. Explain significance of adherence to antibiotic policy and antibiotic stewardship program.
22. Be a part of antimicrobial stewardship team for the institution.
23. Demonstrate knowledge about recent published guidelines that recommend antimicrobial treatment therapy in various clinical situations.
24. Effectively communicate with the patients/ relatives about the role of antimicrobial agents in their disease and advice on appropriate use.
25. Actively engage with patients, relatives and the community to advise on the role of antimicrobial agents in therapy and the threat of resistance.
26. Participate in clinical audit and quality improvement programmes relating to antimicrobial use.
27. Teach students, colleagues and other health professionals regarding antimicrobial use and resistance.

Student appraisal form for MD in Microbiology											
	Elements	Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	Scholastic aptitude and learning										
1.1	Has knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity (e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned(e.g Posters, publications etc)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work based assessments										
1.6	Self-directed Learning										
2	Work related to training										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										

2.3	Ability to work with other members of the team										
2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional attributes										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee?	Yes	No								
	If not explain.										
	Name and Signature of the assesse										
	Name and Signature of the assessor										

	Date										
--	------	--	--	--	--	--	--	--	--	--	--

COMPETENCY BASED

POSTGRADUATE TRAINING

PROGRAMME

FOR

MD IN GENERAL MEDICINE

**COMPETENCY BASED
POSTGRADUATE TRAINING PROGRAMME
FOR MD IN GENERAL MEDICINE**

I. Preamble:

The purpose of postgraduate training program is to create specialists who would provide high quality health care and advance the cause of science through research & training. The competency based training programme aims to produce a post-graduate student who after undergoing the required training should be able to deal effectively with the needs of the community and should be competent to handle all problems related to his/her specialty including recent advances. The student should also acquire skill in teaching of medical/para-medical students in General Medicine. The student is also expected to know the principles of research methodology and modes of accessing literature.

II. Objectives;

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate complete the course. The objectives may be considered under following subheadings-

Subject Specific Objectives

The postgraduate training should enable the student to:

1. Practice efficiently internal medicine specialty, backed by scientific knowledge including basic sciences and skills
2. Diagnose and manage majority of conditions clinically and with the help of relevant investigations
3. Exercise empathy and a caring attitude and maintain professional integrity, honesty and high ethical standards.
4. Plan and deliver comprehensive treatment using the principles of rational drug therapy
5. Plan and advise measures for the prevention and rehabilitation of patients.
6. Manage emergencies efficiently by providing Basic Life Support (BLS) and Advanced Life Support (ALS) in emergency situations
7. Recognize conditions that may be outside the area of the specialty competence and refer them to an appropriate specialist.
8. Demonstrate skills in documentation of case details including epidemiological data.
9. Play the assigned role in the implementation of National Health Programs.
10. Demonstrate competence in basic concepts of research methodology and clinical epidemiology; and preventive aspects of various disease states.

11. Be a motivated 'teacher' - defined as one keen to share knowledge and skills with a colleague or a junior or any learner
12. Continue to evince keen interest in continuing education irrespective of whether he/she is in a teaching institution or is practicing and use appropriate learning resources
13. Be well versed with his medico-legal responsibilities
14. Undertake audit, use information technology tools and carry out research - both basic and clinical, with the aim of publishing the work and presenting the work at scientific forums.
15. The student should be able to recognize the mental condition characterized by self absorption and reduced ability to respond to the outside world (e.g. Autism), abnormal functioning in social interaction with or without repetitive behavior and/or poor communications, etc.

The intended outcome of a competency based program is a consultant specialist who can practice medicine at a defined level of competency in different practice settings. i.e. ambulatory (outpatient), inpatient, intensive care and emergency medicine. No limit can be fixed and no fixed number of topics can be prescribed as course contents. The student is expected to know his subject in depth; however, emphasis is on the diseases / health problems most prevalent in this area, as competence in skills commensurate with the actual hands-on training.

Subject Specific Competencies

A. Cognitive domain.

By the end of the course, the student should have acquired knowledge (cognitive domain), professionalism (affective domain) and skills (psychomotor domain) as given below:

i) Basic Sciences

1. Basics of human anatomy as relevant to clinical practice e.g. surface anatomy of various viscera, neuro-anatomy, important structures/organs location in different anatomical locations in the body; common congenital anomalies.
2. Basic functioning of various organ-system, control of vital functions, pathophysiological alteration in diseased states, interpretation of symptoms and signs in relation to pathophysiology.
3. Common pathological changes in various organs associated with diseases and their correlation with clinical signs; understanding various pathogenic processes and possible therapeutic interventions possible at various levels to reverse or arrest the progress of diseases.
4. Knowledge about various microorganisms, their special characteristics important for their pathogenetic potential or of diagnostic help; important organisms associated with tropical diseases, their growth pattern/life-cycles, levels of therapeutic interventions possible in preventing and/or eradicating the organisms.

5. Knowledge about pharmacokinetics and pharmaco-dynamics of the drugs used for the management of common problems in a normal person and in patients with diseases kidneys/liver etc. which may need alteration in metabolism/excretion of the drugs; rational use of available drugs.
6. Knowledge about various poisons with specific reference to different geographical and clinical settings, diagnosis and management.
7. Research Methodology and Studies, epidemiology and basic Biostatistics.
8. National Health Programmes.
9. Biochemical basis of various diseases including fluid and electrolyte disorders; Acid base disorders etc.
10. Recent advances in relevant basic science subjects

ii) Systemic Medicine

1. Preventive and environmental issues, including principles of preventive health care, immunization and occupational, environmental medicine and bioterrorism.
2. Aging and Geriatric Medicine including Biology, epidemiology and neuropsychiatric aspects of aging.
3. Clinical Pharmacology - principles of drug therapy, biology of addiction and complementary and alternative medicine.
4. Genetics - overview of the paradigm of genetic contribution to health and disease, principles of Human Genetics, single gene and chromosomal disorders and gene therapy.
5. Immunology - The innate and adaptive immune systems, mechanisms of immune mediated cell injury and transplantation immunology.
6. Cardio-vascular diseases - Approach to the patient with possible cardiovascular diseases, heart failure, arrhythmias, hypertension, coronary artery disease, valvular heart disease, infective endocarditis, diseases of the myocardium and pericardium and diseases of the aorta and peripheral vascular system.
7. Respiratory system - approach to the patient with respiratory disease, disorders of ventilation, asthma, Chronic Obstructive Pulmonary Disease (COPD), Pneumonia, pulmonary embolism, cystic fibrosis, obstructive sleep apnoea syndrome and diseases of the chest wall, pleura and mediastinum.
8. Nephrology - approach to the patient with renal diseases, acid-base disorders, acute kidney injury, chronic kidney disease, tubulo-interstitial diseases, nephrolithiasis, Diabetes and the kidney, obstructive uropathy and treatment of irreversible renal failure.
9. Gastro-intestinal diseases - approach to the patient with gastrointestinal diseases, gastrointestinal endoscopy, motility disorders, diseases of the oesophagus, acid peptic disease, functional gastrointestinal disorders, diarrhea, irritable bowel syndrome, pancreatitis and diseases of the rectum and anus.

10. Diseases of the liver and gall bladder - approach to the patient with liver disease, acute viral hepatitis, chronic hepatitis, alcoholic and non-alcoholic steatohepatitis, cirrhosis and its sequelae, hepatic failure and liver transplantation and diseases of the gall bladder and bile ducts.
11. Haematologic diseases - haematopoiesis, anaemias, leucopenia and leucocytosis, myeloproliferative disorders, disorders of haemostasis and haemopoietic stem cell transplantation.
12. Oncology - epidemiology, biology and genetics of cancer, paraneoplastic syndromes and endocrine manifestations of tumours, leukemias and lymphomas, cancers of various organ systems and cancer chemotherapy.
13. Metabolic diseases - inborn errors of metabolism and disorders of metabolism.
14. Nutritional diseases - nutritional assessment, enteral and parenteral nutrition, obesity and eating disorders.
15. Endocrine - principles of endocrinology, diseases of various endocrine organs including diabetes mellitus.
16. Rheumatic diseases - approach to the patient with rheumatic diseases, osteoarthritis, rheumatoid arthritis, spondyloarthropathies, systemic lupus erythematosus (SLE), polymyalgia, rheumatic fibromyalgia and amyloidosis.
17. Infectious diseases - Basic consideration in Infectious Diseases, clinical syndromes, community acquired clinical syndromes. Nosocomial infections, Bacterial diseases - General consideration, diseases caused by gram-positive bacteria, diseases caused by gram - negative bacteria, miscellaneous bacterial infections, Mycobacterial diseases, Spirochetal diseases, Rickettsia, Mycoplasma and Chlamydia, viral diseases, DNA viruses, DNA and RNA respiratory viruses, RNA viruses, fungal infections, protozoal and helminthic infections.
18. Neurology - approach to the patient with neurologic disease, headache, seizure disorders and epilepsy, coma, disorders of sleep, cerebrovascular diseases, Parkinson's disease and other movement disorders, motor neuron disease, meningitis and encephalitis, peripheral neuropathies, muscle diseases, diseases of neuromuscular transmission and autonomic disorders and their management.
19. The mental condition characterized by complete self-absorption with reduced ability to communicate with the outside world (Autism), abnormal functioning in social interaction with or without repetitive behavior and/or poor communication etc.
20. Dermatology - Structure and functions of skin, infections of skin, papulosquamous and inflammatory skin rashes, photo-dermatology, erythroderma, cutaneous manifestations of systematic diseases, bullous diseases, drug induced rashes, disorders of hair and nails, principles of topical therapy.

Orientation session : All PG students joining the course should have an orientation session to acquaint them with the requirements and other details. A plan for orientation session has been given at Annexure 1.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should have acquired following skills:

Clinical Assessment Skills

- Elicit a detailed clinical history
- Perform a thorough physical examination of all the systems

Procedural skills

- Test dose administration
- Mantoux test
- Subcutaneous injection
- Intramuscular injection
- Intravenous cannulation
- Intravenous injections
- IV- Infusions
- Sampling of fluid for culture
- ECG recording
- Pleural tap
- Lumbar puncture
- Cardiac
 - TMT
 - Holter Monitoring
 - Echocardiogram
 - Doppler studies
- Cardio Pulmonary Resuscitation (CPR)
- Central venous line insertion, CVP monitoring
- Blood and blood components matching and transfusions
- Arterial puncture for ABG
- Fine needle aspiration cytology (FNAC) from palpable lumps
- Bone marrow aspiration and biopsy
- Abdominal paracentesis - diagnostic
- Aspiration of liver abscess
- Pericardiocentesis
- Joint fluid aspiration
- Liver biopsy
- Nerve/ muscle/ skin/ kidney/ pleural biopsy
- Ultrasound abdomen, echocardiography
- Upper GI endoscopy, procto-sigmoidoscopy

Respiratory management

- Nebulization
- Inhaler therapy
- Oxygen delivery

Critically ill person

- Monitoring a sick person
- Endotracheal intubation
- CPR
- Using a defibrillator
- Pulse oximetry
- Feeding tube/Ryle's tube, stomach wash
- Naso-gastric intubation

- Urinary catheterization – male and female
- Prognostication
- Haemodialysis
- Intercostal tube placement with underwater seal Thoracocentesis
- Sedation
- Analgesia

Neurology- interpret

- Nerve Conduction studies
- EEG
- Evoked Potential interpretation
- Certification of Brain death

Laboratory-Diagnostic Abilities

- Urine protein, sugar, microscopy
- Peripheral blood smear
- Malarial smear
- Ziehl Nielson smear-sputum, gastric aspirate
- Gram's stain smear-CSF, pus
- Stool pH, occult blood, microscopy
- KOH smear
- Cell count - CSF, pleural, peritoneal, any serous fluid

Observes the procedure

- Subdural, ventricular tap
- Joint Aspiration – Injection
- Endoscopic Retrograde Cholangio- Pancreatography (ERCP)
- Peritoneal dialysis

Interpretation Skills

Clinical data (history and examination findings), formulating a differential diagnosis in order of priority, using principles of clinical decision making, plan investigative work-up, keeping in mind the cost-effective approach i.e. problem solving and clinical decision making.

- Blood, urine, CSF and fluid investigations - hematology, biochemistry
- X-ray chest, abdomen, bone and joints
- ECG
- Treadmill testing
- ABG analysis
- Ultrasonography

- CT scan chest and abdomen
- CT scan head and spine
- MRI
- Barium studies
- IVP, VUR studies
- Pulmonary function tests
- Immunological investigations
- Echocardiographic studies

Interpretation Under Supervision

- Hemodynamic monitoring
- Nuclear isotope scanning
- MRI spectroscopy/SPECT
- Ultrasound guided aspiration and biopsies

Patient Management Skills

- Proficiency in management of medical emergencies, including emergency triaging
- Drawing and executing patient management plan and long term care
- Documenting patient records on day to day basis and problem oriented medical record
- Identifying need for timely referral to appropriate departments/health facility and pre-transport stabilization of the sick patients.

Communication skills

- While eliciting clinical history and performing physical examination
- Communicating health, and disease
- Communicating about a seriously ill or mentally abnormal
- Communicating death
- Informed consent
- Empathy with patient and family members
- Referral letters, and replies
- Discharge summaries
- Death certificates
- Pre-test counseling for HIV
- Post-test counseling for HIV
- Pedagogy -teaching students, other health functionaries-lectures, bedside clinics, discussions
- Health education - prevention of common medical problems, promoting healthy life-style, immunization, periodic health screening, counseling skills in risk factors for common malignancies, cardiovascular disease, AIDS
- Dietary counseling in health and disease
- Case presentation skills including recording case history/examination, preparing follow-up notes, preparing referral notes, oral presentation of new cases/follow-up cases
- Co-coordinating care - team work (with house staff, nurses, faculty etc.)
- Linking patients with community resources
- Providing referral
- Genetic counseling

Academic Skills

- Familiarity with basic research methodology, basic IT skills. Planning the protocol of the thesis, its execution and final report
- Review of literature
- Conducting clinical sessions for undergraduates medical students
- Desirable: writing and presenting a paper. Teaching sessions for nurses and medical workers

Others

- Demonstrating
 - Professionalism
 - Ethical behavior (humane and professional care to patients)
- Utilization of information technology
 - Medline search, Internet access, computer usage
- Research methodology
 - designing a study
 - interpretation and presentation of scientific data
- Self-directed learning
 - identifying key information sources
 - literature searches
 - information management
- Therapeutic decision-making
 - managing multiple problems simultaneously
 - assessing risks, benefits and costs of treatment options
 - involving patients in decision-making
 - selecting specific drugs within classes
 - Rational use of drugs

SYLLABUS

III. COURSE CONTENTS:

A. Basic Sciences

1. Basics of human anatomy as relevant to clinical practice
 - surface anatomy of various viscera
 - neuro-anatomy
 - important structures/organs location in different anatomical locations in the body
 - common congenital anomalies
2. Basic functioning of various organ-system,
 - control of vital functions,
 - pathophysiological alteration in diseased states.
 - Interpretation of symptoms and signs in relation to patho-physiology.
3. Common pathological changes
 - In various organs associated with diseases and their correlation with clinical signs.
 - Understanding various pathogenic processes and possible therapeutic interventions at various levels to reverse or arrest the progress of diseases.

4. Knowledge about various microorganisms.
 - Their special characteristics important for their pathogenetic potential or of diagnostic help;
 - Important organisms associated with tropical diseases, their growth pattern/life-cycles, levels of therapeutic interventions possible in preventing and/or eradicating the organisms.
 5. Knowledge about pharmacokinetics and pharmaco-dynamics of the drugs used for
 - The management of common problems in a normal person and in patients with diseases kidneys/liver etc. which may need alteration in metabolism/excretion of the drugs.
 - Rational use of available drugs.
 6. Knowledge about various poisons with specific reference to different geographical and clinical settings, diagnosis and management.
 7. Research Methodology and Studies, epidemiology and basic Biostatistics.
 8. National Health Programmes.
-
9. Biochemical basis of various diseases including fluid and electrolyte disorders; Acid base disorders etc.
 10. Recent advances in relevant basic science subjects.

B. Systemic Medicine

11. Preventive and environmental Medicine,

- Principles of preventive health care,
- Immunization and occupational Medicine,
- Environmental medicine
- Bio-terrorism.

12. Aging and Geriatric Medicine:

- Comprehensive geriatric assessment.
- Biology of ageing
- Physiological changes of ageing
- Presenting problems in geriatric medicine –Falls, Urinary incontinence
- Neuro –psychiatric aspects of aging
- Rehabilitation.

13. Clinical Pharmacology

- Basic consideration of clinical pharmacology.
- principles of drug therapy
- Pharmacodynamics
- Adverse drugs reactions.
- Drug interactions.
- Drug nomenclature
- Monitoring drugs therapy
- New drug delivery systems.
- Pharmacogenetics
- Precision medicine
- Biology of addiction
- Complementary and alternative
- Evidence-based medicine in drug therapy.

14. Genetics:

- Principles of Human Genetics
- Overview of the paradigm of genetic contribution to health and disease
- Single gene and chromosomal disorders
- Gene therapy
- Diseases caused by genetic defects of mitochondria.
- Screening counseling and presentation of genetic disorder.
- Human genome project, stem cell therapy and gene transfer in clinical medicine.
- Pharmacogenomic.

15. Immunology

- Introduction to the immune system
- The major histocompatibility gene complex
- Primary immune deficiency diseases
- Human immunodeficiency virus disease
- Allergies and Anaphylaxis
- Transplantation immunology

16. Cardio-vascular diseases:

- Essential Anatomy, Physiology and Embryology of the heart.
- Approach to the patient with Cardiovascular diseases
- Physical examination of the Cardiovascular system
- Relevant investigations for the diagnosis of cardiac diseases
- Bradyarrhythmias- Disorders of Sinus node function and AV conduction disturbances
- Tachyarrhythmias- Premature complexes, atrial tachycardia, Atrial flutter, atrial fibrillation, Supraventricular, Junctional and Ventricular tachyarrhythmias.
- Heart failure and Cor Pulmonale
- Valvular Heart Disease
- Infective endocarditis
- Cardiomyopathy and Myocarditis
- Pericardial disease
- Congenital heart disease in the adult
- Cardiac tumors, Cardiac manifestations of systemic diseases and Traumatic cardiac injury
- Pulmonary Hypertension
- Cardiac Transplantation and Prolonged assisted circulation
- Heart disease in the elderly
- Cardiac patient and surgery
- Cardiac disorder in pregnancy
- Therapeutic procedures- BLS, ALS, Defibrillation, Cardiac pacing, Pericardiocentesis, Intraaortic balloon pumping 3rd Generations Stents
- Devices in Cardiac disorder.
- Newer Investigation for diagnosis of Rhythm Abnormalities: External Loop Records Internal Loop
- Atherosclerosis- Pathogenesis, clinical manifestations, prevention and treatment of atherosclerosis.
- Ischemic Heart Diseases- Stable angina pectoris, Unstable angina pectoris, Acute myocardial infarction. The student is expected to know about Percutaneous revascularization procedures and CABG.
- Systemic Hypertension
- Diseases of the Aorta

- Vascular diseases of the extremities

16. Respiratory system:

- Applied aspects of respiratory anatomy and respiratory physiology.
- Approach to the patient with disease of respiratory system.
- Disturbances in respiratory function.
- Diagnostic procedures in respiratory diseases.
- Asthma, Tropical pulmonary eosinophilia, Hypersensitivity pneumonitis
- Environmental lung diseases.
- Chronic bronchitis, emphysema and airways obstruction.
- Small airways Disease
- Interstitial lung diseases.
- Smoking and air pollution.
- Mycobacterial Diseases - Diagnostic methods, pathogenesis, clinical manifestation and treatment. National programme on Tuberculosis including DOTS.
- Pneumonitis, Pneumonia.
- Pulmonary manifestation of HIV infection.
- Lung abscess, bronchiectasis, cystic fibrosis.
- Pulmonary thromboembolism.
- Disorders of pleura, mediastinum and diaphragm.
- Disorders of ventilation.
- Sleep disorders
- ARDS.
- Mechanical ventilatory support.
- Intrathoracic malignancies.
- Lung transplantation.
- Surgical approach to lung disease.

18. Nephrology:

- Structure and function of the kidneys.
- Fluid and electrolytes.
- Acid base disorders.
- Approach to the patients with kidney disease.
- Acute renal failure.
- Chronic renal failure.
- Glomerular diseases.
- Tubular disorders.
- Tubulointerstitial diseases of the kidney.
- Vascular disorders of the kidney.
- Cystic renal disease.
- Nephrolithiasis.
- Urinary tract infection .
- Urinary tract obstruction.
- Drugs and kidney.
- Tumors of the kidneys and genitourinary tract.
- Diseases of prostate gland.
- Renal transplantation.

19. Gastro-intestinal diseases:

- Approach to the patient with gastrointestinal diseases
- Gastrointestinal endoscopy procedures
- Diseases of the esophagus
- Peptic ulcer and related disorders
- Disorders of absorption and digestion
- Inflammatory bowel diseases
- Irritable bowel syndrome
- Common diseases of the colon
- Mesenteric vascular insufficiency
- Acute intestinal obstruction
- Acute appendicitis and peritonitis
- Diseases of the rectum and anus.
- Approach to the patient with pancreatic diseases
- Acute pancreatitis
- Chronic pancreatitis
- Neuroendocrine tumours of the pancreas
- Pancreatic malignancy

20. Diseases of the liver and gall bladder:

- Approach to the patient with liver diseases
- Evaluation of liver functions
- Hepatobiliary Disorders Imaging
- The hyperbilirubinemias
- Acute viral hepatitis
- Chronic hepatitis
- Alcoholic liver disease
- Toxic and drug induced hepatitis
- Non- alcoholic steatohepatitis
- Cirrhosis and its complications
- Non-cirrhotic portal hypertension
- Liver abscess
- Infiltrative, Genetic and Metabolic diseases affecting liver
- Liver diseases in pregnancy
- Liver in Systemic Disease
- Venous- occlusive diseases of liver
- Liver tumours
- Liver transplantation
- Diseases of the gall bladder and bile ducts

21. Haematologic diseases and Disorders of Hemostasis:

- Iron deficiency and other hypoproliferative Anemias
- Disorders of Hemoglobin
- Megaloblastic Anemia
- Hemolytic anemia and anemia due to acute blood loss
- Aplastic anemia , Myelodysplasia and Related bone marrow failure syndromes
- Polycythemia vera and other Myeloproliferative diseases
- Acute and Chronic myeloid leukemia
- Malignancies of lymphoid cells
- Plasma cell disorders

- Transfusion biology and therapy
- Hematopoietic cell transplantation
- Disorders of platelet and vessel wall
- Coagulation disorders
- Venous thrombosis
- Antiplatelet, Anticoagulant and Fibrinolytic drugs

22. Oncology:

- Approach to the patient with cancer
- Prevention and early detection of cancer
- Cancer genetics
- Cancer cell biology and angiogenesis
- Principles of cancer treatment
- Infection in patients with cancer
- Cancer of skin
- Head and neck cancer
- Neoplasms of the lung
- Breast cancer
- Gastrointestinal tract cancer
- Tumors of the liver and biliary tree
- Pancreatic cancer
- Bladder and renal cell carcinoma
- Benign and malignant diseases of the prostate
- Testicular cancers
- Gynecological malignancies
- Soft tissue and bone sarcomas and bone metastasis
- Carcinoma of unknown primary
- Paraneoplastic syndromes
- Thymoma
- Late consequences of cancer and its treatment
- Oncologic emergencies

23. Metabolic diseases

- Disorders of lipoprotein metabolism.
- Wilson's disease
- Lysosomal storage diseases
- Hemochromatosis
- Porphyrias
- Disorders of purine and pyrimidine metabolism
- Homocystinuria
- Glycogen storage diseases and other inherited disorders of carbohydrate metabolism
- Inherited disorders of connective tissue
- Inherited disorders of amino acid metabolism.
- Lipodystrophies

24. Nutritional diseases

- Basic Considerations of Nutrition.
- Assessment of Nutritional Status.
- Vitamin and Trace Mineral Deficiency and Excess.
- Enteral and Parenteral Nutrition Therapy.
- Protein Energy Malnutrition.
- Free Radicals and Antioxidants.
- Malnutrition in the hospital population. Biology of obesity.
- Evaluation and Management of obesity.
- Eating disorders.

25. Endocrinology

- Principles of endocrinology
- Chronobiology and neuroendocrinology and the neuroendocrine system.
- Anterior pituitary (disorders of anterior pituitary and hypothalamus).
- Posterior pituitary (disorders of neurohypophysis).
- Disorders of thyroid gland
- Disorders of adrenal cortex
- Disorders of adrenal medulla, catecholamines and pheochromocytoma.
- Diabetes mellitus
- Hypoglycemia/ pancreatic islet cell disorders
- Disorders affecting multiple endocrine system (polyglandular disorders).
- Disorders of the testis and male sexual function.
- Disorders of the ovary and female reproductive tract.
- Disorders affecting multiple endocrine system.
- Heart as an endocrine system
- Endocrine disorders of the breast.

26. Rheumatic diseases

- approach to the patient with rheumatic diseases
- osteoarthritis
- Systemic lupus erythematosus
- Rheumatoid arthritis
- Scleroderma- diffuse and limited
- Sjogren's syndrome
- Ankylosing spondylitis, reactive arthritis, psoriatic arthritis and undifferentiated spondyloarthropathy
- Behcet's syndrome
- Vasculitis syndromes- Polyarteritis nodosa, Wegener's granulomatosis, Takayasu's arteritis, Henoch – Schonlein purpura, Churg- Strauss syndrome , Giant Cell arteritis, Kawasaki disease, Drug induced vasculitis
- Sarcoidosis
- Amyloidosis
- *Emergencies in Rheumatology*
- *Rheumatic Manifestation of systemic Disease*
- Approach to Articular and Musculoskeletal disorders
- Osteoarthritis
- Gout and other Crystal Arthropathies
- Infectious arthritis
- Relapsing polychondritis
- Periarticular disorders of the Extremities

27. Infectious diseases:

- Basic consideration in Infectious Diseases
- clinical syndromes
- approach to acutely ill febrile patients.

Bacterial Infections

- Introduction:
- Bacterial Genetics, Pathogenesis, Treatment and Prophylaxis, Sterilization, Antibiotic Resistance, Bioterrorism.
- Diseases caused by Gram- Positive Bacteria: Staphylococcus, Streptococcus, Pneumococcus, Corynebacteria, Bacillus anthracis, Bacillus cereus, Clostridium Species-Gas Gangrene and Food Poisoning, Actinomycosis, Nocardiosis, Listeria.
- Diseases caused by Gram- Negative Bacteria : Meningococci, Gonococci, Moraxella, Salmonella, Shigella, Proteus, Pseudomonas, Campylobacter, Helicobacter, Yersinia, Haemophilus, Bordetella, Brucella, Legionella, Bartonella, Klebsiella. Mycoplasma , Chlamydia.-Rickettsia and Coxiella. Vibrio cholera and other vibriose.
- Spirochaetal diseases: Syphilis, Relapsing Fever, Lyme's disease and Leptospirosis.
- Mycobacterial Infections: Pulmonary & Extrapulmonary Tuberculosis, Leprosy, Atypical mycobacterial infections.

Viral Infections

- Introduction: Classification, viral genetics, diagnostic modalities and antiviral therapy.
- Diseases caused by the DNA virus: Smallpox, Chickenpox, Orf, Molluscum contagiosum, Herpes simplex, Varicella zoster, Herpes zoster, CMV, EBV, Adenovirus and Hepatitis B virus.
- Diseases caused by RNA virus:
- Enterovirus- including Poliovirus, Coxsackie virus, Echovirus, Rhinovirus. Influenza virus with special reference to H5N1, H1N1, Mumps virus, Parainfluenza virus, Respiratory syncytial virus, Rubeola.
- Arbovirus including- Chikungunya, Japanese encephalitis, Yellow fever, Dengue virus, Kyasanur forest disease, Hantan virus, Chandipura virus. Rabies virus, Hepatitis A. C. D, E,F and G, Arenavirus, Ebola fever, Coronavirus, Rotavirus.
- Oncogenic viruses:
- Viruses with oncogenic potential, mechanism of oncogenicity
- Swan Flu, Ebola virus, Zika virus Infection

HIV and AIDS

- Epidemiology, genetics, pathogenicity, Indian perspective, clinical features, lab diagnosis, Prevention and Treatment.
- Drug Resistance
- Non Opportunistic Infections
- Pre- Exposing Prophylaxis's
- Post Exposing Prophylaxis's
- HIV Vaccine

Protozoal Infection

- Introduction: General introduction, modes of transmission, lab diagnosis, antiprotozoal drugs
- Diseases caused by Amebas Entamoeba histolytica, Primary amoebic meningoencephalitis.
- Diseases caused by Zoomastigotes: Intestinal, Oral, Vaginal, Blood and tissue flagellates.
- Diseases caused by Sporozoa: Isospora, Plasmodium, Toxoplasma.

Helminthic Infection

- Introduction: General introduction, modes of spread, diagnostic procedures and antihelminthic drugs
- Diseases caused by Cestodes: Taenia, Echinococcus, Hymenolepis, Diphyllbothrium,
- Diseases caused by Trematodes: Intestinal, Hepatic, Lung and blood trematodes
- Diseases caused by Nematodes: Strongyloides, Ankylostoma, Necator, Angiostrongylus, Enterobius, Ascaris, Wuchereria, Brugia, Onchocerca, Monsonella, Loa, Dracunculosis, Gnathostoma.

FUNGAL INFECTIONS

- General Introduction, Diagnostic Modalities And Treatment Options; Fungal infections in the immunocompromised; Diseases caused by Histoplasmosis, Coccidioidomycosis, Blastomycosis, Cryptococcosis, Candidiasis, Aspergillosis, Mucormycosis, Pneumocystis Infection.

28. Neurology

Diagnosis of Neurologic Disorders

- Neurobiology of diseases
- Approach to the patient with neurologic diseases
- Electrophysiological studies of the central and peripheral nervous system
- Neuroimaging in neurologic disorders
- Neurogenetics (molecular diagnosis)

Diseases of The Central Nervous System

- Seizures and epilepsy
- Cerebrovascular diseases
- Alzheimer's disease and other dementias
- Parkinson's diseases and other extrapyramidal disorders
- Ataxic disorders
- Motor neuron diseases
- Disorders of cranial nerves
- Disorders of the autonomic nervous system
- Disorders of the spinal cord
- Traumatic lesions of the head and spine
- Primary and metastatic tumours of the nervous system
- Multiple sclerosis and other demyelinating conditions of the central nervous system
- Viral meningitis and encephalitis
- Bacterial meningitis and other suppurative meningitis
- Chronic and recurrent meningitis
- Prion diseases
- Critical care neurology

Disorders of The Nerve And Muscle

- Approach to the patient with peripheral neuropathy
- Guillain-Barre syndrome and other Immune mediated neuropathies
- Inherited neuropathies
- Myasthenia Gravis and other diseases of the neuromuscular junction
- Approach to the patient with muscle disease
- Polymyositis, Dermatomyositis and Inclusion Body myositis
- Muscular dystrophies and other muscle diseases.

- Chronic fatigue syndrome

29. Psychiatric Disorders.

- Introduction to Psychiatry – Psychiatric history taking and clinical examination including the mental state examination
- Classification of psychiatric disorders
- Psychiatric aspects of physical diseases
- Mood (Affective) disorders – depressive disorders, mania and hypomania
- Suicide and attempted suicide
- Anxiety disorders – obsessive compulsive disorders, general anxiety disorders, panic disorder
- Schizophrenia
- Organic mental disorders
- The mental condition characterized by complete self-absorption with reduced ability to communicate with the outside world (Autism),
- *Psychotherapies in Mental Health*
- Eating disorders – anorexia nervosa, bulimia nervosa
- Sexual disorders
- Personality disorders
- Psychiatry and the law
- Lithium poisoning

30. Dermatology:

- Structure and functions of skin
- infections of skin
- papulo-squamous and inflammatory skin rashes
- photo-dermatology
- erythroderma
- cutaneous manifestations of systematic diseases
- bullous diseases
- Eczema\
- Psoriasis,
- Immunologically mediated skin diseases.
- drug induced rashes
- disorders of hair and nails
- principles of topical therapy

31. Radio Diagnosis

- Ultrasound in medicine, Doppler Imaging
- Computed Tomography
- Magnetic Resonance Imaging
- Nuclear Imaging PECT/PEMRI

32. Critical Care Medicine

- Principles of Critical care medicine.
- Approach to the patient in critical care setting.
- Acute Respiratory Failure.
- Ventilator management in the Intensive Care Unit.
- Approach to patient with shock.

- Care of Terminally ill Patients
- Cardiogenic shock and pulmonary edema./Advanced Cardiac like support
- Severe sepsis and septic shock.
- Neurological critical care./
- Non Invasive positive pressure Ventilation

33. Environmental and Occupational Hazards

- Illnesses due to Poisons, Drug Over dosage and Envenomation
- Disorders caused by reptile bites and marine animal envenomations – ectoparasite infestations and arthropod bites and stings
- Specific Environmental and Occupational Hazards
- Drowning and near drowning
- Electrical injuries
- Radiation injury
- Heavy metal poisoning
- Acclimatization disorders
- Disaster management
- Bioterrorism

34. Disorders of Bone and Mineral Metabolism

- Introduction to bone and mineral metabolism
- Diseases of parathyroid gland and other hypercalcemic and hypocalcemic disorders
- Osteoporosis
- Osteomalacia and rickets
- Disorders of bone – Paget’s disease of bone, osteosclerosis/ osteonecrosis

35. Recent Advances

Student is expected to keep himself abreast of recent advances in various fields of medicine especially in diagnostic and therapeutic aspects of various diseases. Some of these advances are –

- Electrophysiology of the heart, various ablation techniques in the treatment of cardiac arrhythmias, resynchronization therapy and stenting,
- ERCP, capsule endoscopy,
- Bronchoscopy,
- Interventional neurological techniques,
- Organ transplantation, gene therapy, stem cell therapy.

36. Miscellaneous

- Adult Immunization
- Preoperative Management

Note: The list of topics given are general guidelines. They are neither comprehensive nor all inclusive.

IV. TEACHING AND LEARNING ACTIVITIES:

Didactic lectures are of least importance; seminars , journal club, symposia , reviews and guest lectures will get priority for acquiring theoretical knowledge. Bedside teaching ,ground rounds ,interactive group discussions and clinical demonstrations will be hallmark of clinical/practical learning. Students will have hands on training in performing various procedures and ability to interpret results of various test/investigations. Exposure to newer specialized diagnostic/therapeutic procedures will be given.

Importance is attached to ward rounds especially in conjunction with emergency admissions. Clinical training includes measures for assessing competence in skills being in touch and providing feedback on progress towards a satisfactory standard of performance. The following are guidelines to various teaching/learning activities employed in post graduate training program ;

A. Theoretical Teaching:

1. **Lectures:** Lectures are to be kept to a minimum. Certain selected topics can be taken as lectures. Lectures may be didactic or integrated.
2. **Journal Club:** Recommended to be held **once a week**. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A time table with names of the students and the moderator should be announced in advance.
3. **Subject Seminar:** Recommended to be held **once a week**. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator should be announced in advance.
4. **Group Discussion:** Selected topics for group discussion are given to all PG students and All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the group discussion with names of the students should be announced in advance.
5. **Case Discussion:** Recommended to be held **once a week**. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the case presentation with names of the students should be announced in advance.
6. **Ward Rounds:** Ward rounds may be service or teaching rounds.
 - a) **Service Rounds:** Postgraduate students should do service rounds every day for the care of the patients. Newly admitted patients should be worked up by the post graduate student and presented to the faculty members the following day.
 - b) **Teaching Rounds:** Every unit should have 'grand rounds' for teaching purpose at the bed side. A diary should be maintained for day-to-day activities by the post-graduate students.

Entries of (a) and (b) should be made in the Log book.
7. **Clinico-Pathological Conference:** Recommended once a month for all post graduate students. Presentation to be done by rotation. Presentations will be assessed using checklist. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPCs.
8. **Inter Departmental Meeting ;** Strongly recommended particularly with departments of Pathology and Radio-Diagnosis at least once a month. These meetings should be attended by post-graduate students and relevant entries must be made in the Log Book.

Pathology: Interesting cases shall be chosen and presented by the post-graduate students and discussed by them as well as the senior staff of Pathology department. The staff of Pathology department would then show the slides and present final diagnosis. In these sessions the advanced immuno-histo-chemical techniques, the burgeoning markers, other recent developments can be discussed. Radio-diagnosis: Interesting cases and the imaging modalities should be discussed. Emphasis should be given for the radiological differential diagnosis.

9. **Mortality Meeting:** The mortality meeting should be conducted in the department every month. The post graduate student should prepare the details regarding the cause of death after going through the case records in detail, and should present during the mortality meeting. The death records will be discussed in detail during this meeting.
10. **Teaching Skills:** Post-graduate students must teach under graduate students (eg. Medical, Nursing) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as by the students. Record of their participation is to be kept in Log Book. Training of postgraduate students in Educational Science and Technology is recommended.
11. **Continuing Medical Education (CME):** Recommended that at least 1 state level CME programmes should be attended by each student during the course.
12. **Poster, Paper Presentation and Publication;** A post graduate student of a postgraduate degree course in broad specialities should present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the post degree examination.

B) Clinical / Practical Training:

Following is the clinical training of the postgraduate students for three years period.

- I. A major tenure of posting should be in internal medicine. It should include care of in- patient, out-patient, specialty clinics and maintenance of case records for both in-and out – patient.

II. Rotation Posting

Exposure to the following areas must be done. Inter-Unit rotation in the Department is done for period of one year(divided during the first year) , Second Year P.G. Rotation Posting for super specialty department for one year and in third year candidate stay in the parent unit.

SL. No	Department
1.	Medical ICU
2.	Trauma Centre and Emergency Medical Services (TCEMS)
3.	Casualty
4.	ICCU (Cardiology)
5.	Neurology
6.	Nephrology
7.	Oncology
8.	Gastroenterology
9.	Endocrinology
10.	District Residency Posting DRP/ Rural Posting
11.	Psychiatry / Chest & TB / Dermatology

- Department encourage students for e-learning activities.

Illustration of Structured Training

Time Period	Description/Levels	Content	Responsibilities
Ist Month	Orientation	Basic cognitive skills	- Combined duties - Supervised procedures
I year	Beginners	Procedural abilities OPD & ward work	- History sheet writing - Clinical abilities, - Procedural abilities (PA,PI)*, - Laboratory-diagnostic(All PI) - Communication skills O,A,PA - BLS & ACLS
II nd Year	Intermediate	Intermediate degree of cognitive abilities Specialised procedural skills Emergency	- Independent duties - All procedures - Respiratory management abilities (All PI) - Communication skills (PA, PI) - Writing thesis - Teaching UGs
III rd year		Special skills Intensive critical care	- Advanced levels of independent duties, - casualty calls, - ICU, NICU, - UG teaching

- Specialized skills include exchange transfusions, intercostal drainage, peritoneal dialysis, defibrillation/ cardioversion etc.

During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently; for this purpose, students will be trained in Skill Lab

V. ASSESSMENT FOR THE DEGREE COURSE

1. Internal Assessment ;

During the course of three years, the department will conduct two tests. Two of them will be annual, one at the end of first year and other at the end of second year. The third test will be a preliminary examination which will be held three months before the final examination conducted by college similar to final university examination.

The test may include the written papers, practicals / clinicals / Direct Observation of Procedural Skills (DOPS) / Case Based Discussion (CBD)/ Mini Clinical examination (MiniCEX) / OSCE and viva-voce. Records and marks obtained in such tests will be maintained by the head of the department and will be sent to the University when called for.

Formative Assessment:

The student to be assessed periodically as per categories listed in postgraduate student appraisal form. Annual assessment during the MD training will be based on:

1. Journal based / Annexure recent advances learning
2. Patient based / Laboratory or Skill based learning
3. Self-directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure II)

SUMMATIVE ASSESSMENT,

The summative examination would be carried out as per the Rules given in Postgraduate medical education regulations, 2000.

Results of all evaluations should be entered into P.G Log Book and departmental file for documentation purposes. Main purpose of periodic examination and accountability is to ensure clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.

2. Maintenance of Log Book:

Every candidate shall maintain a Log book/work diary and record his/her participation in the training programs conducted by the department such as journal reviews, seminars, etc Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, conducted by the candidate. All the procedures performed by the post graduate students should be entered in the Log book. All the daily activities including the ward rounds and the routine procedures performed on day to day basis should be entered in the Log book and it should be verified and signed by the faculty member. The Log book shall be scrutinized and certified by the Head of the Department and Head of the Institution and presented in the University practical/clinical examination.

VI. SCHEME OF EXAMINATION

Candidates will be allowed to appear for examination only if attendance is 80% at end of each academic year and internal assessment are satisfactory and dissertation is accepted.

The Post graduate examination shall be in three parts:

1. Dissertation:

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognized Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory : 400 Marks

The examinations shall be organised on the basis of 'Grading' or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D. will be held at the end of 3rd academic year. An academic term shall mean six month's training period.

There will be four theory papers, each of three hours duration. Total marks of each paper will be 100.

No of Questions	Marks for each question	Total Marks
10	10	100

- Paper I Basic Sciences, Recent advances in Medicine, Nutrition, and Clinical Pharmacology. Emergency and Critical Care Medicine, Geriatrics Medicine.
- Paper II Cardiovascular system, Gastro Intestinal system, Hepatobiliary, Pancreatic disorders, Infectious diseases including Tropical Medicine
- Paper III Central Nervous system, respiratory system, Immune system, Connective tissue and joint disorders.
- Paper IV Nephrology, Endocrinology & Metabolism, Hematology, Oncology, Dermatology and Psychiatry, Poisoning. Environmental and Occupational hazards.

3. Clinical / Practical and Oral/viva voce Examination: 400 Marks

A) Viva voce examination : 100 Marks

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may be given case reports, spirometry, ABG, gross specimens, histo-pathology slides, X-rays, ultrasound, CT scan images, PFT report, ventilation-perfusion scan images, etc. for interpretation and questions on these as well as use of instruments will be asked. Student's knowledge on use of instruments and drugs will also be evaluated during viva-voce examination. It includes discussion on dissertation also.

B) Pedagogy

Candidate is asked to make a presentation for 8 – 10 minutes on a topic given in advance with the consent of external examiner.

PRACTICAL & VIVA VOCE = 400 MARKS

Sl.No		No.of Cases	Marks
1	Long Case	1	120
2	Short Case	2	120
3	Emergency Case	1	60
4	Viva Voce	-	100

VIVA VOCE=100			
Table I (25)	Table II (25)	Table III (25)	Table IV (25)
• ECG (10)	Instruments (10)	Imaging (10)	Log Book (15)
• Research Methodology (15)	Drugs (15)	Emergency (15)	Pedagogy (10)
○ Dissertation			
○ Basic Research Methodology			
○ Important Clinical Trials			

Maximum Marks

Maximum Marks for M.D. General Medicine	Theory	Practical	Viva Voce	Grand Total
	400	300	100	800

VII Recommended Books (latest edition)

I. Clinical Methods (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Clinical Methods	Hutchison	W. B. Saunders
2	Symptoms and Signs in Clinical Medicine	Chamberlain	Butterworth Heinemann
3	Clinical Examination	McLeod's	Elsevier
4	Neurological Examination in Clinical Practice	Bicker staff	Blackwell Science
5	Bedside Cardiology	Jules Consant	Little, Brown & Company
6	The Neurologic Examination	De'jong	Jaypee & Lippincott Williams & Wilkins

I. General Medicine (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Principles of Internal Medicine	Harrison	McGraw Hill
2	Textbook of Medicine	API	API Mumbai
3	Textbook of Medicine	Cecil	W. B. Saunders
4	Textbook of Medicine	D. J. Weatherall Iedingham	Oxford University Press
5	Principles & Practice of Medicine	Davidson	Churchill Livingstone
6	Current Medical Diagnosis and Treatment,	Lawrence M. Tierney	McGraw Hill
7	Clinical Medicine	Praveen Kumar Micheal Clark	Elsevoer W. B. Saunders

III. Cardiology (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	The Clinical Recognition of Congenital Heart Diseases	Josph K. Perloff	W. B. Saunders
2	An introduction to Electrocardiography	Leo Schamroth	Black Well Science
3	Practical Electrocardiography	Galen S. Wagner	Lippincott Williams & Wilkins (LWW)
4	Heart Disease	Eugene Braunwald	W. B. Saunders
5	The Heart	Hurst	McGraw Hill
6	Congenital Heart Disease in Adults	Perloff Child	W. B. Saunders

IV. Neurology (latest edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Principles of Neurology	Adam's Victor & Ropper A. H.	Mc Graw Hill
2	Neurology in Clinical Practice	Bradley W. G. Daroff R. B.	Butterworth Heinenann (BH) publications
3	Neurological Differential Diagnosis	John Patten Walter	Springer
4	Diseases of the Nervous System	Walton & Donaghy	Oxford University Press
5	Brains Diseases of Nervous System	Michael Donaghy	Oxford University Press

V. Gastro-Enterology (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Current Diagnosis and Treatment in Gastroenterology	Freedman S. L.	Lange Medical Publication
2	Diseases of Liver and Biliary System	Sheila Sherlock	Blackwell Sciences
3	Gastrointestinal and Liver Disease	Sleissenger & Fordtran's	W. B. Saunders
4	Diseases of the Liver	Schiff	Lippincott Williams & Wilkins (LWW)

VI. Nephrology (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	The Kidney	Brenner & Rector's	W. B. Saunders
2	Diseases of the Kidney & Urinary Tract	Robert W. Schrier	Lippincott Williams & Wilkins (LWW)
3	Textbook of Nephrology	Massry & Glassock	Williams & Wilkins

VII. Hematology (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Clinical Hematology	Wintrobe	Williams & Wilkins

VIII. Respiratory Medicine/ Critical Care Medicine (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Chest Medicine Essentials of Pulmonary and Critical Medicine	Ronald George	Williams & Wilkins
2	Manual of Intensive Care Medicine	Irwin and Rippe	Lippincott Williams & Wilkins (LWW)
3	Textbook of Respiratory Diseases	Crofton & Douglas	PG Publication Company

IX. Geriatrics/Gerontology (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Geriatric Medicine for students	Brocklehurst	Churchill Livingstone
2	Oxford Textbook of Geriatric Medicine	Evans	McGraw Hill

X. Oncology (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Cancer Principles and Practice of Oncology	Devita V. T.	Lippincott Williams & Wilkins (LWW)

XI. Endocrinology (latest edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Williams Text book of Endocrinology	Henry.M Kronenberg	Elsevier

Reference Books (Latest Edition)

Anatomy/ Physiology/ Biochemistry/ Biostatistics (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Clinical Neuroanatomy	Richards Snell	Lippincott Williams & Wilkins (LWW)
2	Textbook of Medical Physiology	Arthur C. Guyton	W. B. Saunders Company
3	Review of Medical Physiology	William F. Ganong	McGraw Hill
4	Biochemistry	Harper	Lange
5	Methods in Biostatistics	B. K. Mahajan	Jaypee
6	Biochemistry	Lippincott	Lippincott Williams & Wilkins (LWW)
7	Grays Anatomy	Henry Gray	Elsevier

Pharmacology/ Microbiology/ Pathology (Latest Edition)

Sl. No.	Name of the Textbook	Authors	Publisher
1	Textbook of Pharmacology	Brunton	McGraw Hill
2	Goodman and Gilman's-The Pharmacological basis of Therapeutics	Joel Griffith Hardman	McGraw Hill

VIII. Recommended Journals:

Sl. No.	Name of the Journal
1	Journal of Association of Physicians of India (JAPI)- Monthly.
2	British Medical Journal (BMJ)- weekly
3	New England Journal of medicine- weekly.
4	The Lancet- weekly.
5	American journal of medicine –monthly.
6	Indian Journal of Tuberculosis- Quarterly.
7	Postgraduate Medical journal- Monthly.
8	Stroke- Monthly.
9	Neurology Clinic of North America Quarterly.
10	Indian Journal of Public Health- Quarterly.
11	Cardiology Clinics – Quarterly.
12	Heart – Monthly.
13	JAMA- American Weekly.
14	Indian Practitioner- Monthly.
15	The Practitioner – U.K. _ Monthly.
16	Indian- Heart Journal – Bimonthly.
17	National Medical Journal of India – Bimonthly.
18	Medicine – Monthly- Edt. Allister. Vale.
19	Clinics in Chest Medicine- Quarterly.
20	Antiseptic- Normal Journal- Monthly.
21	Bombay Hospital Journal – Quarterly.
22	Medical Clinics of North America- Bimonthly.
23	Post-Graduate Medicine- Monthly.
24	European Respiratory Journal- Monthly.
25	Indian Journal of Chest Diseases- Quarterly.
26	Indian Journal of Tuberculosis- Quarterly.
27	Brain- Monthly
28	Annals of Neurology- Monthly
29	Journal of Indian Medical Association- Monthly.

- **Annexure I**

Orientation Programme for PG students in MD General Medicine

- KLE University Syllabus
- Duties and responsibilities of PG
- Basic Skills and communication skills
- How to present journals and seminars
- How to write death certificate

**Postgraduate Students Appraisal Form
Pre / Para /Clinical Disciplines**

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory			Satisfactory			More Than Satisfactory			Remarks
		1	2	3	4	5	6	7	8	9	
1.	Journal based / recent advances learning										
2.	Patient based /Laboratory or Skill based learning										
3.	Self directed learning and teaching										
4.	Departmental and interdepartmental learning activity										
5.	External and Outreach Activities / CMEs										
6.	Thesis / Research work										
7.	Log Book Maintenance										

Publications

Yes/ No

Remarks* _____

***REMARKS:** Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT SIGNATURE OF HO

**POST GRADUATE DEGREE COURSE
M.S. IN ORTHOPAEDICS**

PREAMBLE:

The purpose of PG education is to create specialist who would provide high quality health care and advance the cause of science through research and training.

A postgraduate undergoing training MS in Orthopaedics should be trained to identify and recognize various congenital, developmental, inflammatory, infective, traumatic, metabolic, neuromuscular, degenerative and oncologic disorders of the musculoskeletal systems. She/he should be able to provide competent professional services to trauma and Orthopaedic patients at a primary/ secondary/tertiary healthcare centers.

The purpose of MS Orthopaedic is to standardize Orthopedic, Traumatology & Emergency Medicine teaching at post graduate level throughout the country so that it will benefit in achieving uniformity in postgraduate teaching as well as resultantly creating competent Orthopaedic surgeons with adequate expertise.

1) GOALS:

A candidate upon successfully qualifying in the M.S. (Orthopaedics) examinations should:

1. Identify the diseases and injuries of musculo-skeletal system and obtain proper history and perform thorough clinical examination.
2. Plan / Interpret investigations, Institute the management in diseases and injuries of musculo-skeletal system.
3. Acquire scientific temper for teaching and research in the discipline/subject
4. Acquire skills to manage Orthopaedic services.
5. Organise rehabilitative services to the physically handicapped persons.

2) SUBJECT SPECIFIC LEARNING OBJECTIVES:

This will be dealt with under the following headings:

1. Theoretical knowledge (Cognitive domain)
2. Practical and clinical skills (psychomotor domain)
3. Attitudes including communication skills (Affective domain)
4. Writing thesis / Reviewing Research activities (Scholarly activity)

5. Training in Research Methodology (Practice based learning, Evidence based practice)

6. Professionalism

7. Teaching skills

3) SUBJECT SPECIFIC COMPETENCIES:

A. Cognitive domain: Knowledge

At the end of the M.S. Orthopaedics programme, the post graduate student should be able to:

1. Demonstrate sufficient understanding of the basic sciences relevant to Orthopaedic speciality through a problem based approach.
2. Describe the Principles of injury, its mechanism and mode, its clinical presentation, plan and interpret the appropriate investigations, and institute the management of musculoskeletally injured patient.
3. Identify and describe the surface anatomy and relationships within of the various bones, joints, ligaments, major arteries, veins and nerves of the musculoskeletal system of the spine, upper limb, lower limb and the pelvis, chest, abdomen and head & neck.
4. Define and describe the pathophysiology of shock (circulatory failure).
6. Define and describe the pathophysiology of Respiratory failure
7. Describe the principles and stages of bone and soft tissue healing
7. Understand and describe the metabolic, nutritional, endocrine, social impacts of trauma and critical illness.
8. Enumerate, classify and describe the various bony/soft tissue injuries affecting the axial and appendicular skeletal system in adults and children.
9. Describe the principles of internal and external fixation for stabilization of bone and joint injuries.
10. Describe the mechanism of homeostasis, fibrinolysis and methods to control hemorrhage
11. Describe the physiological coagulation cascade and its abnormalities
12. Describe the pharmacokinetics and dynamics of drug metabolism and excretion of analgesics, anti inflammatory, antibiotics, disease modifying agents and chemotherapeutic agents.
13. Understanding of biostatistics and research methodology
14. Describe the clinical presentation, plan and interpret investigations, institute management and prevention of the following disease conditions

- a. Nutritional deficiency diseases affecting the bones and joints
 - b. Deposition arthropathies
 - c. Endocrine abnormalities of the musculoskeletal system
 - d. Metabolic abnormalities of the musculoskeletal system
 - e. Congenital anomalies of the musculoskeletal system
 - f. Developmental skeletal disorder of the musculoskeletal system
15. Describe the pathogenesis, clinical features plan and interpret investigations and institute the management in adults and children in
- a. Tubercular infections of bone and joints (musculoskeletal system)
 - b. Pyogenic infections of musculoskeletal system
 - c. Mycotic infections of musculoskeletal system
 - d. Autoimmune disorders of the musculoskeletal system
 - e. Rheumatoid arthropathy, Ankylosing spondylitis, seronegative arthropathy
 - f. Osteoarthritis and spondylosis
16. Describe the pathogenesis, clinical presentation, plan and interpret investigations and institute appropriate treatment in the following conditions:
- a. Post polio residual paralysis
 - b. Cerebral palsy
 - c. Muscular dystrophies and myopathies
 - d. Nerve Injuries
 - e. Entrapment neuropathies
17. Identify the diagnosis and describe management of musculoskeletal manifestation of AIDS and HIV infection
18. Describe the aetiopathogenesis, identify, plan and interpret investigation and institute the management of osteonecrosis of bones.
19. Identify situations requiring rehabilitation services and prescribe suitable orthotic and prosthetic appliances and act as a member of the team providing rehabilitation care
20. Identify a problem, prepare a research protocol, conduct a study, record observations, analyse data, interpret the results, discuss and disseminate the findings.
21. Identify and manage emergency situation in disorders of musculoskeletal system
22. Understanding of the basics of diagnostic imaging in orthopaedics like:
- a. Plain x-ray
 - b. Ultrasonography
 - c. Computerised axial tomography
 - d. Magnetic resonance imaging

- e. PET scan
 - f. Radio Isotope bone scan
 - g. Digital Subtraction Angiography (DSA)
 - h. Dual energy x-ray Absorptiometry
 - i. Arthrography
23. Describe the aetiopathogenesis, clinical presentation, Identification, Plan investigation and institute treatment for oncologic problems of musculoskeletal system both benign and malignancies, primary and secondary.
 24. Understand the basics, principles of biomaterials and orthopaedic metallurgy
 25. Describe the principles of normal and abnormal gait and understand the biomedical principles of posture and replacement surgeries.
 26. Describe social, economic, environmental, biological and emotional determinants of health in a given patient with a musculoskeletal problem.

B. Psychomotor domain: Surgical Skills

1. At the end of the first year of M.S. Orthopaedics programme, the student should be able to:

1. Elicit a clinical history from a patient, do a physical examination, document in a case record, order appropriate investigations and make a clinical diagnosis
2. Impart wound care where applicable
3. Apply all types of POP casts/slabs, splints and tractions as per need
4. Identify shock and provide resuscitation
5. Perform aspiration of joints and local infiltration of appropriate drugs
6. Perform appropriate wound debridement
7. Perform arthrotomy of knee joint
8. Perform incision and drainage of abscess
9. Perform split thickness skin grafting
10. Perform fasciotomes
11. Apply external fixators
12. Apply skeletal tractions including skull tongs
13. Triage a disaster situation and multiple trauma patients in an emergency room
14. Perform on bone models, interfragmentary compression screws, external fixation, Tension band wiring and Broad plating
15. Perform closed reduction of common dislocations like shoulder and common fractures like collar fracture, supracondylar fracture.

16. Perform on a cadaver standard surgical approaches to the musculo skeletal system

2. At the end of the second year of M.S. Orthopaedics course, the student should be able to:

1. Take an informed consent for standard orthopaedic procedures
2. Perform closed/open biopsies for lesions of bone, joints and soft tissues
3. Perform split thickness skin grafting and local flaps
4. Perform on bone models, internal fixation with k-wires, screws, plates. Dynamic hip/condylar screws/nailing.
5. Perform sequestrectomy and saucerisation
6. Perform arthrotomy of joints like hip/shoulder, ankle, elbow
7. Perform repair of open hand injuries including tendon repair
8. Perform arthodesis of small joints
9. Perform diagnostic arthroscopy on models and their patients
10. Perform carpal tunnel/tarsal tunnel release
11. Apply ilizarov external fixator
12. Perform soft tissue releases in contractures, tendon lengthening and correction of deformities
13. Perform amputations at different levels
14. Perform corrective surgeries for CTEV, DDH, perthes/ skeletal dysplasia

3. At the end of the third year of M.S. Orthopaedics programme, the student should be able to:

1. Assist in the surgical management of polytrauma patient
2. Assist in Arthroplasty surgeries of hip, knee, shoulder and the ankle
3. Assist in spinal decompressions and spinal stabilizations
4. Assist in operative arthroscopy of various joints
5. Assist /perform arthrodesis of major joints like hip, knee, shoulder, elbow
6. Assist in corrective osteotomies around the hip, pelvis, knee, elbow, finger and toes
7. Assist in surgical operations on benign and malignant musculoskeletal tumour including radical excision and custom prosthesis replacement.
8. Assist in open reduction and internal fixations of complex fractures of acetabular, pelvis, IPSI lateral floating knee/elbow injuries, shoulder girdle and hand
9. Assist in spinal deformity corrections
10. Independently perform closed/open reduction and internal fixation with DCP, LCP,

intramedullary nailing, LRS

11. Assist in limb lengthening procedures
12. Assist in Revision surgeries
13. Provide pre and post OP care
14. Perform all clinical skills as related to the speciality.

C. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.

2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.

3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

Attitudes including Communication skills and Professionalism

a. Communication skills:

1. Exhibits participation in honest, accurate health related information sharing in a sensitive and suitable manner
2. Recognizes that being a good communicator is essential to practice effectively
3. Exhibits effective and sensitive listening skills
4. Recognises the importance and timing of breaking bad news and knows how to communicate
- 5 Exhibits participation in discussion of emotional issues
6. Exhibits leadership in handling complex and advanced communication
7. Recognizes the importance of patient confidentiality and the conflict between confidentiality and disclosure
8. Able to establish rapport in therapeutic bonding with patients, relatives and other stakeholders through appropriate communication
9. Able to obtain comprehensive and relevant history from patients/relatives

10. Able to counsel patients on their condition and needs

b. **Teamwork:** Seek cooperation. Coordination and communication among treating specialties and paramedical staff

c. **Counseling of relatives:** regarding patients condition, seriousness, bereavement and counseling for organ donation in case of brain stem death

d. **Leadership:** Trauma prevention, education of the public, paramedical and medical persons.

Advocacy: with the government and other agencies towards cause of trauma care

e. **Ethics:** The Code of Medical Ethics as proposed by Medical Council of India will be learnt and observed.

***SUBJECT SPECIFIC PRACTICE-BASED OR PRACTICAL
COMPETENCIES***

Name/ Description of practice based competencies	Expected quantum
1. Taking a Clinical History from a patient with appropriate physical exam a. Hip-pain, Limp, Deformity, Instability, Both in child and adult b. Knee-pain, Deformity, Instability in child and adult c. Ankle, Foot d. Shoulder e. Elbow f. Wrist g. Head h. Spine	At least 3 clinical encounters in each region

2. In the Bone Skills

Lab Basic

1. Introduction and tension band wiring
2. Lag screw interfragmentary compression
3. Broad plating
4. Narrow plating
5. Ex-Fix
6. Cancellous screw fixation
7. Umex

Intermediary

1. DHS
2. DCS
3. Tibia nailing
4. Femur nailing
5. Tibia condyle
6. Elbow
7. Ankle

Advanced:

1. Pelvis
2. Pubic symphysis
3. Acetabulum
4. MIPPO
5. Hemiarthroplasty
6. Spine posterior
7. Spine anterior

Practice at least
twice on bone
models and record

3. On Patients

i. At the end of the first year of M.S. Orthopaedics programme, the student will be able to perform:

- a. Wound care - different types of wound, and different chemotherapeutic agents for wound care, including VAC application
- b. POP casts/slabs, splints and tractions as per need. Learning of different types of bandaging.
- c. Identify shock and provide resuscitation
- d. Aspiration of joints and infiltration of appropriate drugs
- e. wound debridement
- f. Arthrotomy of knee joint and assist in arthrotomy of Hip, ankle, shoulder.
- g. Incision and drainage of abscess
- h. Split thickness skin grafting
- i. Fasciotomes
- j. External fixators
- k. Skeletal tractions including skull tongs
- l. Triage a disaster situation and multiple trauma patients in an emergency room
- m. Perform on bone models, interfragmentary compression screws, external fixation, Tension band wiring and Broad plating
- n. Closed reduction of common dislocations like shoulder and common fractures like collar fracture, supracondylar fracture.
- o. Perform on a cadaver standard surgical approaches to the musculo skeletal system.

ii. At the end of the second year of M.S. Orthopaedics course, the student should be able to:

- a. Perform closed/open biopsies for lesions of bone, joints and soft tissues
- b. Perform split thickness skin grafting and local flaps

As per the clinical volume available in each institution

<ul style="list-style-type: none"> c. Perform on bone models, internal fixation with k-wires, screws, plates. Dynamic hip/condylar screws/nailing. d. Perform sequestrectomy and saucerisation e. Perform arthrotomy of joints like hip/shoulder, ankle, elbow f. Perform repair of open hand injuries including tendon repair g. Perform arthodesis of small joints h. Perform diagnostic arthroscopy on models and their patients i. Perform carpal tunnel/tarsal tunnel release j. Apply ilizarov external fixator k. Perform soft tissue releases in contractures, tendon lengthening and correction of deformities l. Perform amputations at different levels m. Perform corrective surgeries for CTEV, DDH, perthes/ skeletal dysplasia n. Perform cadaver based procedures, Arthroscopy, Arthrotomy. 	<p>As per the clinical volume available in each institution</p>
<p>iii. At the end of the third year of M.S. Orthopaedics programme, the student should be able to:</p> <ul style="list-style-type: none"> a. Assist in the surgical management of poly trauma patient b. Assist in Arthroplasty surgeries of hip, knee, shoulder and the ankle c. Assist in spinal decompressions and spinal stabilizations d. Assist in operative arthroscopy of various joints e. Assist /perform arthrodesis of major joints like hip, knee, shoulder, elbow f. Assist in corrective osteotomies around the hip, pelvis, knee, elbow, finger and toes g. Assist in surgical operations on benign and malignant musculoskeletal tumour including radical excision and custom prosthesis replacement. h. Assist in open reduction and internal fixations of complex fractures of acetabulum, pelvis, IPI lateral floating knee/elbow injuries, shoulder girdle and hand i. Assist in spinal deformity corrections 	<p>As per the clinical volume available in each institution</p>

<p>Independently perform closed/open reduction and internal fixation with DCP, LCP, intra medullary nailing, LRS Assist in limb lengthening procedures Assist in Revision surgeries Provide pre and post OP care This care should be exercised from first year Perform all clinical skills as related to the speciality.</p>	
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SYLLABUS

I. COGNITIVE DOMAIN

At the end of the M.S. Orthopaedics programme, the post graduate student should be competent and show sufficient understanding of Basic Sciences as applicable to Orthopaedics and Trauma through a problem based approach.

1. Basic Sciences as related to Orthopaedics and Trauma

- a) Embryogenesis of all organ systems
- b) Structure and function of Central Nervous System
- c) Structure and function of the peripheral Nervous System
- d) Structure and function of the arterial and venous system
- e) Structure and functions of the head & neck, abdomen, thorax and extremities.

2. Physiological basis and Pathophysiology in Health and Disease

- a) Physical Growth
- b) Temperature regulation
- c) Acid Base Balance
- d) Fluid Balance
- e) Hematopoiesis
- f) Hemostasis
- g) Electrolyte balance
- h) Bone mineralization: Calcium-Phosphate balance
- i) Renal functions
- j) Hepatic function
- k) Respiratory functions

- l) Cardiac functions
- m) Gastrointestinal functions
- n) Endocrine functions
- o) Developmental Milestones
- p) Nutritional Needs of Orthopaedic/Trauma Patients
- q) Allergy

3. *Clinical Microbiology as related to Orthopaedic infections*

- a) Virology
- b) Bacteriology
- c) Mycology
- d) Parasitology (Protozoology and Helminthology)
- e) Waste disposal, Sterilization, Disinfection

4. *Clinical Pharmacology as related to Orthopaedics & Trauma*

- a) Pharmacokinetics – of common medications used in Orthopaedics & Trauma
- b) Antimicrobials
- c) Analgesia, Sedation
- d) Drug Interactions
- e) Adverse effects
- f) Antidotes for Poisons
- g) Drug induced disease

5. *Professionalism and Ethics*

- a) Professionalism
- b) Ethics
- c) Medico legal essentials

6. *Wound healing principles*

- a) Types of wounds
- b) Stages of wound healing
- c) Biochemical & Molecular factors in wound healing
- d) Chemotherapeutic and other Pharmaceuticals in wound care
- e) Host, Environment and agent factors

7. *Bone Healing*

- a) Principles of bone healing
- b) Biological bone healing
- c) Factors influencing bone healing

d) Biomechanism of bone healing

IV) COURSE CONTENTS: SYLLABUS

A) BASIC SCIENCES: ANATOMY, PHYSIOLOGY, BIOCHEMISTRY, PATHOLOGY, MICROBIOLOGY, PHARMACOLOGY, MEDICOLEGAL ASPECTS AND BIOMECHANICS

- 1) Anatomy : Embryology & Development of Musculoskeletal System, Histology.
Anatomy of spine, shoulder girdle, chest, Abdomen, pelvic girdle, upper limb & lower limb.
- 2) Physiology : Physiology of Musculoskeletal system, Bone metabolism, Hormonal Control of Musculoskeletal system.
- 3) Bio Chemistry : Bio chemical aspects related to Orthopaedics.
- 4) Pathology : General pathology, Pathology related to Orthopaedics.
- 5) Biomechanics : Biomechanics of Trunk and Limbs.
- 6) Pharmacology : Anti inflammatory, Antibiotics, Anti malignant drugs and other related pharmacotherapeutic drugs.
- 7) **Suture material**
- 8) **Metallurgy in Orthopaedics**
- 9) **Stem cells in Orthopedics**
- 10) **Gene therapy in Orthopedics**
- 11) **Orthobiologics**
- 12) **Robotics in Orthopaedics**
- 13) **3D Printing**
- 14) **Artificial Intelligence in Orthopaedics**

B) ORTHOPAEDIC TRAUMATOLOGY :

At the end of the course the students should be able to describe basic concepts and mechanisms of injury, clinical presentation, interpret investigations, plan / institute the management of musculoskeletal injured patients and to recognize complications and their efficient management.

Fracture classifications

Head injury & fasciomaxillary injury.

General principles of management of neurovascular injury.

Management of polytrauma.

Consequences of musculoskeletal trauma & rehabilitation of the injured.

General principles of management of musculoskeletal trauma – surgical & conservative. – **triage, disaster management, BTLS & ATLS**

Systemic Complications in Orthopaedics

- **Shock**
- **Crush syndrome**
- **Disseminated Intravascular Coagulation (DIC)**
- **Acute Respiratory Distress Syndrome (ARDS)**

Fracture healing, closed and open fractures, problems of union.

Malunited fractures

Diagnosis of **delayed union**/non union& management.

Musculo skeletal trauma

Acute dislocations

Old unreduced dislocations

Recurrent dislocations

Recent advances in internal fixation of fracture

Bone grafting & bone substitutes

Soft tissue coverage in fractures (example: skin flaps etc)

Fracture complications and their treatment

Regional:

- **Fractures & dislocations of Cervical, Thoracic, Lumbar and sacral injuries.**
- **Fractures & dislocations of Shoulder girdle, pelvic girdle, upper limb & lower limb.**

Instruments & Implants in Advanced Orthopaedic Trauma Management:

- **Intra Medullary Nails and Locking compression plates**
- **LISS (Less Invasive Stabilisation System)**
- **Ilizarov technique**

C. Arthroscopy

- **General Arthroscopy Principles**
- **Arthroscopy of Shoulder & Elbow**
- **Arthroscopy of Knee & Ankle**

D. Arthrodesis

- **Arthrodesis of lower extremity and hip**
- **Arthrodesis of upper extremity**
- **Arthrodesis of spine**

E. Arthroplasty

- **Biomechanics of joints and replacement of the following joints**
- **Hip**
- **Knee**
- **Ankle**
- **Shoulder**
- **Elbow**

F. ORTHOPAEDIC DISEASES:

Aetio-pathogenesis, clinical features, investigations and Management of Congenital and Acquired Limb Deficiencies and Deformities

Nutritional deficiency diseases affecting bone & joints

Metabolic & hormonal osteoarthropathies

Skeletal dysplasias and developmental diseases

Infective diseases of Musculoskeletal system, Polio, Pyogenic, Tubercular, Mycotic bone and joint infections

Rheumatoid Arthropathy, Rheumatic disease

Osteoarthritis, **Gout & Pseudogout**

Sero-negative spondyloarthropathies

Cerebral palsy, Poliomyelitis

Muscular Dystrophies

Nerve injuries

Osteonecrosis of bones (Perthes, Osgood-Schlatters, Kienbocks disease, Severs diseases etc.)

G. Bone Tumors

- **Benign bone tumors**
- **Malignant bone tumors**
- **Tumor like conditions**
- **Metastatic bone Tumors**

H. Amputations and Disarticulations

- **Amputations and disarticulations in the lower limb**
- **Amputations and disarticulations in the upper limb**

I. Prosthetics & Orthotics and Physical medicine

J. Musculoskeletal aids, orthotics & prosthesis

K. Non traumatic miscellaneous disorders of musculoskeletal system

L. Evaluation of physical disability

M. Pediatric Orthopaedics:

- **Fractures and dislocations in children**
- **Perthes' disease**
- **Slipped capital femoral epiphysis**
- **Developmental Dysplasia of Hip (DDH)**
- **Neuromuscular disorders**

N. Traumatic Disorders of Joints (Sports Injuries)

- **Ankle injuries**
- **Knee injuries**
- **Shoulder and elbow injuries**
- **Wrist and hand injuries**

O. Miscellaneous Diseases

- **Diseases of muscles**
- **Fibrous Dysplasia**
- **Unclassified diseases of bone**
- **Paget's disease**
- **Peripheral vascular disease**
- **Orthopaedic manifestations of bleeding disorders**

P. Biomaterials

- **Bio-degradable implants in Orthopaedics**
- **Bone substitutes**
- **Bone Banking**

Q. Recent Advances in Orthopaedics

- **Autologous chondrocyte implantation**
- **Mosaicplasty**
- **Video assisted Thoracoscopy (VATS)**
- **Endoscopic spine surgery**
- **Metal on Metal Arthroplasty of hip**
- **Surface replacement of joints**
- **Microsurgical techniques in Orthopaedics**
- **Computer Navigation Assisted Arthroplasty**
- **Designing a modern Orthopaedic operation theatre**
- **Sterilization**
- **Theatre Discipline**
- **Laminar air flow**
- **Modular OTs**
- **Nano Technology in Orthopaedics**
- **Dual Mobility Hip in THR**
- **Oxinium Knee**
- **Gender Specific Knee Prosthesis**
- **Double Bundle ACL Reconstruction**
- **Bone Morphogenic Proteins in Orthopaedics**
- **Tantalum Cups in THR**
- **Total Ankle Arthroplasty**
- **Total Elbow Arthroplasty**
- **Biodegradable Implants in Orthopaedics**
- **Expandable Megaprosthesis**
- **Bionic Arm**
- **Stem Cells in Orthopaedics**
- **Precountered Plates for Fracture Management**
- **Minimally Invasive Spine Surgery**
- **Role of PRP in Orthopaedics**
- **Myoelectric Prosthesis**
- **Dog Bone Button Technique for AC Joint Reconstruction**
- **Laminar Airflow in Orthopaedic Operation Theater**
- **Robotics in Orthopaedics**
- **Recent Medication in Orthopaedics (Denosumab, Teriperatide etc.,)**
- **Recent Advances in Imaging Modalities in Orthopaedics**
- **Implants for Fixation of Small Bones of Hand**

R. Degenerative disorders of the spine

- 1. Prolapsed Inter Vertebral Disc (PIVD)**
- 2. Lumbar Canal Stenosis (LCS)**
- 3. Spondylolysis/Spondylolisthesis**

4. **Lumbar Spondylosis**
5. **Ankylosing Spondylitis**
6. **Spinal fusion: various types and their indications**

S. DIAGNOSTIC SKILLS AND KNOWLEDGE OF

- a) Radiology:
 - i) Plain Radiology, CT Scan, MRI, Bone scan & Ultrasonography
 - ii) Interventional Radiography: Myelography, Sinogram, Arthrography & CT guided biopsy
- b) Biopsy: FNAC, Trocar & Open biopsy
- c) Arthroscopy

T. SURGICAL SKILLS TO ACQUIRE:

1. Management of shock in injured person
2. Incision and drainage of abscess
3. Aspiration and infiltration of joints
4. Closed reduction of fractures
5. Application of casts, splints & tractions
6. Fracture fixation: closed / open reduction & internal fixation of bones
7. Knowledge of debridement, surgical toilet & application of external fixators
8. Arthrotomy & Synovectomy
9. Arthroplasty & Arthrodesis
10. Foot and Ankle surgery
11. Plastic reconstruction and other reconstructive procedure of musculoskeletal trauma.
12. Acetabular fracture fixation and pelvic osteotomies
13. Elbow and hand surgery
14. Deformity correction with **External fixators like Illizarov, JESS, L.R.S (Limb Reconstruction system), etc..**
15. Spine surgeries
 - a. Disc surgery
 - b. Instrumentation in spine
 - c. Surgical procedure in T.B spine
 - d. Deformity correction in spine
16. Amputations
17. **Epidural injection for pain relief**

V. TEACHING AND LEARNING ACTIVITIES:

A. Theoretical Teaching:

1. **Lectures:** Lectures are to be kept to a minimum. Certain selected topics can be taken as lectures. Lectures may be didactic or integrated.
2. **Journal Club:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A time table with names of the students and the moderator should be announced in advance.
3. **Subject Seminar:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator should be announced in advance.
4. **Case Discussion:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the case presentation with names of the students should be announced in advance.
5. **Ward Rounds:** Ward rounds may be service or teaching rounds.
 - Service Rounds: Postgraduate students should do service rounds every day for the care of the patients. Newly admitted patients should be worked up by the post graduate student and presented to the faculty members the following day.
 - Teaching Rounds: Every unit should have 'grand rounds' for teaching purpose at the bed side. A diary should be maintained for day-to-day activities by the post-graduate students.
Entries of (a) and (b) should be made in the Log book.
6. **Clinico-Pathological Conference:** Recommended once a month for all post graduate students. Presentation to be done by rotation. Presentations will be assessed using checklist. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPCs.
7. **Inter Departmental Meetings:** Strongly recommended particularly with departments of Pathology and Radio-Diagnosis at least once a month. These meetings should be attended by post-graduate students and relevant entries must be made in the Log Book.
 - Pathology: Interesting cases shall be chosen and presented by the post-graduate students and discussed by them as well as the senior staff of Pathology department. The staff of Pathology department would then show the slides and present final diagnosis. In these sessions the advanced immuno-histo-chemical techniques, the burgeoning markers, other recent developments can be discussed.
 - Radio-diagnosis: Interesting cases and the imaging modalities should be discussed.

Emphasis should be given for the radiological differential diagnosis.

8. **Mortality / Morbidity Meetings:** The mortality meeting should be conducted in the department every month. The post graduate student should prepare the details regarding the cause of death after going through the case records in detail, and should present during the mortality meeting. The death records will be discussed in detail during this meeting. The register to be maintained for the same.
 9. **Teaching Skills:** Post-graduate students must teach under graduate students (eg. Medical, Nursing) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as by the students. Record of their participation is to be kept in Log Book. Training of postgraduate students in Educational Science and Technology is recommended.
 10. **Continuing Medical Education Programmes (CME):** Recommended that at least 1 state level CME programmes should be attended by each student during the course.
 11. **Conferences:** Attending conferences is compulsory. Post-graduate student should attend one national and one state level conference during the course.
 - 12) **Research Activities:** A post graduate student of a postgraduate degree course in broad specialities/super specialities would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the post graduate degree examination.
- 13 **Basic practices for post graduates at the initiation of course:**
- A. **Good clinical practice** - post graduates should develop good clinical practices which is essential for training for clinical research that involve human participants.
 - B. **BLS/ATLS** – post graduates should undergo BLS/ATLS course so they will be skillful to manage cases in emergencies.
 - C. **NPTEL**- all post graduates should undergo the BCBR course and clear NPTEL exams.
14. The Post-graduate students to be encouraged to carry out e-learning and research activities in the department other than dissertation work.
15. **Training in Research Methodology (Practice based learning, Evidence based practice)**
- B) Clinical / Practical Training:**
- SKILLS LAB SESSIONS: to be conducted once a fortnight for all three years**
- Ist Year**
- Trauma care

Closed reductions of fractures, Plaster application.
 Debridement of open fractures, External fixations
 Internal fixations of minor fractures with K wire
 Non-traumatic conditions.
 Manipulative correction of congenital problems like CTEV
 Biopsies
 Excision of benign lesions
 Tendon lengthening, **Tenotomy etc.**
BLS (Basic Life Support) Course and ATLS Course

IInd Year

Trauma
 Tension band wiring of fracture patella, fracture olecranon, etc
 DCP of forearm bones, tibia, etc
 DHS
 Interlocking nailing of long bone fractures
 Non traumatic conditions
 Carpal tunnel release
 Bone grafting
 Soft tissue release under supervision

IIIrd Year

Trauma
 Hemi replacement arthroplasty of femur
 Dynamic condylar screw fixation
 Acetabular fracture fixation
Hemi arthroplasty of shoulder joint
 Osteotomies
 Soft tissue release
 Tendon transfers
 Basic arthroscopy (diagnostic)

A] Basic graduate skills

The students should have acquired the certain skills during his under-graduation and internship. These skills have to be reinforced at the beginning of the training periods. These skills include:

Procedure	Category	Year	Number
Insertion of I.V. lines. nasogastric tube, urinary catheters, etc.	PI	I	50
Minor suturing and removal of sutures	PI	I	50
Removal of tubes and drains	PI	I	50
Routine wound dressings	PI	I	50

B] Ward Procedures

Ward work forms an important part of the training of the surgeon. In addition to the routine examination of the patient with proper recording of findings, diligent practice of the following is recommended.

Procedure	Category	Year	Number
Effusion of joints & L.I.H.C.	PI	I	5
Ability to teach UG's and Interns	PI	I	NA
Blood sampling- venous and arterial	PI	I	NA
Bone Marrow Aspiration	PI	I	2
Major wound dressing	PI	I	10
Communication skills with patients, relatives colleagues and paramedical staff	PI	I	NA*
Ordering of the requisite laboratory and radiological investigations and interpretation of the reports in light of the clinical picture	PI	I	NA
Proficiency in common ward procedures	PA	I	NA
Skills for Per-rectal examination and Proctoscopy	PI	I	NA
Thoracocentesis	PI	II	5
Universal precautions against communicable diseases	PI	I	NA
Venesection.	PI	I+II	5

NA: Not Applicable.

C] ICU Procedures

Procedure	Category	Year	Number
Insertion of Arterial lines	PI	I+II	10
Insertion of Central venous lines	PI	I	10
Insertion of endotracheal tubes	PI	I+II	10
Intercostal Drainage	PI	I+II	5
Tracheostomy	PI	I	2
Working knowledge of ventilators and various Monitors	PI	I	NA
Interpretation of Arterial blood gases	PI	I	NA
Correction of Electrolyte disturbances	PI	I	NA
Prescribing Parenteral & Enteral nutrition	PI	I	NA

D] Emergency Room Procedures

Procedure	Category	Year	Number
Application of Splints for Fractures	PI	I	NA
Arterial and Venous Lines	PI	I	NA
Assessment and initial management of polytrauma	PI	I	NA
Cardiopulmonary Resuscitation	PI	I	NA
Procedure	Category	Year	Number

Management of Airway obstruction	PI	I	NA
Management of shock and Cardiac Respiratory failure	PI	I	NA
Recognition and Initial management of Orthopaedic Emergencies	PI	I	NA
Suturing Techniques	PI	I	NA

E] Pre-operative workup

Procedure	Category	Year	Number
Ability for adequate pre-operative preparation in special situations like diabetes, renal failure cardiac and respiratory failure etc. and risk Stratification	PI	I	NA
Communication skills with special reference to obtaining informed consent	PI	I	NA
Proper pre-operative assessment and preparation of patients including DVT prophylaxis, Blood transfusion and Antibiotics	PI	I	NA

F] Post-operative Care

Procedure	Category	Year	Number
Airway management	PI	I	NA
Basic Physiotherapy & Rehabilitation	PI	I	NA
Management of epidural analgesia	PI	I	NA
Management of Sinus	PI	I	NA
Management of postoperative hypo and hypertension	PI	I	NA
Postoperative pain control	PI	I	NA
Skills for nutritional rehabilitation of patients.	PI	I	NA
Skills for proper Fluid & Antibiotic management	PI	I	NA
Amputation stump care	PI	I	NA

G] Minor O.T. Procedure

Procedure	Category	Year	Number
Ganglion under Local Anesthesia	PI	I	5
Drainage of Abscesses	PI	I	5
FNAC	PI	I	5
Major dressings – Open fractures	PI	I	20
Release of compartment syndrome	PI	II	10
Minor Biopsies – Lymph node, ulcer swellings etc.	PI	I	20
Reduction and plaster application of simple fractures and dislocations	PA	I	10
Removal of simple subcutaneous swellings	PI	I	10
Arthrotomy, skeletal traction	PA/A/O	II	10
Suturing Techniques	PI	I	20
Arthroscopy	PA	II	5

Wound debridement	PI	II	10
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HJ Major Operating rooms techniques

Procedure	Category	Year	Number
Instrument arrangement and trolley layout	PA	I	NA
Skills in sterilization techniques. O.T. Layout and Asepsis	O	I	NA
Skin preparation- painting and draping	PI	I	NA
Techniques of scrubbing and gowning	PI	I	NA

IJ Orthopaedic Operative Procedures

Procedure	Category	Year	Number
Percutaneous pin fixation for fractures	PI	I	10
External fixator application	PI	I	5
ORIF – Trochanteric fractures	PI and PA	III	1 and 3
Hemiarthroplasty – fracture neck femur	PA	III	2
Internal fixation for fracture shaft femur	PI	III	3
Internal fixation for fracture patella	PI	III	2
Internal fixation for fracture humerus	PI	III	2
Internal fixation for fracture both bones forearm	PI	III	3
Internal fixation for fractures of leg bones	PI	I	10
Management of complex fracture dislocation	PA/PI	II /III	5
Open reduction of dislocations	PA	III	2
Management of complex wounds	PI	I	10
Diagnostic & Therapeutic Arthroscopy	PA	III	1
Arthroplasty of Hip & Knee	PA	III	3
Repair of peripheral nerve injuries	PA	III	3
Amputation & Disarticulation	PI	III	3
Vascular repair	PA	III	2
CTEV – Soft tissue release	PI	III	5
HDP Habitual Dislocation Patella	PA/PI	II/III	1
Laminectomy	PA	III	2
Quadriceps plasty	PI	II	5
Spinal fusion	PA	III	3
Discoidectomy	PA/PI	II/III	10
Pott’s spine surgeries	PA	II	5
Osteotomies	PA/O	III/II	3
ORIF Pelvic Fractures	PA/O	III/II	3
Reconstructive Surgery Of Great Toe (Hallux Correction)	PA/O	III/II	5
Scoliosis Correction	PA/O	III/II	3
Tendon Transfers	PA/O	III/II	5
Tumour Surgery & Biopsy	PA/O	III/II	10
V..I.C – Bone Shortening	PA/O	III/II	5
Wrist Fusion	PA/O	III/II	4
Ring External Fixator (ILIZAROV)	PA/O	III/II	3
Implant Removal	PI/O	II	10
Polio Reconstruction	PA/O	III	5
AVNFH Decompression With Fibula Graft	PA/O	III	6

Rotator Cuff Surgery	PA/O	III	3
Arthrodesis - Upper Limb	PA/O	III	5
Arthrodesis - Lower Limb	PA/O	III	6
Fixation of fractures of the small bones of hand & foot	PI/O	II	10
Skin grafting	PI	II	10
Bone grafting	PI	II	10

O-Observed, A – Assisted, PA – Performed with Assistance, PI – Performed Independently

J. Rotational Postings in other Departments:

Anatomy – one hour every week in anatomy dissection hall for 6 months in the first year

Applied subjects – posting in second year

Trauma / emergency medicine for 3 months, one month in 1st year, one month in 2nd year, one month in 3rd year

Anaesthesia for 2 weeks

Radiology including CT/ MRI for 2 weeks

Neurosurgery for one month

Plastic surgery for one month

Allied subjects: Posting in artificial limb center / physical medicine and rehabilitation for one month

K. Training in teaching skills:

Bedside clinic for undergraduates for 15 hours

Bedside clinic for first year PG by third Year PG for 15 hours

Should attend at least two national / state CME or Conferences during the course

Should present at least one paper in any of the orthopedic conferences during the course.

VI. OTHER CRITERIA TO BE FULFILLED FOR THE DEGREE COURSE:

ASSESSMENT

FORMATIVE ASSESSMENT, ie., assessment to improve learning

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

The Internal Assessment should be conducted in theory and practical/clinical examination, should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

~~1. Internal evaluation: Internal Formative Assessment:-~~

~~———— During the course of three years, the department will conduct three tests. Two of them will be annual, one at the end of first year and other at the end of second year. The third test will a preliminary examination which may be held three months before the final examination.~~

~~The test may include the written papers, practicals / clinicals / **Direct Observation of Procedural Skills (DOPS) / Case Based Discussion (CBD) / Mini Clinical examination (MiniCEX)** and viva-voce. Records and marks obtained in such tests will be maintained by the head of the department and will be sent to the University when called for.~~

Along with these assessments, there will quarterly assessment based on following educational activities:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs
6. Mini Cex (mini clinic evaluation exercises) encounter – at least 4

7. Clinical encounter cards – at least 4

8. Direct observation of Procedural skills – at least 6 including Cadaver Dissection

9. OSCE/Theory, Essay, Short Notes

10. MCQ's

11. Bone Skill Lab performance assessment

The student will be assessed periodically as per categories listed in postgraduate student appraisal form (in the Logbook).

Results of all evaluations should be entered into P.G's diary and departmental file for documentation purposes. Main purpose of periodic examination and accountability is to ensure clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.

2. Maintenance of Log Book:

Every candidate shall maintain a Log book/work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any, conducted by the candidate. All the procedures performed by the post graduate students should be entered in the Log book. All the daily activities including the ward rounds and the routine procedures performed on day to day basis should be entered in the Log book and it should be verified and signed by the faculty member. The Log book shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the University practical/clinical examination.

3. Dissertation:

Every post graduate student shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher, the result of which shall be written up and submitted in the form of a Thesis. Work for writing the Thesis is aimed at contributing to the development of a spirit of enquiry, besides exposing the post graduate student to the techniques of research, critical analysis, acquaintance with the latest advances in medical science and the manner of identifying and consulting available literature.

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

VII. SCHEME OF EXAMINATION: (Final Summative Assessment)

Candidates will be allowed to appear for examination only if attendance (Minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

A. Theory: 400 Marks

There shall be four papers, each of three hours duration. Total marks of each paper will be 100. Questions on recent advances may be asked in any or all the papers. The format of each paper will be same as shown below.

Type of Questions	No. of Questions	Marks for each question	Total Marks
Long essay	10	10	100
Grand Total			100

Paper I	- Basic sciences as applied to the subject	- 100 marks
Paper II	- Traumatology and Rehabilitation	- 100 marks
Paper III	- Orthopaedic Disease	- 100 marks
Paper IV	- Recent advances in Orthopedic surgery & General Surgery as applied to Orthopaedics	- 100 marks

Note : The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

3. Practical/clinical and Oral/viva voce examination

Practical examination

Practical examination should be spread over **two days** and include various major components of the syllabus focusing mainly on the psychomotor domain.

Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject focusing on psychomotor and affective domain. It should include:

- Stations for clinical, procedural and communication skills
- Log Book Records and reports of day-to-day observation during the training
- Should test the post graduate student's overall knowledge of the subject in:
 - Ortho Radiology
 - Ortho Pathology
 - Histopathology & Gross anatomy

- Instruments
- Orthotics and Prosthetics

B. Clinical / Practical Examination: 200 Marks

To elicit competence in clinical skills and to discuss differential diagnostic therapeutic aspects.

Types of Cases	No. of Cases	Marks
Long Case	1	100
Short Cases	3 (50 marks each)	150
Ward Rounds	2 Cases (25 each)	50
Total	6	300

C. Viva- Voce Examination: 100 Marks

Aims: To elicit candidate's knowledge and investigative/ therapeutic skills.

1). Viva-voce examination – [80 Marks]

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may be given case reports, spirometry, ABG, gross specimens, histo-pathology slides, X-rays, ultrasound, CT scan images, PFT report, ventilation-perfusion scan images, etc., for interpretation and questions on these as well as use of instruments will be asked. Student's knowledge on use of instruments and drugs pertaining to the respiratory system will also be evaluated during viva-voce examination. It includes discussion on dissertation also.

2) Pedagogy Exercise and Log Book – [20 Marks]

(i) Candidate is asked to make a presentation for 8 – 10 minutes on a topic given in the beginning of clinical examination. 10 Marks

(ii). Candidate is asked to make a presentation for 8 - 10 minutes on the dissertation topic and the review of Log Book. 10 Marks

D. Maximum Marks:

Maximum marks for M.S. in Orthopaedics	Theory	Practical	Viva	Grand Total
	400	300	100	800

VII. RECOMMENDED BOOKS (LATEST EDITIONS):

- 1) Campbell's Operative Orthopaedics, Vols 1, 2, 3 & 4 Campbell's Operative Orthopaedics, 4-Volume Set, 14th Edition by Frederick M Azar, MD, S. Terry Canale, MD and James H. Beaty, MD
- 2) Mercer's Orthopaedic Surgery Vol. 1 & 2, Author(s) : Robert B Duthie Edition: Ninth, Year of Publication: 2003
- 3) Rockwood And Greens – Fractures in Adults, Vol 1& 2 Rockwood and Green's Fractures in Adults Author(s): Paul Tornetta , William Ricci MD, FAAOS, Charles M. Court-Brown MD, FRCS Ed (Orth), Margaret M. McQueen MD, Michael McKee MD, FRCS (C) Publication Date: March 27, 2019
- 4) Fractures in Children – Rockwood & Wilkins - Rockwood and Wilkins Fractures in Children Edition: 9. Author(s): Peter M Waters MD, David L. Skaggs MD, John M. Flynn. Publication Date: March 19, 2019
- 5) Paediatric Orthopaedics – Tachidjian, Vol 4 Tachdjian's Pediatric Orthopaedics: From the Texas Scottish Rite Hospital for Children, 6th edition - November 27, 2020 Author: John Herring
- 6) Concise System Of Orthopaedics And Fractures – Graham Apley Apley's Concise System of Orthopaedics and Fractures Louis Solomon, David Warwick, Selvadurai Nayagam CRC Press, 31-Mar-2005
- 7) Textbook of Orthopaedics and Trauma – Kulkarni, Vol 1 Textbook of Orthopedics and Trauma (4 Volumes) GS Kulkarni, Sushrut Babhulkar, Publish Year 2016
- 8) B.D. Chaurasia's Human Anatomy, Vol1, Vol 2, Vol 3 B D Chaurasia's Handbook of Anatomy English Editions 2022 Eighth Editions Volume 2 (paperpack, CHAURASIAS), Author: CHAURASIAS, Publisher: CBS Publishers, Publishing Date 2022
- 9) Pharmacology and Pharmacotherapeutics – Satoskar- Pharmacology and Pharmacotherapeutics, 24th Edition - June 30, 2015, Authors: RS Satoskar, Nirmala Rege, SD Bhandarkar
- 10) Orthopaedics Anatomy and Surgical Approaches Frederick Wreckling Orthopaedic Anatomy and Surgical Approaches Edited by Frederick W. Reckling, Jo Anne B. Reckling and Melvyn P. Mohn, S. P. Frostick, First Published August 1, 1991
- 11) Green's Operative Hand Surgery-Vol. 1&. 2, Green, David P; Hotchkiss, Robert N Green's Operative Hand Surgery, 2-Volume Set 7th Edition - February 24, 2016, Authors: Scott W. Wolfe, William C. Pederson, Scott H. Kozin, Mark S. Cohen
- 12) Surgical Exposures in Orthopedics: The Anatomic Approach, Hoppenfeld, Stanley; De Boer, Piet Surgical Exposures in Orthopaedics: The Anatomic Approach, Edition: 6, Author(s): Piet de Boer MD, Richard Buckley MD, FRCSC, Stanley Hoppenfeld MD, Publication Date: October 7, 2021

- 13) Text Book of Ilizarov Surgical Techniques Bone Correction And Lengthening, Golyakhovsky, Vladimir; Frankel, Victor H Textbook of Ilizarov Surgical Techniques: Bone Correction and Lengthening by Vladimir Golyakhovsky, Victor H Frankel, Publishing Year 2010
- 14) Applied Orthopaedic Biomechanics, Dutta, Santosh; Datta, Debasis Applied Orthopaedic Biomechanics, by Debasis Datta Santosh K Dutta Publisher : B.I.Publications, Year 2008.

Sl, No	Name of the Book	Author	Publisher
1.	Cambell's Operative Orthopaedics,	Terry Canale assistance by Kay Daughtery.	Mosby
2.	Fractures in Adults and Children	Charles. A. Rockwood Jr, David Green, Robert. E. Bucholz& James. D. Heckman- Lippincot	Lippincot, Williams & Wilkinson.
3.	Tureks Orthopedics	By- Weinstein. SL. & Others,	Lippincot, Williams & Wilkinson.
4.	Mercer's Orthopaedic Surgery	By- Robert. B. Duthie. & George. Bentley.	Hodderd&ARNOLD
5.	Watson-Jones Fractures & Joint Injuries	By- J. N. Wilson	Churchill-Livingstone.
6.	Total Hip Joint Replacement	Eftekhar. N. S.	Mosby
7.	By- Gustilo	Fractures & Dislocations	Mosby
8.	Pediatric Orthopaedics	Sharrard	Blackwell Scientfic
9.	Pediatric Orthopaedics	Tachdain	W.B.Saunders
10.	Clinical Surgery	Das	S. Das.
11.	Clinical Orthopaedic Examination	Ronald McRae	Churchill Livingstone
12.	Splints & Traction in Orthopaedics	Stewart	Churchill Livingstone
13.	Tuberculosis of Spine	Tuli. S. M.	Jaypee brothers
14.	AO Principles of Fracture Management	Colton. C. L. Fernandez. A.	Theime Medical Publishers.
15.	Manual of Internal Fixation	Muller & others	Springer
16.	Operative Arthroscopy	McGinty	Lippincot,
17.	Rothman-Simeon- The Spine	H.N.Herkowitz& Others	Saunders
18.	Lister's The Hand	Paul smith	Churchill Livingstone
19.	The Lumbar Spine	J. N. Weinstein & S. W. Wiesel	Saunders
20.	Bone Tumors	J. M. Mirra	Lee &Febiger
21.	Campbell's operative Orthopaedics	12th edition	Churchill Livingstone
22.	Insall & Scott surgery of knee	5th edition	Elsevier

VIII. RECOMMENDED JOURNALS:

1	Journal of bone and Joint Surgery
2	American Journal of Orthopaedics
3	Clinical Orthopaedics and Related Research
4	Orthopaedic clinics of North America
5	Trauma
6	Arthroscopy
7	Indian Journal of Orthopaedics
8	Journal of Arthroplasty
9	Journal of Spine Surgery
10	ActaOrthopedica Scandinavia
11	J.Paed. Ortho

2.5	Ability to record and document work accurately and appropriate for level of training										
2.6	Participation and contribution to health care quality improvement										
3	Professional attributes										
3.1	Responsibility and accountability										
3.2	Contribution to growth of learning of the team										
3.3	Conduct that is ethical appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment been discussed with the trainee?	Yes	No								
	If not explain										
	Name and Signature of the assessee										
	Name and Signature of the assessor										
	Date										

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT

SIGNATURE OF HODs

COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN PAEDIATRICS

Preamble

General health needs of the children in the community are changing in the recent years. The traditional curriculum has gaps in fulfilling the health needs of the children. The ideal approach is to create a competency based curriculum which makes the Postgraduates competent pediatricians who can deal effectively the needs of the community. The planned revised competency based curriculum for the postgraduates has identified and addressed the gaps.

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training. A post graduate student after undergoing the required training should be able to deal effectively with the needs of the community and should be competent to handle the problems related to his specialty including recent advances. S/He should also acquire skills in teaching of medical/para- medical students.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. The “domains of learning” are retained under the heading “competencies”.

SUBJECT SPECIFIC OBJECTIVES

The objectives of MD Course in Paediatrics are to produce a competent pediatrician who:

- Recognizes the health needs of infants, children and adolescents and carries out professional obligations in keeping with principles of the National Health Policy and professional ethics
- Has acquired the competencies pertaining to Paediatrics that are required to be practiced in the community and at all levels of health system
- Has acquired skills in effectively communicating with the child, family and the community

- Is aware of contemporary advances and developments in medical sciences as related to child health
- Is oriented to principles of research methodology
- Has acquired skills in educating medical and paramedical professionals
- Is able to recognize mental conditions and collaborate with Psychiatrists/Child Psychologists for the treatment of such patients

SUBJECT SPECIFIC COMPETENCIES

A. Cognitive domain

At the end of the MD course in Paediatrics, the students should be able to:

1. Recognize the key importance of child health in the context of the health priority of country
2. Practice the specialty of Pediatrics in keeping with the principles of professional ethics
3. Identify social, economic, environmental, biological and emotional determinants of child and adolescent health, and institute diagnostic, therapeutic, rehabilitative, preventive and promotive measures to provide holistic care to children
4. Recognize the importance of growth and development as the foundation of Pediatrics and help each child realize her/his optimal potential in this regard
5. Take detailed history; perform full physical examination including neuro-development and behavioral assessment and anthropometric measurements in the child and make clinical diagnosis
6. Perform relevant investigative and therapeutic procedures for the paediatric patient
7. Interpret important imaging and laboratory results
8. Diagnose illness based on the analysis of history, physical examination and investigations
9. Plan and deliver comprehensive treatment for illness using principles of rational drug therapy
10. Plan and advice measures for the prevention of childhood disease and disability

11. Plan rehabilitation of children with chronic illness and handicap and those with special needs
12. Manage childhood emergencies efficiently
13. Provide comprehensive care to normal, 'at risk' and sick neonates
14. Demonstrate skills in documentation of case details, and of morbidity and mortality data relevant to the assigned situation
15. Recognize the emotional and behavioral characteristics of children, and keep these fundamental attributes in focus while dealing with them
16. Demonstrate empathy and humane approach towards patients and their families and keep their sensibilities in high esteem
17. Demonstrate communication skills of a high order in explaining management and prognosis, providing counseling and giving health education messages to patients, families and communities
18. Develop skills as a self-directed learner. Recognize continuing educational needs; use appropriate learning resources and critically analyze published literature in order to practice evidence-based Paediatrics
19. Demonstrate competence in basic concepts of research methodology and epidemiology
20. Facilitate learning of medical/nursing students, practicing physicians, paramedical health workers and other providers as a teacher-trainer
21. Implement National Health Programs, effectively and responsibly
22. Organize and supervise the desired managerial and leadership skills
23. Function as a productive member of a team engaged in health care, research and education.
24. Recognize mental conditions, characterized by self absorption, reduced ability to respond, abnormal functioning in social interaction with or without repetitive behavior, poor communication (autism) and collaborate with Psychiatrists/Child Psychologists for the treatment of such patients.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should have acquired following skills:

History & Examination. History taking including psychosocial history, physical examination including fundus examination, newborn examination, including gestation assessment. Thermal protection of young infants, nutrition, anthropometry and its assessment, assessment of growth, use of growth chart, SMR rating, developmental assessment, communication with children, parents, health functionaries, social support groups, family tree and genetic counseling.

I. History and Examination

The student must gain proficiency in eliciting, processing and systemically presenting Paediatrics history and examination with due emphasis of the important and minimization of less important facts. The following skills must be achieved:

- i) Recognition and demonstration of physical findings
- ii) Recording of height, weight, head circumference and mid arm circumference and interpretation of these parameters using growth reference standard

- assessment of nutritional status and growth
- iii) Assessment of pubertal growth
- iv) Complete development assessment by history and physical examination, and recognizing developmental disabilities, including autism
- v) Systematic examination
- vi) Neonatal examination including gestation assessment by physical neurological criteria
- vii) Examination of the fundus and the ear-drum
- viii) Skills related to IMNCI and IYCF

II. Monitoring Skills

- a. Monitoring skills: Temperature recording, capillary blood sampling, arterial, blood sampling, etc.,
- b. Non-invasive monitoring of blood pressure, pulse and respiratory rates, saturation; ECG

III. Investigative Procedures

- i) Venous, capillary and arterial blood sampling using appropriate precautions
- ii) Pleural, peritoneal, pericardial aspiration; subdural, ventricular and lumbar puncture
- iii) Tuberculin test
- iv) Biopsy of liver and kidney
- v) Urethral catheterization and suprapubic tap
- vi) Gastric content aspiration

IV. Therapeutic Skills

- a. Hydrotherapy, nasogastric feeding, endotracheal intubation, cardio-pulmonary resuscitation (Pediatric and neonatal), administration of oxygen, venipuncture and establishment of vascular access, administration of IV fluids, blood, blood components, parenteral nutrition, intraosseous fluid administration, intra-thecal administration of drugs. Common dressings and abscess drainage and basic principles of rehabilitation.

- i) Breast feeding assessment and counseling; management of common problems
- ii) Establishment of central and peripheral vascular access; CVP monitoring
- iii) Administration of injections using safe injection practices
- iv) Determination of volume and composition of intravenous fluids and their administration
- v) Neonatal and Pediatric basic and advanced life support
- vi) Oxygen administration, CPAP and nebulization therapy
- vii) Blood and blood component therapy
- viii) Intraosseous fluid administration
- ix) Phototherapy, umbilical artery and venous catheterization and exchange transfusion
- x) Nasogastric feeding
- xi) Common dressings and abscess drainage; intercostal tube insertion
- xii) Basic principles of rehabilitation
- xiii) Peritoneal dialysis
- xiv) Mechanical ventilation

Bed Side Investigations. Hemoglobin, Total Leucocyte Count, ESR, peripheral smear, staining, examination, urine routine and microscopic examination, stool microscopy, hanging drop preparation, examination of CSF and other body fluids, gram staining, ZN staining, shake test on gastric aspirate.

Interpretation of plain X-ray chest, abdomen, bone, skull; ECG, ABG report, CT scan, MRI scan etc.

Understanding of common EEG patterns, audiograms, Ultrasonographic abnormalities and isotope studies.

V. Bed side investigations, including

- i) Complete blood counts, micro ESR, peripheral smear
- ii) Urinalysis
- iii) Stool microscopy and hanging drop

- iv) Examination of CSF and other body fluids
- v) Blood sugar
- vi) Shake test on gastric aspirate
- vii) Gram stain, ZN stain

VI. Patient Management Skills

- i) Proficiency in management of pediatric emergencies, including emergency triaging
- ii) Drawing and executing patient management plan and long term care
- iii) Documenting patient records on day to day basis and problem oriented medical record
- iv) Care of a normal and sick newborn, management of neonatal disorders hypothermia, sepsis, convulsions, jaundice, metabolic problems
- v) Identifying need for timely referral to appropriate departments/health facility and pre-transport stabilization of the sick child

VII. Communication Skills; Attitudes; Professionalism

- i) Communicating with parents/child about nature of illness and management plan prognostication, breaking bad news
- ii) Counseling parents on breast feeding, nutrition, immunization, disease prevention, promoting healthy life style
- iii) Genetic counseling
- iv) Communication and relationship with colleagues, nurses and paramedical workers
- v) Appropriate relation with pharmaceutical industry
- vi) Health economics
- vii) Professional and research ethics

VIII. Interpretation of Investigations

- i. Plan x-ray chest, abdomen, skeletal system

- ii. Contrast radiological studies: Barium swallow, barium meal, barium enema, MCU
- iii. Ultrasound skull and abdomen
- iv. Histopathological, biochemical and microbiological investigations
- v. CT Scan and MRI (skull, abdomen, chest)
- vi. Electrocardiogram, electroencephalogram
- vii. Arterial and venous blood gases
- viii. **Desirable:** Interpretation of radio-isotope studies, audiogram, neurophysiological studies, (BERA, VER, Electromyography [EMG], Nerve Conduction Velocity [NCV]), lung function tests

IX. Academic Skills

- i. Familiarity with basic research methodology, basic IT skills. Planning the protocol of the thesis, its execution and final report
- ii. Review of literature
- iii. Conducting clinical sessions for undergraduates medical students
- iv. Desirable: writing and presenting a paper. Teaching sessions for nurses and medical workers

Syllabus

Course contents:

Guidelines

During the training period, effort must be made that adequate time is spent in discussing child health problems of public health importance in the country or particular region.

Basic Sciences

- Principles of inheritance, chromosomal disorders, single gene disorders, multifactorial / polygenic disorders, genetic diagnosis and prenatal diagnosis, pedigree drawing.
- Embryogenesis of different organ systems especially heart, genitourinary system, gastro-intestinal tract. Applied anatomy and functions of different organ systems.
- Physiology of micturition and defecation; placental physiology; fetal and neonatal circulation; regulation of temperature, blood pressure, acid base balance, fluid

electrolyte balance and calcium metabolism.

- Vitamins and their functions.
- Hematopoiesis, hemostasis, bilirubin metabolism.
- Growth and development at different ages, growth charts; puberty and its regulation.
- Nutrition: requirements and sources of various nutrients.
- Pharmacokinetics of common drugs, microbial agents and their epidemiology.
- Basic immunology, biostatistics, clinical epidemiology, ethical and medico-legal issues.
- Teaching methodology and managerial skills.

Understanding the definition, epidemiology, aetiopathogenesis, presentation, complications, differential diagnosis and treatment of the following, but not limited to:

Growth and development

- Principles of growth and development
- Normal growth and development
- Failure to thrive and short stature
- Normal growth and development
- Sexual maturation and its disturbances
- Autism (as mentioned in objective 24)

Neonatology

- perinatal care
- care in the labor room and resuscitation
- prematurity
- common transient phenomena
- infections
- jaundice
- neurologic disorders
- renal disorders
- thermoregulation and its disorders
- low birth weight
- newborn feeding
- respiratory distress
- apnea
- anemia and bleeding disorders
- gastrointestinal disorders
- malformations
- understanding of perinatal medicine

Nutrition

- maternal nutritional disorders;
- nutrition for the low birth

- weight impact on fetal outcome
- infant feeding including deficiencies complementary feeding
- protein energy malnutrition
- adolescent nutrition
- nutritional management of systemic illness (GI, hepatic, renal illness)
- breast feeding
- vitamin and mineral
- obesity
- parenteral and enteral nutrition

Cardiovascular

- congenital heart diseases (cyanotic and acyanotic)
- infective endocarditis
- disease of myocardium (cardiomyopathy, myocarditis)
- hyperlipidemia in children
- rheumatic fever and rheumatic heart disease
- arrhythmia
- diseases of pericardium
- systemic hypertension

Respiratory

- congenital and acquired disorders of nose tract tonsils and adenoids
- congenital anomalies of lower respiratory tract
- foreign body in larynx trachea and bronchus
- subglottic stenosis (acute, chronic)
- bronchial asthma
- acute pneumonia, bronchiolitis
- recurrent, interstitial pneumonia
- atelectasis
- pleural effusion
- infections of upper respiratory
- obstructive sleep apnea
- acute upper airway obstruction
- trauma to larynx
- neoplasm of larynx and trachea
- bronchiolitis
- aspiration pneumonia, GER
- suppurative lung disease
- lung cysts, mediastinal mass

Gastrointestinal and liver disease

- disease of oral cavity
- disorders of deglutition

and esophagus

- peptic ulcer disease
- intestinal obstruction
- pancreatic disorders
- malabsorption syndrome
- irritable bowel syndrome
- Hirschsprung disease
- hepatitis
- chronic liver disease
- metabolic diseases of liver

- congenital pyloric stenosis
- acute and chronic
- acute and chronic diarrhea
- inflammatory bowel disease
- anorectal malformations
- hepatic failure
- Budd-Chiari syndrome
- cirrhosis and portal hypertension

Nephrology and Urologic disorders

- acute and chronic glomerulonephritis
- hemolytic uremic syndrome
- VUR and renal scarring
- renal tubular disorders
- voiding dysfunction
- congenital and hereditary renal disorders
- posterior urethral valves
- undescended testis, hernia, hydrocoele

- xanthema syndrome
- urinary tract infection
- involvement in systemic diseases
- neurogenic bladder,
- renal and bladder stones
- hydronephrosis
- Wilms tumor

Neurologic disorders

- seizure and non-seizure paroxysmal events
- meningitis, encephalitis
- febrile encephalopathies
- neurocysticercosis and other neuroinfestations
- SSPE
- neurometabolic disorders
- neuromuscular disorders
- learning disabilities

- epilepsy, epileptic syndromes
- brain abscess
- Guillain-Barre syndrome
- HIV encephalopathy
- cerebral palsy
- neurodegenerative disorders
- mental retardation
- muscular dystrophies

- acute flaccid paralysis and AFP surveillance
- movement disorders

- malformations
- Tumors

Hematology and Oncology

- deficiency anemias
- aplastic anemia
- thrombocytopenia
- blood component therapy
- bone marrow transplant/stem cell transplant
- myelodysplastic syndrome
- neuroblastoma

- hemolytic anemias
- pancytopenia
- disorders of hemostasis
- transfusion related infections
- acute and chronic leukemia
- Lymphoma
- hypercoagulable states

Endocrinology

- hypopituitarism/hyperpituitarism
- pubertal disorders
- adrenal insufficiency
- adrenogenital syndromes
- hypoglycemia
- gonadal dysfunction and intersexuality

- diabetes insipidus
- hypo – and hyper-thyroidism
- Cushing's syndrome
- diabetes mellitus
- short stature
- obesity

Infections

- bacterial (including tuberculosis)
- fungal
- rickettsial
- protozoal and parasitic
- control of epidemics and infection prevention

- viral (including HIV)
- parasitic
- mycoplasma
- nosocomial infections
- safe disposal of infective material

Emergency and Critical Care

- emergency care of shock
- respiratory failure
- status epilepticus

- cardio-respiratory arrest
- acute renal failure
- acute severe asthma

- fluid and electrolyte disturbances
- poisoning
- scorpion and snake bites

- acid-base disturbances
- accidents

Immunology and Rheumatology

- arthritis (acute and chronic)
- immunodeficiency syndromes

- vasculitides
- systemic lupus erythematosus

ENT

- acute and chronic otitis media
- post-diphtheritic palatal palsy
- allergic rhinitis/sinusitis

- hearing loss
- acute/chronic tonsillitis/adenoids
- foreign body

Skin Diseases

- exanthematous illnesses
- pigment disorders
- infections
- atopic, seborrheic dermatitis
- alopecia

- vascular lesions
- vesicobullous disorders
- Steven-Johnson syndrome
- drug rash
- ichthyosis

Eye problems

- refraction and accommodation
- cataract
- strabismus
- disorders of retina, including tumors

- partial/total loss of vision
- night blindness
- conjunctival and corneal disorders

Behavioral and Developmental disorders

- rumination, pica
- sleep disorders
- breath holding spells
- mood disorders

- enuresis, encopresis
- habit disorders
- anxiety disorders
- temper tantrums

- attention deficit hyperactivity disorders
- autism (as mentioned in objective 24)

Social/Community Paediatrics

- national health programs related to child health
- IMNCI
- Vaccines: constituents, efficacy, storage, contraindications and adverse reactions
- rationale and methodology of pulse polio immunization
- child labor, abuse, neglect
- adoption
- disability and rehabilitation
- rights of the child
- National policy of child health and population
- juvenile delinquency
- Principles of prevention, control of infections (food, water, soil, vector borne)
- Investigation of an epidemic

Orthopaedics

- major congenital orthopedic deformities
- bone and joint infections
- common bone tumors

Approach to clinical problems

Growth and development

- precocious and delayed puberty
- developmental delay
- impaired learning

Neonatology

- low birth weight newborn
- sick newborn

Nutrition

- lactation management and complementary feeding
stunting)
- protein energy malnutrition (underweight, wasting, and micronutrient deficiencies)
- failure to thrive

Cardiovascular

- Murmur
- congestive heart failure
- arrhythmia
- cyanosis
- systemic hypertension
- shock

GIT and Liver

- Acute diarrhea
- abdominal pain and distension
- vomiting
- gastrointestinal bleeding
- hepatosplenomegaly
- persistent and chronic diarrhea
- ascites
- constipation
- jaundice
- hepatic failure and encephalopathy

Respiratory

- Cough/chronic cough
- wheezy child
- hemoptysis
- respiratory distress

Infections

- acute onset pyrexia
- recurrent infections
- nosocomial infections
- prolonged pyrexia with and without localizing signs
- fever with xanthema

Renal

- Hematuria/dysuria
- voiding dysfunctions
- hypertension
- bladder/bowel incontinence
- renal failure (acute and chronic)

Hematology and Oncology

- anemia
- bleeding

Neurology

- limping child
- paraplegia, quadriplegia
- macrocephaly and microcephaly
- acute flaccid paralysis
- convulsions
- cerebral palsy
- floppy infant
- headache

Endocrine

- thyroid swelling
- obesity
- ambiguous genitalia
- short stature

Miscellaneous

- skin rash
- epistaxis
- arthralgia, arthritis
- lymphadenopathy
- proptosis

TEACHING AND LEARNING METHODS

A) Theoretical Teaching

1. **Lectures:** Lectures are to be kept to a minimum. Certain selected topics can be taken as lectures. Lectures may be didactic or integrated.
2. **Journal Club:** Recommended to be held **once a week**. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A time table with names of the students and the moderator should be announced in advance.
3. **Subject Seminar:** Recommended to be held **once a week**. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator should be announced in advance.
4. **Case Discussion:** Recommended to be held **twice** a week. All the PG students are expected to attend and actively participate in discussion and enter in the

Log Book relevant details. The presentations would be evaluated using check lists and would carry Weightage for internal assessment. A timetable for the case presentation with names of the students should be announced in advance.

5. **Ward Rounds:** Ward rounds may be service or teaching rounds.
 - Service Rounds: Postgraduate students should do service rounds every day for the care of the patients. Newly admitted patients should be worked up by the post graduate student and presented to the faculty members the following day.
 - Teaching Rounds: Every unit should have 'grand rounds' for teaching purpose at the bed side. A diary should be maintained for day-to-day activities by the post-graduate students.
Entries of (a) and (b) should be made in the Log book.

6. **Clinico-Pathological Conference:** Once in six months for all post graduate students. Presentation to be done by rotation. Presentations will be assessed using checklist. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPCs.
7. **Inter departmental Meetings:** Strongly recommended particularly with departments of Pathology and Radio-Diagnosis at least once a month. These meetings should be attended by post-graduate students and relevant entries must be made in the Log Book.

Pathology: Interesting cases shall be chosen and presented by the post-graduate students and discussed by them as well as the senior staff of Pathology department. The staff of Pathology department would then show the slides and present final diagnosis. In these sessions the advanced immuno-histo-chemical techniques, the burgeoning markers, other recent developments can be discussed.

Radio-diagnosis: Interesting cases and the imaging modalities should be discussed. Emphasis should be given for the radiological differential diagnosis.

8. **Mortality Meeting:** The mortality meeting should be conducted in the department every month. The post graduate student should prepare the details regarding the cause of death after going through the case records in detail, and should present during the mortality meeting. The death records should be discussed in detail during this meeting.

9. **Teaching Skills:** Post-graduate students must teach under graduate students (eg. Medical, Nursing) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as

by the students. Record of their participation is to be kept in Log Book. Postgraduate students will be trained in Educational Science and Technology (MET).

10. **Continuing Medical Education Programmes (CME):** Each student during the course should attend at least 1 state level CME programme
11. **Conferences:** Attending conference is compulsory. Post-graduate student should attend 1/2 National and 1/2 state level conference during the course.

12. NALS / ADVANCED NRP and PALS, BLS Certification: Should be certified in NALS / ADVANCED NRP and PALS, BLS during study course before appearing for final examination.

13. **Research Activities:** The Post-graduate students to be encouraged to carry out research activities in the department other than dissertation work.

B). CLINICAL / PRACTICAL TRAINING:

Mandatory Postings

- Paediatric emergency (minimum 1 month a year)
- Neonatology (NICU) (minimum 3 months a year)
- Intensive Care (PICU) (minimum 2 months a year)
- District Residency Programme with participation in Community Outreach Child Health Programs (at least 3 months over the entire course; 3rd or 4th or 5th semester;

Note: Additionally, the PG students may be sent to allied specialties (Cardiology, Neurology, nephrology *etc.*) depending on facilities available. It should be ensured that the training conforms to the curriculum.

Desirable postings based on need, availability, accessibility, and feasibility and may be innovatively integrated into schedule of posting to optimize learning experiences.

- Subspecialities Outpatient Clinics / observing- assisting in emergency
 - o Clinical
 - ♣ Child Psychiatry
 - ♣ Pediatric Surgery
 - ♣ Developmental Pediatrics
 - ♣ Pediatric Nephrology
 - ♣ Pediatric Hemato-oncology
 - ♣ Pediatric Cardiology

- ♣ Pediatric Gastroenterology
- ♣ Pediatric Rheumatology/Immunology/Allergy
- ♣ Genetic
- ♣ Pediatric Pulmonology
- ♣ Pediatric Dermatology
- ♣ Pediatric Endocrinology
- ♣ Adolescent Health

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- ♣ DOTS, PPTCT, ART center with pediatric exposure
- ♣ Microbiology diagnostic Lab
- ♣ Radiology including CT/MRI
- ♣ Forensic Medicine especially Child related
- ♣ Neuro-rehabilitation (PMR, Physiotherapy, Occupational Therapy)

Posting under “District Residency Programme” (DRP):

All postgraduate students pursuing MD/MS in broad specialities in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate programme and the rotation

shall be termed as “District Residency Programme” and the PG medical student undergoing training shall be termed as “District Resident”.

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty

Postgraduate teaching

programme General principles

Acquisition of practical competencies being the keystone of PG medical education, PG training should be skills oriented. Learning in PG program should be essentially self-directed and primarily emanating from clinical and academic work. The formal sessions

are merely meant to supplement this core effort.

Teaching methodology

This should include regular bedside case presentations and demonstrations, didactic lectures, seminars, journal clubs, clinical meetings, and combined conferences with allied departments. The post graduate student should be given the responsibility of managing and caring for patients in a gradual manner under supervision. Department should encourage e-learning activities.

Formal teaching sessions

In addition to bedside teaching rounds, at least 5-hr of formal teaching per week are necessary.

Orientation session : All PG students joining the course should have an orientation session to acquaint them with the requirements and other details. A plan for orientation session has been given at Annexure 1.

Teaching Sessions

- Journal club t Once a week
 - Seminar Once a week
 - Case discussions Twice a week
 - Interdepartmental case or seminar [Cardiology, Pediatric Surgery] Once a month
-
- Attend accredited scientific meetings (CME, symposia, and conferences).
 - Additional sessions on resuscitation, basic sciences, biostatistics, research methodology, teaching methodology, hospital waste management, health economics, medical ethics and legal issues related to pediatric practice are suggested.

- Common course work :The following course work is common and mandatory for all Postgraduate students irrespective of discipline / specialty which needs to be completed within one year of the commencement of the batch. The online certificate generated on successful completion of the course and examination thereafter, will be acceptable evidence of having completed this course. The certification will be a mandatory requirement to be eligible to appear for the final examination of the respective postgraduate course.
 - i. Course in Research Methodology
 - ii. Course in Ethics including Good Clinical Practices
 - iii. Basic Cardiac Life Support (BCLS) skills
 - iv. Awareness in basics of management and audit Awareness in Medical Audit, Management, Health Economics, and Health Information System, basics of statistics, exposure to human behaviour studies and knowledge of pharmacy

- There should be a training program on Research methodology for existing faculty to build capacity to guide research.
- The postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.
- A postgraduate student would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.
-

- **Log book:** During the training period, the post graduate student should maintain a Log Book indicating the duration of the postings/work done in Pediatric Wards, OPDs and Casualty. This should indicate the procedures assisted and performed,

and the teaching sessions attended. The purpose of the Log Book is to:

- a) Help maintain a record of the work done during training,
- b) Enable Consultants to have direct information about the work; intervene if necessary,
- c) Use it to assess the experience gained periodically.

All aspects of the work done by each student in the department shall be entered regularly in the log book. The Log books shall be checked and assessed periodically by the faculty members imparting the training. The log book shall be scrutinized by the concerned staff at regular intervals. The log book shall be used to aid the internal evaluation of the student. The log book shall be reviewed at the time of viva-voce in the university examination.

During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision in the skill lab, followed by performing independently. Posting in the Skill lab is mandatory for all Postgraduates.

Dissertation:

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal

with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

There should be periodic department review of the thesis work, as per following schedule:

- End of 6 months Submission of protocol

- During 2ndyear Mid-term presentation
- 6 months prior to examination Final presentation; submission.

Every candidate pursuing MD degree course is required to carry out work on a selected research project under the guidance of a recognized post graduate teacher. The results of such a work shall be submitted in the form of a dissertation.

For details regarding DISSERTATION Refer 9.1 to 9.11 of Chapter-I.

ASSESSMENT

FORMATIVE ASSESSMENT:

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills. The Internal Assessment should be conducted in theory and practical/clinical examination. The department should conduct three tests, two of them be annual tests at the end of first and second year. The third test will be preliminary examination which will be held three months before the final examination conducted by the college similar to final University Examination. The tests may include written papers, practical's / clinicals (Direct Observation of Procedural skills)/ OSCE/Case Based discussion/ Mini Cex and viva voce.

Continuous /Periodic assessment during the MD training should be based on:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT:

The summative examination would be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2021.

The postgraduate examination shall be in three parts:

1. Thesis

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

VI. SCHEME OF EXAMINATION

SCHEME OF EXAMINATION

Candidates will be allowed to appear for examination only if attendance (Minimum 80%) and internal assessment are satisfactory and dissertation is accepted. The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately

shall be mandatory for passing examination as a whole. The examination for M.D will be held at the end of 3rd academic year. An academic term shall mean six month's training period.

A. Theory : 400 Marks

There shall be four papers, each of three hours duration. Total marks of each paper will be 100. Questions on recent advances may be asked in any or all the papers. The format of each paper will be same as shown below.

There shall be four theory papers. Each paper should have 10 short essay questions (SEQ)

Type of Questions	No. of Questions	Marks for each question	Total Marks
Short essay	10	10	100
Grand Total			100

Paper I : Fetal and Newborn

Paper II : General Pediatrics I*
General Paediatrics I includes : Respiratory, CNS, Hematology, Nutrition, Growth and Development, Oncology, Endocrine, Metabolic, Allergy / Immunology, Psychiatry.

Paper III : General Pediatrics II**
Includes : Infection. Gastroentriology, Hepatology, Immunization, Renal, CVS, Surgical, Adolescent, Collagen, Vascular, Miscellaneous

Paper IV : Ambulatory OPD Pediatrics, Community and social Pediatrics, emergency and Critical Care Pediatrics.

Note : The distribution of chapters/topics shown against the papers are suggestive only and may overlap or change.

B) CLINICAL EXAMINATION: 300 MARKS

	No of Cases	Marks
Long Case	1	100
Short Case	1	50
Newborn case	1	50
Case Spotters	4	100 (25 X 4)
Total		300

Note:

- **The long case will be a patient with either central nervous system (CNS) or a Multi system involvement, which can test the knowledge and skill of the student.**
- **Grand Rounds : Emergency, Ambulatory Cases, Spotters**

C. VIVA- VOCE EXAMINATION: 100 MARKS

Aims: To elicit candidate's knowledge and investigative/ therapeutic skills.

All examiners will conduct viva voce conjointly on candidates comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may also be given case reports, charts, gross specimens, pathology slides, instruments, X-ray, ultrasound, CT scan images, for interpretation.

Viva voce four tables of 80 marks each includes the following

1. Nutrition
2. X- Rays, MRI, CT
3. Drugs and vaccines.
4. Instruments, Case based interpretation of investigations

2) PEDAGOGY EXERCISE AND LOG BOOK – 20 MARKS

- (i) Candidate is asked to make a presentation for 8 to 10 minutes on a topic given in the beginning of clinical examination. 10 Marks
- (ii) Candidate is asked to make a presentation for 8 – 10 minutes on the dissertation topic and review of Log Book 10 Marks

D) MAXIMUM MARKS

Maximum Marks for MD Degree course in Paediatrics	Theory	Practical (Clinical)	Viva Voce	Grand Total
	400	300	100	800

VII. RECOMMENDED BOOKS (LATEST EDITIONS):

Textbooks :

Essential

Sl. No.	Name of the Book	Author	Publisher
1	Nelson's Textbook of Paediatrics,	Behrman, Kleigman, Jenson	Elsevier
2	IAP Guide book of Immunization	Nitin K. Shah	Jaypee Brothers
3	Manual of Neonatal Care	John P Cloherty, Eric C Eichenwald, Ann R Stark	Lippincot Williams and Wilkins
4	Care of the Newborn	Singh M.	Sagar Publication
5	O.P. Ghai Essential pediatrics	O. P. Ghai, Piyush Gupta, V K Paul	CBS Publisher and Distributors
6	Pediatrics Clinical methods	Singh M.	Sagar Publication
7	Hutchison clinical methods	Michael Swash	Saunders
8	Principles of Pediatric and Neonatal Emergencies	A Parathsarthy, H P S Sachadev	Jaypee publication
9	Illingworth Normal child	Illingworth R. S.	Churchill Livingstone
10	Illingworth Development of the child and infant.	Illingworth R. S.	Churchill Livingstone

11	IAP Text book of Paediatrics	A Parathsarthy,	Jaypee publication
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References

Sl. No.	Name of the Book	Author	Publisher
1	Rudolph's Pediatrics	Colin D Rudolph, Abraham Rudolph	Mc Graw Hill
2	Forfar and Arneil's Textbook of Pediatrics	Neil Mc Intosh, Roselind Smyth, Peter Helms	Churchill Livingstone
3	Oski's Pediatrics: Principles and Practice	Frank A. Oski, Julia A. McMillan, Catherine D. DeAngelis, Joseph B. Warshaw	Wolter Kluwer Company
4	Avery's Disease of the Newborn	Taeush, Ballard, Gleason	Elsevier
5	Roberton's Text book of Neonatology	Janet M. Rennie	Elsevier
6	Nada's Pediatric Cardiology	James E Lock, Donald C Fielar, F Keane	Elsevier
7	Perloff's Approach to congenital Heart Disease	Joseph K Perloff, John S Child,	Harcourt Brace & Company , W B Saunders Co.
8	Harriet Lane pediatric clinical manual	Jason Robertson, Nicole Shilkofski	Elsevier
9	Blood diseases of Infancy and Childhood	Dennis R Miller's, Robert L B, Linda Patrica Miller	Saunders/ Elsevier
10	Clinical Hematology in Medical Practice	D C DeGruchy's, F Firkin	Churchill Livingstone
11	Pediatric Nephrology	Holliday, M.A.; Barrett, Avner, E.D.	Williams and Wilkins
12	Caffey's Pediatric X-ray diagnosis	Jerald P. Kuhn, Thomas L. Slovis, Jack O Haller	Mosby
13	Protein Energy Malnutrition	Alleyne, G A O	Edward Arnold
14	Tuberculosis in Children	Miller F J W	Churchill Livingstone
15	Essentials of Tuberculosis in Children	Vimlesh Seth, S K Kabra	Jaypee Brothers

16	Swenson's Pediatric Surgery	Orvar Swenson	Appleton-Century Crofts (Education Division)
17	Text book of Pediatric Infectious diseases	Ralph D Feigin, James D Cherry, Gail J Dammlor, Sheldon L Kaplan,	Saunders
18	Fenichel's Pediatric Neurology	Fenichel G M	Saunders / Elsevier
19	Kendig's Respiratory Diseases in Pediatrics	Victor Chernic, Thomas Boat, Robert Wilmott, Andrew Bush	Saunders
20	Liver Disorders in Childhood	Alex P Mowat	Butterworth and Co
21	Roger's Pediatric Critical Care	Mark C Roger, Mark A Helfaer	William & Wilkins
22	Smith's Recognisable patterns of Human Malformations	Kenneth Lyons Jones	Saunders / Elsevier
23	Swaiman's textbook of pediatric neurology	Kenneth F Swaiman, Stephen Ashwal	Mosby
24	Practical pediatric nutrition	Elizebeth M E	Poskitt

VIII RECOMMENDED JOURNALS

Indexed Journals

1. Indian Pediatrics
2. Indian Journal of Pediatrics
3. Pediatric Clinics of North America
4. New England Journal of Medicine
5. Lancet
6. British Medical Journal
7. Journal of Pediatrics
8. Archives Diseases of Childhood and Adolescence
9. Pediatrics
10. Clinics in Perinatology
11. Seminars in Neonatology
12. Tropical pediatrics
13. Journal of Neonatology – (National Neonatology forum of India)

Annexure I

Orientation sessions for PG students joining MD in Paediatrics

This could be spread over 4-5 sessions once or twice a week depending on departmental routine and feasibility.

For all PG students

Orientation to the Hospital: Various Departments and facilities available

- Communication skills: Patients and colleagues
- Literature search
- Basic research methodology
- Protocol writing and thesis

Pediatric PGs

Introduction to Residency in Paediatrics

- Universal precautions and appropriate disposal of hospital waste
- Management of shock
- Congestive cardiac failure
- Normal fluid and electrolyte requirement and their disorders
- Interpretation and management of disorders of acid-base balance
- Evaluation of a sick newborn
- Management of seizures, hypothermia and hypoglycemia in the newborn
- Management of seizures and status epilepticus
- Management of comatose patients
- Hospital management of severe PEM
- Acute kidney injury
- Fulminant hepatic failure
- Management of respiratory distress

- Management of acute diarrhea
- Approach to a bleeding child and its management
- Rational antibiotic therapy

**Postgraduate Students Appraisal Form
Pediatrics**

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory			Satisfactory			More Than Satisfactory			Remarks
		1	2	3	4	5	6	7	8	9	
1.	Journal based / recent advances learning										
2.	Patient based /Laboratory or Skill based learning										
3.	Self directed learning and teaching										
4.	Departmental and interdepartmental learning activity										
5.	External and Outreach Activities / CMEs										
6.	Thesis / Research work										
7.	Log Book Maintenance										

Publications

Yes/ No

Remarks* _____

***REMARKS:** Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT

SIGNATURE OF HOD

POSTGRADUATE DEGREE

M.D. IN PSYCHIATRY

I. GOALS

The purpose this curriculum is to create specialists who would provide high quality health care and advance the cause of science through research & training. A postgraduate specialist having undergone the required training should be able to recognize the health needs of the community, should be competent to handle medical problems effectively and should be aware of the recent advances pertaining to his specialty. The post graduate student should acquire the basic skills in teaching of medical/para-medical students. She/he is also expected to know the principles of research methodology and modes of consulting library.

II. SUBJECT SPECIFIC LEARNING OBJECTIVES

The course of the postgraduate students in Psychiatry is to impart Knowledge and skills that may enable them to diagnose and treat common and rare diseases, complications of Psychiatric diseases and their unusual manifestations. The student should also be aware of the recent advances in the specialty.

At the end of postgraduate training the student should be able to:

- Practice efficiently and effectively, backed by scientific Knowledge and skill.
- Understand the relevance of mental health in relation to the health needs of the country
- Exercise empathy and a caring attitude maintaining high ethical standards.
- Identify the social, economic, biological and emotional determinants of mental health
- Institute appropriate diagnostic, therapeutic and rehabilitative procedures to the mentally ill patient
- Take detailed history, conduct appropriate ethically valid physical examination and institute appropriate evaluation procedures to make a correct clinical diagnosis

- Perform relevant investigative and therapeutic procedures for the psychiatric patient
- Recommend appropriate laboratory and imaging examinations and interpret the results correctly
- Plan and deliver comprehensive treatment of a psychiatric patient using principles of rational drug therapy
- Plan rehabilitation of psychiatric patient suffering from chronic illness
- Clinically manage psychiatric emergencies efficiently
- Develop appropriate skills to practice evidence-based psychiatry
- Demonstrate competence in basic concepts of research methodology and epidemiology
- Be aware of and take appropriate steps in the implementation of national mental health programs, effectively and responsibly
- Be aware of the concept of essential drugs and rational use of drugs
- Be aware of the legal issues in the practice of Psychiatry
- Be aware of the special requirements in the practice of Child and adolescent Psychiatry and Geriatric Psychiatry
- Demonstrate empathy and humane approach towards patients and their families and respect their sensibilities
- Demonstrate communication skills of a high order in explaining management and prognosis, providing counseling and giving health education messages to patients, families and communities
- Research: He should know the basic concepts of research methodology and plan a research project in accordance with ethical principles. S/he should also be able to interpret research findings and apply these in clinical practice. S/he should know how to access and utilize information resources and should have basic knowledge of statistics. The student should take up the common course work in Research methodology, ethics and good clinical practice
- Student should be able to provide of basic life support, whenever necessary.

- Ethical considerations in the teaching and practice of Psychiatry
- Be aware of the role of sex and gender in the practice of psychiatry
- Be able to determine the capacity and capability of the individual (especially children and adolescents) to identify and articulate a gender identity

Teaching skills: The student should know the principles of large group and small group teaching in Psychiatry. Should be able to use innovative teaching learning methods to enhance learning experience.

S/He should learn the basic methodology of teaching and develop competence in teaching medical/paramedical students, health professionals, members of allied disciplines (e.g. behavioural sciences), law enforcement agencies, families and consumers and members of the public.

II. COMPETENCIES

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. The objectives may be considered under the following subheadings.

1. Cognitive
2. Psychomotor
3. Affective

1. Cognitive:

1. The student should be able to demonstrate knowledge of basic sciences (Anatomy, Physiology, Biochemistry, Microbiology, Pathology and Pharmacology) as applied to Psychiatry.
1. The student should be able to explain etiology, assessment, classification and management and prognosis of various psychiatric disorders (including psychiatric sub-specialties), and Neuroanatomy, Neurophysiology, Neurochemistry,
2. Neuroimaging, Electrophysiology, Psycho-neuroendocrinology, Psychoneuroimmunology, Chronobiology and Neurogenetics.

4. Acquire knowledge of delirium, dementia, amnesic & other cognitive disorders and mental disorders due to a general medical condition.
5. The student should acquire knowledge of emergency measures in acute crisis arising out of various psychiatric illnesses including drug detoxification and withdrawal.
6. The student should acquire knowledge of pharmacokinetics & pharmacodynamics of drugs involved in psychiatric management of patients.
7. The student should acquire knowledge of (a) normal child development and adolescence, mental retardation in children (b) learning & associated disorder and their management (c) abuse and neglect in childhood
8. The student should acquire theoretical aspects of psychiatric rehabilitation
9. The student should acquire knowledge of substance related disorders and their management.
10. The student should acquire knowledge of psychotic disorders, mood disorders, and anxiety disorders and their management
11. The student should acquire knowledge of sexual and gender identity disorders and their management.
12. The student should acquire knowledge of eating disorders and sleep disorders and their management.
13. The student should understand difference between sex and gender/ biological and social construction of personhood; sexual/gender identity; transgender, gender non-conformity, and other gender diverse identities, sexual/sexuality identity, sexual orientation, sexual desire; the wide variety, and cultural presence of various sexual orientations and desires; gender dysphoria and its management.
14. The student should be conversant with recent advances in Psychiatry.
15. The student should be conversant with routine bedside diagnostic and therapeutic procedures and acquire knowledge of latest diagnostics and therapeutics procedures available.
16. The student should be conversant with various policy related aspects of Psychiatric practice in India (e.g. Mental Health Act, National Health Mental Health Programs etc.).

17. The student should be able conversant with various concepts of forensic psychiatry and laws pertaining to mental health including POCSO act.
18. The student should be conversant with research methodologies.
19. Student should be conversant with the role of Yoga and Meditation in the management of psychiatric disorders.

2. Psychomotor:

The student, at the end of the course should be able to perform independently, the following:

1. In good history taking, physical examination, mental state examination, and able to establish rapport and counsel family members and patients on scientific basis.
2. Choosing the required investigations.
3. Write a complete case record with all necessary details.
4. Write a proper discharge summary with all relevant information
5. Obtain informed consent for any examination/procedure.
6. Perform clinical audit.
7. Basic Life support measures
8. Management of emergencies.
9. Must be able to perform modified Electroconvulsive therapy (ECT).
10. Using appropriate admission procedures as per the Mental Health Care Act.
11. Able to do risk assessment and mental capacity assessment.
12. Provide a clinical formulation, arrive at a logical working diagnosis and differential diagnosis after clinical examination.
13. Should have the following skills in relation to gender related issues:
 - Demonstrate the ability to assess the gender identity of an individual and distress caused (if any) due to the individual's own gender identity in simulated environment.

- Describe and understand how to discuss sexual orientation, sexuality identity, gender identity, as well as intersex identity (differences in sex development) as part of routine history taking.
- Demonstrate the ability to educate and counsel individuals or family members about intersex variations, sexual orientations, sexuality identities, gender incongruence, gender dysphoria, and gender identities. Demonstrate ability to identify when a mental health referral is needed for the above.
- Demonstrate knowledge that conversion therapy practices for sexual orientation or gender identity or on people with intersex variations is unethical.
- Describe differences between Gender Incongruence and Gender Dysphoria.
- Describe and understand gender identity, the biological and gender binaries, rejection of gender binary, gender non-conforming, gender non-binary, androgynous, and other identities.
- Demonstrate the ability to educate an individual and family members that Gender Incongruence by itself is not a disorder and does not require clinical intervention. Any form of conversion therapy is unethical.
- Discuss situations where there is a role for mental health support in Gender Dysphoria i.e., discussing with family, deciding on hormonal treatments or Sex Reassignment Surgery (Gender Affirming Care or Gender Affirmative Therapies or Gender Confirmation Surgery).

The student, at the end of the course should be able to perform independently, the following:

1. Conduct detailed Mental Status Examination (MSE)
2. Cognitive behaviour therapy
3. Supportive psychotherapy
4. Modified ECT and non-invasive neuromodulation
5. Clinical IQ assessment
6. Management of alcohol withdrawal
7. Alcohol intoxication management

8. Opioid withdrawal management
9. Delirious patients
10. Crisis intervention

The student must be able to demonstrate approach to patient with variety of clinical presentations including following symptoms:

1. Psychotic symptoms
2. Seizures true and pseudo seizure
3. Anxiety symptoms
4. Affective symptoms
5. Cognitive symptoms
6. Catatonia
7. Delirium
8. Malingering
9. Behavioral symptoms of developmental disorders

The student, at the end of the course should be able to perform under supervision, the following:

1. Behavior therapy
2. Opioid intoxication management
3. Genetic counselling
4. Family therapy
5. Cognitive behaviour therapy and other newer therapies
6. First level psychological intervention for sexual abuse, sexual assault and domestic violence

The student, at the end of the course should be able to assist the expert in the following:

1. Interpersonal therapy
2. Management of suicide attempt

3. Affective:

- Adopt ethical principals in all aspects of his/ her practice; professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- Develop communication skills, in particular to explain various options available in the management and to obtain a true informed consent from the patient.
- Provide leadership and get the best out of his / her team in a congenial working atmosphere.
- Apply high moral and ethical standards while carrying out human or animal research.
- Be humble and accept the limitations of his / her knowledge and skill and to ask for help from colleagues when needed.
- Respect patient's rights and privileges including patient's right to seek information and right to seek a second opinion.

Syllabus

Course Contents (Components of curriculum):

No limit can be fixed and no fixed number of topics can be prescribed as course content. A student is expected to know the subject in depth. However, emphasis should be on the disease / health problems most prevalent in that area. Knowledge of recent advances and basic sciences as applicable to his / her specialty should get high priority. Competence in psychiatric, medical and psychotherapeutic skills (actual hands on training) must be ensured.

A. Theoretical Concepts:

1. Adjustment Disorders
2. Anxiety Disorders

3. *Child and adolescent psychiatric disorders.*
4. *Chronobiology, Psych neuroendocrinology & Psychoneuroimmunology.*
5. Classification in Psychiatry
6. *Community Psychiatry*
7. Consultation-Liaison Psychiatry
8. *Culture Bound Syndromes/ Transcultural Psychiatry*
9. *Dissociative (Conversion)*
10. Eating Disorders
11. Electro-Convulsive Therapy
12. Electrophysiology
13. Emergencies in Psychiatry
14. *Epidemiology: of Psychiatric disorders*
15. Ethics In Psychiatry
16. Factitious Disorders
17. *Forensic / Legal Psychiatry*
18. History of Psychiatry
19. *Impulse-Control Disorders*
20. *Memory*
21. Mental Health Issues In Women
22. Mental Retardation

23. *Mood Disorders*

24. Neuroanatomy, Neurophysiology and Neurochemistry – related to Psychiatry

25. *Neuro-imaging related to psychiatry*

26. *Neuropsychology*

27. *Psychology (General & Clinical): With Special Emphasis on Personality, Emotions, Learning, Motivation, memory, etc.*

28. Psychology (Social)

29. Psychometry / Psychodiagnostics

30. *Organic Psychiatry (Delirium, Dementia etc.)*

31. Personality Disorders

32. **Psychodynamics**

33. **Psychiatric assessment (including History Taking, Neurological Examination, Mental Status Examination, Investigations, Use of rating scales, etc.).**

34. Psychopharmacology

35. Psychoses (Including Schizophrenia, Schizophreniform Disorder, Schizoaffective Disorder, Delusional Disorder, Brief Psychotic Disorder, Shared Psychotic Disorder, etc.)

36. Psychosomatic Disorders.

37. *Psychotherapy: Introduction to different types of Psychotherapies*

38. *Occupational Therapy and Rehabilitation: Basic Concept.*

39. Movement Disorders (including Medication-Induced Movement Disorders, etc)

40. Newer therapies like rTMS, Vagal Nerve Stimulation, Deep Brain Stimulation
Psycho surgery

41. Normal sexuality, Sexual And Gender Identity Disorders

42. Sleep, its and Sleep Disorders

43. Somatoform Disorders

44. *Statistics /Research Methodology: Basic Concepts.*

45. Stress and stress management

46. Substance Related Disorders

47. Suicide and its prevention

48. Pre-Menstrual Dysphoric Disorder

49. Perinatal Psychiatry

50. Geriatric Psychiatry (including dementia, legal and ethical issues, positive psychiatry in aging, psychiatric aspects of long term care)

51. *Miscellaneous:* Non-compliance, Malingering, Antisocial Behaviour, Borderline Intellectual Functioning, Age-Related Cognitive Decline, Bereavement [including Death], Academic Problems, Occupational Problems, Identity Problems, Religious or Spiritual Problems, Acculturation Problems, Phase of Life Problems, Chronic Fatigue Syndrome, etc.)

The student may know the following:

1. History of Psychiatry

2. Epidemiology
3. Mind – the evolving concepts
4. Psychiatry rating scales
5. Placebo Effect
6. Sex and Gender Issues in Psychiatry

B. Practical / Clinical concepts:

Post graduate students should do ward rounds every day. Newly admitted patients should be worked up by them and should be presented to the staff during rounds. Students are also expected to work up the case in outpatient department, take a proper clinical history, examine the patient, perform essential diagnostic /therapeutic procedures and interpret them to arrive at a reasonable diagnosis.

Each student will be given clinical responsibility as full time assignment to various areas in rotation. He / she will be given full responsibility of patient care and the record keeping under the supervision of staff members.

The student will initially observe and later perform procedures like electro convulsive therapy (ECT), psychotherapies, narco-analysis / suggestion, bio-feedback, etc independently.

C. Diagnostic procedures:

The student will initially observe and later perform the following diagnostic tests independently. The student will discuss the test results to the staff member and seek further guidance from them.

- a. IQ assessment
- b. Projective tests like Rorschach's ink blot test, Thematic apperception test, Sentence completion test, Draw a person test, etc.
- c. Personality assessment tests
- d. Rating scales

e. Lobe function tests

f. Electro encephalogram

g. Narco analysis

Various academic activities will be supervised, rated periodically by the consultants. Resident will be encouraged to keep a logbook and meticulously make entries.

Teaching and Learning Activities:

Didactic lectures are of least importance. Seminars, journal clubs, symposia, reviews and guest lectures should get priority for developing theoretical knowledge. Bedside teaching, grand rounds, interactive group discussions, clinical demonstrations and clinical case presentations should be the hallmark of clinical / practical learning. Student should have hands-on training in performing various procedures like ECT and also in various counseling, psychotherapeutic skills including behavior techniques. He / she should have the ability to interpret various tests / investigations. Student should have exposure to newer specialized diagnostic / therapeutic procedures concerning his / her subject.

The post graduate student should have knowledge of:

- Psycho-pharmacology and broadening the treatment options using medicines.
- Neuro-imaging techniques to understand behavior and psychiatric illness.
- Community-Psychiatry.
- Functioning of psychiatric hospital.

Community Psychiatry should go beyond familiarization with the National Mental Health Programme. The post graduate student should have hands on experience with:

- Training programmes for primary care physicians
- Organizing Mental Health Camps
 - Carrying out Health Education Activities
- Forensic /Legal Psychiatry
- Integration of Mental Health Care with General Health Care

1. Theoretical teaching:

- a) **Lectures:** Lectures are to be kept a minimum. Certain selected topics will be taken as lectures.
- b) **Journal Club:** It should be a monthly meeting in which a resident presents a critical evaluation of a research paper from an appropriate journal. Residents are expected to attend & discuss.
- c) **Seminars:** There should be a weekly seminar in which the Junior Residents present material on assigned topics in rotation. It should be followed by discussion in which all trainees are expected to participate. Generally the topics covered should be those that supplement the formal teaching program.
- d) **Case presentations:** All new in-patients and outpatients' cases should be routinely reviewed with one of the Consultants. In addition, the PG student is required to present case material at routine rounds and other case conferences. Senior PG students will conduct evening classes on clinical topics.
- e) **Case Conferences:** A case conference should be held every week where a Junior Resident prepares and presents a case of academic interest by rotation and it is attended by all the members of the department.
- f) **Ward Rounds:**
 - i. **Service rounds-** Students should do service rounds every day for the care of patients. Any problems in the management of patients should be informed to the consultant and guidance should be sought.
 - ii. **Teaching rounds-** Newly admitted patients should be worked up in detail by the student and should be presented to the consultant and the team having psychologists and psychiatric social workers. The team will guide the student to arrive at a suitable diagnosis and discuss

various therapeutic options. Student's knowledge and skills are assessed by the team and student is guided where ever necessary.

g) Teaching skills: Post graduate student must teach MBBS students, Physiotherapy students and Nursing students by taking bed side clinics, tutorials, lectures, etc.

h) Psychotherapy Tutorials: These should be held in small groups supervised by a consultant during which a case is presented by a resident and psychotherapeutic management is discussed.

i) Speciality Clinics: *Neuro Psychiatry clinic for elderly Child guidance clinic Clinic for Senile disorder Psycho Motor clinic Deaddiction Memory clinic Family Counselling*

j) Continuing Medical Education Programmes(CME): It is recommended that at **least 2** state level CME should be attended by each **student in 3 years**.

k) Conference: Post –A post graduate student of a postgraduate degree course in broad specialties/super specialties would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination.

l) Research Forum: There will be periodic meetings of one hour each in which the residents present their plan of research as well as the report of the completed work of their project. The other research scholars/workers in the department also participate in it. The faculty, residents and the non-medical professionals make critical comments and suggestions.

m) Extra-mural Activities: Residents are encouraged to attend certain academic / semi-academic activities in the allied subjects. e.g. seminars / lectures held at departments of sociology, psychology and neurology etc.

2. Practical Training:

Rotation:

Clinical Postings

- A major tenure of posting should be in General Psychiatry. It should include care of in-patients, out-patients, special clinics and maintenance of case records for both in and out patients.
- Exposure to the following areas should be given: -

Schedule of clinical posting for MD Psychiatry (36 months):

Each student/resident shall be given clinical responsibility as full time assignment to various areas in rotation. The general schedule of clinical posting shall be according to a standardized scheme:

Ward (Including Child & Adolescent Psychiatry, Consultation – Liaison Psychiatry and Drug de-addiction training)	13 Months
OPD and Wards (Including, Consultation – Liaison Psychiatry and Drug de-addiction training)	12 Months
Neurology	02 Months
Child Psychiatry including CDC	03 Month
Internal (Gen) Medicine	01 Month
Clinical Psychology	01 Month
Community Psychiatry (District Residency Program)	03 Month
Mental Hospital / (NIMHANS) Posting	30 Days
Child Psychiatry	10 Days
De-addiction Clinic	10 Days
Behaviour Therapy	10 Days
Total	36 Months – 00 Days

The Student/Resident will be given full responsibility of the patient care and the record keeping under the supervision of the senior residents and consultants. The resident will also take patients for individual as well as group psychotherapy under supervision.

Applicable only for trainees in General Hospital Psychiatric units: Facilities for these need to be arranged.

The post graduate student in Psychiatric hospitals would have extended period of exposure to consultation - liaison psychiatry and other medical specialties. Exposure to community-based services should be integral part of various postings. The post graduate student shall be given full responsibility for patient care and record keeping under the supervision of the senior PG students and consultants. The post graduate student shall also take patients for psychological interventions in an individual as well as group setting. S/he must complete a minimum of 100 hours of supervised psychological interventions.

- **Inter-Unit Rotation of posting**

Inter-unit rotation in the department should be done for a period of up to one year (divided during the first year and third year while the post graduate student stays in the parent unit throughout the duration of his thesis work).

3. Clinical meetings:

There should be intra - and inter - departmental meetings for discussing the uncommon / interesting medical problems.

During the training programme, patient safety is of paramount importance, therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently. For this purpose, provision of clinical skills laboratories in medical colleges is mandatory. Objective structured clinical examination (OSCE) modules may be developed and used in teaching.

Other criteria to be fulfilled for the degree course:

1. Maintenance of log book:

Every candidate shall maintain a Log book/work diary and record his/her participation in the training programmes conducted by the department such as

journal reviews, seminars, etc. special mention may be made of the presentations by the candidate by well as details of clinical or laboratory procedures if any conducted by the candidate. All the daily activities including the ward rounds and the routine procedures performed on day to day basis should be entered in the Log book and it should be verified and signed by the faculty member. The Log book shall be scrutinized and certified by the head of the Department and Head of the institution and presented in the University practical/clinical examination

2. Dissertation :

Every candidate pursuing MD degree course is required to carry outwork on a selected research project under the guidance of a recognized post graduate teacher. The research of such a work shall be submitted in the form of a dissertation.

For details regarding DISSERTATION Refer 9.1 to 9.11 of chapter-I

Scheme of Examination

A. Formative assessments:

During the course of three years, the department will conduct two formative assessment exams including Preliminary exam. Two of them will be annual, one at the end of first year and other at the end of second year. Format will be the written papers, practical / clinical and viva – voce. Candidate should pass annual formative assessment to enter into subsequent academic year. Records and marks obtained in such tests be maintained by the head of the department will be sent to the university when called for. Results of all evaluations should be entered in to PG's log book and departmental file for documentation purposes. Main purpose of formative assessment is to ensure clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.

Quarterly assessment during the MD training should be based on:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs
6. Professionalism and teamwork

B. Summative Assessment:

Candidates will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

A. Theory: 400 Marks

There shall be four question papers, each of three hours duration. Total marks for each paper will be 100. Questions on recent advances may be asked in any or all the papers. The format of each paper will be same as shown below.

Type of Questions	Number of questions	Marks for Each question	Total Marks
Essay questions	10	10	100

Paper I: Basic Sciences as related to Psychiatry

Neuroanatomy, Neurophysiology, Neurochemistry, Genetics, General and Abnormal Psychology, Social psychology, Anthropology, Ethology and Statistics

Paper II: Clinical Psychiatry

History of psychiatry, Classificatory Systems in Psychiatry, Adult Psychiatric Disorders like Mood disorders, Schizophrenia, Anxiety Disorders, Personality Disorders, Substance Related Disorders, Sexual Disorders, Eating Disorders, Sleep Disorders. Psychosomatic Disorders, Consultation-Liaison Psychiatry, Geriatric Psychiatry, Psychiatric Emergencies, Psycho-oncology,

Psychoneuroimmunology, Psychoneuroendocrinology, Chronobiology, Electro-Physiological Procedures and Brain Imaging in Psychiatry.

Paper III: Psychiatric Theory and Psychiatric Specialties.

Child & Adolescent Psychiatric Disorders including Mental Retardation. Mental Health issues in women including Post-partum Psychiatric Disorders, Measurements in Psychiatry, Psychopharmacology, Electro Convulsive Therapy, Psychosurgery, Psychotherapy, Rehabilitation in Psychiatry, Forensic Psychiatry, Cultural Psychiatry, Community Psychiatry and Ethics in Psychiatry, Crisis intervention and Suicide.

Paper IV: Recent Advances in Psychiatry and Applied Psychiatry related to Neurology and Medicine.

Neurology and Medicine related to Psychiatry, Organic Psychiatric Disorders and Substance Abuse Disorders. Recent advances in various fields of Psychiatry and related to Psychiatry.

Note: The distribution of chapters / topics shown against the papers are suggestive only and may overlap or change.

B. Practical / Clinical Examination: 300 Marks

Aim: To elicit competence in clinical skills and to discuss differential diagnostic / therapeutic aspects.

There will be one Psychiatry long case of 100 marks. There will be two short cases of 50 marks each (one Psychiatry short case and one Neurology / Neuropsychiatry short case). The format of clinical examination will be same as shown below.

Type of Cases	Number of Cases	Marks
Long Case	1 (Psychiatry)	150
Short Case	3 (50 marks each) (one Psychiatry and one Neurology / Neuropsychiatry)	150
Total	4	300

C. Viva-Voce examination: 100 MARKS

Aim: To elicit candidate's knowledge and investigative / therapeutic skills.

1. Viva – voce examination: (80 marks)

All examiners will conduct viva voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course content. In addition, candidates may be given Case Reports, Gross Specimens, X-Rays, CT and MR Scan Images, EEG recordings, Lab Reports, Psychological assessment instruments and reports, other instruments used in Psychiatry. Candidates may be asked questions regarding this. Candidate's knowledge of drugs pertaining to Psychiatry will also be evaluated during viva – voce examination. Viva – voce examination can include discussion on Dissertation also.

2. Pedagogy Exercise and Log-Book: (20 Marks)

a. Candidate is asked to make presentation for 8 – 10 minutes on a topic given before the clinical examination or may be asked to make a presentation for 8 – 10 minutes on the Dissertation topic.

b. The review of log book

D. Maximum Marks

Maximum marks for MD Psychiatry	Theory	Practical (Clinical)	Viva-Voce	Grand Total
	400	300	100	800

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may also be given Case reports, Charts, Gross specimens, X-rays, CT/MRI scan images, EEG, etc, for interpretation. Questions on use of Drugs, Instruments & Psychodiagnostics will be asked. It can include discussion on dissertation also.

E. Passing Criterion:

To pass the examination, the candidate must secure 50% of the marks in each head of theory and practical separately

VII. RECOMMENDED TEXT BOOKS (LATEST EDITIONS)

Sl. No	Name of the Text Book	Authors	Publisher
1	Kaplan & Sadock's Comprehensive Text Book of Psychiatry, Ed 10 , 2017	Sadcok BJ and Ruiz P	Lippincott William and Wilkins
2	Synopsis of Psychiatry Ed 11, 2018	Kaplan (HI) and Sadock (B)	Waverly Pvt Ltd
3	Organic Psychiatry: Consequence of Cerebral Disorder Ed 4,2009	Leishman (WA)	Blackwell, Sciences
4	The Pharmacological Basis of Therapeutics Ed 12, 2011	Bruton LL, Lazo JS Parker KL, Goodman and Gilman	Mc Graw Hill
5	Introduction to Psychology Ed 7, 2006	Munn (Fernald & Fernald	AITBS
6	Correlative Neuroanatomy and Functional Neurology Ed 1, 2005	Vyas, Gad, Nathawat	Paras Publications
7	Sims' Symptoms in the Mind. An Introduction to Descriptive Psychopathology Ed 4, 2008	F. Oyebode	W.B. Saunders
8	Child and Adolescent Psychiatry Ed 5, 2009	Michael Rutter and Eric Taylor	Blakwell
9	Clinical Psychiatry Ed 5, 1992	Mayer-Gross Slater and Roth	Bailliere Tindall London
10	Text Book of Post Graduate Psychiatry Ed 2, 2003	Niraj Ajuja	Jaypee Brothers
11	Shorter Oxford Text Book of Psychiatry Ed 5 , 2006	Gelder M, Mayou R, Cowen	Oxford University Press
12	Text Book of Psychiatry Ed 7, 2011	Niaraj Ahuja	Jaypee Brothers

13	Fish's Clinical Psychopathology: Signs and Symptoms in Psychiatry Ed 3, 2007	FJ Fish, Casey P, Kelly B	RCPsych Publications
14	ICD 10 Classification of Mental and Behavioural Disorders, Clinical Description and Diagnostic Guidelines, 2007	World Health Organization Geneva	Oxford University Press
15	Mental Health Care Act. (2017)		
16	American Psychiatric Association Practice Guidelines for the Treatment of Psychiatric Disorders Compendium Ed 1, 2006	American Psychiatric Association	American Psychiatric Association Washington DC
17	Diagnostic and Statistical Manual of Mental Disorders -5 (DSM -5), 2013	American Psychiatric Association	American Psychiatric Association Washington DC
18	Stahl's Essential Psychopharmacology: Neuroscientific Basis and Practical Applications. Ed 4, 2014	Stephen M. Stahl	<u>Cambridge University Press</u>
19	Abnormal Psychology and Modern Life. Ed 10. 1998	Robert C. Carson, Don C. Fowles	Pearson Education
20	Walsh's Neuropsychology: A Clinical Approach. Ed 5. 2005	David Darby, Kevin William Walsh	Elsevier Churchill Livingstone
21	Text book of Neuroanatomy	I.B. Singh	

VIII. RECOMMENDED JOURNALS:

Sl. No.	Name of the journal
1	Indian Journal of Psychiatry
2	American Journal of Psychiatry
3	Archives of General Psychiatry (<i>JAMA Psychiatry</i>)
4	British Journal of Psychiatry
5	Psychiatric Clinics of North America
6	Indian Journal of Clinical Psychology
7	Acta Psychiatrica Scandinavica
8	Indian Journal of Psychological Medicine
9	Journal of Clinical Psychiatry

NOTIFICATION

Sub : **Ordinance governing revision of the curriculum for the Super-speciality courses as per the new CBME NMC guidelines.**

Ref : Minutes of the 52nd Academic Council meeting held on 21st March, 2023.

In exercise of the powers conferred under Rule 19 (iv) of the Memorandum of Association of the KAHER, the Academic Council of the KLE Academy of Higher Education and Research in its meeting held on **21st March, 2023** has approved the Ordinance governing revision of the curriculum of the following **Super-speciality courses as per the new CBME NMC guidelines.**

Sl.No.	Name of the course	Sl.No.	Name of the course
01.	M.Ch Urology	07.	DM Cardiology
02.	M.Ch Plastic Surgery	08.	DM Nephrology
03.	M.Ch Paediatric Surgery	09.	DM Cardiac Anaesthesia
04.	M.Ch CVTS	10.	DM Gastroenterology
05.	DM Neurology	11.	M.Ch Surgical Oncology
06.	M.Ch Neurosurgery		

The Ordinance shall be effective for the students admitted to the above **Super-speciality courses as per the new CBME NMC guidelines** under the **Faculty of Medicine** in the Constituent College of the KAHER viz **J.N. Medical College, Belagavi** from the academic session **2023-24** onwards.

By Order,
REGISTRAR

To,
The Dean,
Faculty of Medicine,
KAHER,
Belagavi.

CC to:

1. The PA to Hon. Chancellor, KAHER, Belagavi.
2. The Special Officer to Hon. Vice-Chancellor, KAHER, Belagavi.
3. The Principal, J.N. Medical College, Belagavi.
4. The Controller of Examinations, KAHER, Belagavi.
5. The Director, Academic Affairs, KAHER, Belagavi.
6. The Secretary, University Grants Commission, New Delhi

SECTION - I

REGULATIONS FOR POST DOCTORAL COURSES IN MEDICAL SCIENCES

1. Post Doctoral Courses:

A. D. M. (Doctorate of Medicine)

1. Cardiology
2. Cardiac Anesthesiology
3. Neurology
4. Nephrology
5. Gastroenterology
6. Medical Oncology
7. Pediatric Neurology
8. Interventional Radiology
9. Endocrinology

B. M. Ch. (Master of Chirurgiae)

1. Urology
2. Neuro Surgery
3. Cardiovascular & Thoracic Surgery
4. Plastic Surgery
5. Pediatric Surgery
6. Surgical Oncology

2. Eligibility for Admission:

D.M.: Candidate seeking admission for DM courses in any subject must possess recognized Post-Graduate degree of MD in General Medicine or Pediatrics (or its equivalent) in the subject specified in the regulations of the National Medical Council from time to time.

DM. Cardiology: MD Medicine or MD Pediatrics or its equivalent.

DM. Cardiac Anesthesiology: MD Anesthesiology or its equivalent.

DM. Neurology: MD Medicine or MD Pediatrics or its equivalent.

DM. Nephrology: MD Medicine or MD Pediatrics or its equivalent.

DM. Gastroenterology: MD Medicine or MD Pediatrics or its equivalent.

DM. Medical Oncology: MD Medicine or MD Pediatrics or its equivalent.

DM. Pediatric Neurology: MD Medicine or MD Pediatrics or its equivalent.

DM. Interventional Radiology: MD Medicine or MD Pediatrics or its equivalent.

DM. Endocrinology: MD Medicine or MD Pediatrics or its equivalent.

M.Ch: Candidate seeking admission for MCh courses in any subject must possess recognized degree of MS in General Surgery or of its equivalent recognized degree in the subject specified in the regulations of the National Medical Council time to time.

MCh. Urology: MS in General Surgery or of its equivalent.

MCh. Neuro Surgery: MS in General Surgery or of its equivalent.

MCh. Cardiovascular & Thoracic Surgery: MS in General Surgery or of its equivalent.

MCh. Plastic Surgery: MS in General Surgery or of its equivalent.

MCh. Pediatric Surgery: MS in General Surgery or of its equivalent.

MCh. Surgical Oncology: MS in General Surgery or of its equivalent.

The candidate should fulfill criteria laid down by KAHER from time to time as well as National Medical Council of India as applicable to DM/MCh course.

Selection of students for Post Doctoral Courses:

Admission will be done on basis of merit as determined by centralized Government test held at National level i.e. NEET super speciality. (National eligibility cum test conducted by National Board of Examination.)

3. Obtaining Eligibility Certificate by the University before making admission.

No candidates shall be admitted for any Post Doctoral courses unless the candidate has obtained and produced the eligibility certificate issued by the university.

The candidate has to make an application to the university with the following documents along with the prescribed fee for issue of Eligibility Certificate:

1. MBBS and MD/MS degree /its equivalent degree certificate issued by the university.
2. Marks cards of all the university examinations passed MBBS and MD/MS/its equivalent courses.
3. Attempt certificate issued by the Principal.
4. Certificate regarding the recognition of the medical college by the NMC.
5. Internship completion certificate.
6. In case internship was done in a non-teaching hospital, a certificate from the NMC should be produced stating that the hospital has been recognized for internship.
7. State Medical Council Registration Certificate.

A candidate who has been admitted to Post Doctoral courses should register his/her name in the university within a month of admission after paying the registration fees.

4. Intake of Students:

The intake of students to each course shall be in accordance with the NMC approval.

5. Course of the Study:

Duration: DM/MCh: The courses of study shall be for a period of 3 years consisting of 6 terms.

6. Method of training:

The training of Post Doctoral course shall be residency pattern with graded responsibilities in the management and treatment of patients entrusted to his/her care. The participation of the students in all facets of educational process is essential. Every candidate shall take part in seminars, group discussions, grand rounds, case demonstration, clinics, journal review meetings. Every candidate shall be required to participate in the teaching and training programme of undergraduate and postgraduate students. Training shall include involvement in pertinent laboratory and experimental work, and research studies.

7. Attendance, Progress and Conduct:

1. A candidate pursuing Post Doctoral course shall work in the concerned department of the institution for the full period as a full time Senior Residents. No candidate is permitted to run a clinic/laboratory/nursing home while studying the course.
2. Each term shall be taken as a unit for the purpose of calculating attendance.
3. Every student shall attend/present symposia, seminars, conferences, journal review meetings, grand rounds, case presentation, clinics and lectures during each year as prescribed by the department and not to remain absent himself/herself from work without prior permission.
4. Every candidate is required to attend a minimum of 80% of the training during each academic term of the Post Doctoral course.
5. Any student who fails to complete the course in the manner stated above shall not be permitted to appear for the University Examinations.

8. Monitoring Progress of Studies:

1. Work Diary/Log Book – every candidate shall maintain a work diary and record his/her participation in the training programmes conducted by the department such journal reviews, seminars, etc. special mention may be made of the presentations by the candidate. The work diary shall be scrutinized and certified by the head of the department and head of the institution, and presented in the university practical/clinical examination.
2. Periodic tests: in case of Post Doctoral courses of three years duration (DM/MCh), the concerned departments shall conduct three tests, two of them be annual tests, one at the

end of first year and the other in the second year. The third test may be held three months before the final examination.

3. Records: records will be maintained by the head of the departments and will be made available when required.

9. Research activities

1. Every candidate shall carry out work on an assigned research project under the guidance of a recognized Post Graduate Teacher, the result of which shall be written up and submitted in the form of Thesis. Thesis shall be submitted at least six months before the final year Theory and Clinical/Practical examination.
2. The candidate shall publish(accepted for publication or sent for publication) at least one research paper in an international or national conference and make a poster to make him/her eligible to appear at final post graduate degree examination.

University examination

Every candidate should have fulfilled the minimum attendance requirement prescribed by the NMC and the KLE University (80% of the training during each academic term the post graduate course provided leave of any kind shall not be counted as part of academic term without prejudice to minimum 80% attendance of training period every year)

Scheme of Examination

The examination shall consist of:

1. Written examination (theory) – 400 marks
2. Practical:
 1. Clinical examination – 200 marks (3 cases 1 long(100 marks) + 2 short(50 marks))
 2. Viva-voce – 100 marks
 3. Ward rounds – 100 marks

Total: 800 marks

Examiners:

1. An examiner must fulfill the minimum requirements of a Post graduate teacher as laid down by the NMC.
2. There shall be at least four examiners in each subject at an examination, out of which two shall be externals, and two shall be internals.
3. The external examiner shall ordinarily be invite for another recognized university, preferably from outside the state.
4. Out of two internal examiners, one examiner shall be Professor & Head of the Department.
5. An external examiner shall be appointed for not more than two consecutive terms.
6. The internal examiner in a subject shall not accept external examinership from a college from which external examiner is appointed in his subject.
7. The same set of examiners shall ordinarily be responsible for the written, practical & viva Voce examination.

8. The Head of the Department will be the Chairman of the Board of Examination of the concerned subject and shall moderate the question paper.
9. The Head of the Department of the Institution concerned shall ordinarily be one of the internal examiners and second internal examiner shall rotate after every two years.

Criteria for declaring as pass in University Examination:

A candidate who is declared PASS shall secure not less than 50% marks in each head of passing which shall include (1) theory (2) practical including clinical and viva voce examination separately.

A candidate securing less than 50% of marks as described above shall be declared to have failed in the examination. Failed candidate may appear in any subsequent examination upon payment of fresh examination fees to the Controller of Examinations.

Number of Candidates per day:

The maximum number of candidates for practical/clinical and viva-voce examination shall be maximum of three per day.

SECTION – II

GOALS AND GENERAL OBJECTIVES

GOAL:

The goal of Post Doctoral medical education shall be to produce competent specialist and medical teacher

1. Who shall recognize the health needs of the community and carry out professional obligations ethically and in keeping with the objectives of the national health policy;
2. Who shall have mastered most of the competencies, pertaining to the speciality, that are required to be practiced at the secondary and the tertiary levels of the health care delivery system;
3. Who shall be aware of the contemporary advances and developments in the discipline concerned;
4. Who shall have acquired a spirit of scientific enquiry and is oriented to the principles of research methodology and epidemiology; and
5. Who shall have acquired the basic skills in teaching the medical and paramedical professionals

GENERAL OBJECTIVES:

At the end of Post Doctoral training in the discipline concerned the student shall able to:

1. Recognize the importance of the concerned speciality in the context of the health need of the community and then national priorities in the health sector.
2. Practice the speciality concerned ethically and in step with the principles of primary health care.
3. Demonstrate sufficient understanding of the basic sciences relevant to the concerned speciality.
4. Identify social, economic, environmental, biological and emotional determinants of health in a given case, and take them into account while planning therapeutic rehabilitative, preventive and promotive measures/strategies.
5. Diagnose and manage majority of the conditions in the speciality concerned on the basics of clinical assessment, and appropriately selected and conducted investigations.
6. Plan and advice measures for the prevention and rehabilitation of patients suffering from disease and disability related to the speciality.
7. Demonstrate skills in documentation of individual case details as well as morbidity and mortality data relevant to the assigned situation.
8. Demonstrate empathy and humane approach towards patients and their families and exhibit interpersonal behavior in accordance with the social norms and expectations.
9. Play the assigned role in the implementation of National Health Programmes effectively and responsibly.
10. Organize and supervise the chosen/assigned health care services demonstrating adequate managerial skills in the clinic/hospital or the field situation.

11. Develop skills as a self-directed learner; recognize continuing educational needs; select and use appropriate learning resources.
12. Demonstrate competence in basic concepts of research methodology and epidemiology, and be able to critically analyze relevant published research literature.
13. Develop skills in using educational methods and techniques as applicable to the teaching of medical/nursing students, general physicians and paramedical health workers.
14. Function as an effective leader of a health team engaged in health care, research or training.

Statement of the Competencies:

Keeping in view the general objectives of Post Doctoral training, each discipline shall aim at development of specific competencies, which shall be defined and spelt out in clear terms. Each department shall produce a statement and bring it to the notice of the trainees in the beginning of the programme so that he or she can direct the efforts towards the attainment of these competencies.

Components of the Postdoctoral curriculum:

The major components of the Postdoctoral curriculum shall be:

1. Theoretical knowledge
2. Practical/Clinical skills
3. Attitudes, including communication
4. Training in research methodology

SECTION – III

- I. Course Description of DM (Doctorate of Medicine)
 1. DM in Cardiology
 2. DM in Cardiac Anesthesiology
 3. DM in Neurology
 4. DM in Nephrology
 5. DM in Gastroenterology
 6. DM in Medical Oncology
 7. DM in Pediatric Neurology
 8. DM in Interventional Radiology
 9. DM in Endocrinology

- II. Course Description of MCh (Master of Chirurgiae)
 1. MCh in Urology
 2. MCh in Neuro Surgery
 3. MCh in Cardio Vascular & Thoracic Surgery
 4. MCh in Plastic Surgery
 5. MCh in Pediatric Surgery
 6. MCh in Surgical Oncology

M.Ch Urology

PROGRAMME GOAL

- The goal of postgraduate medical education in M.Ch. urology shall be to produce a competent expert in the field of urology and medical teachers in urology.
- The goal is to produce highly competent medical manpower in Urology.
- The training ingredients should provide in-depth knowledge of the entire urology and relevant basic allied subjects.
- The course is expected to bring about a change in attitude towards better scientific approach with logic and analysis.
- More stress should be given to development of psychomotor skills.
- This should culminate in shaping of a shrewd clinician, confident surgeon and a knowledgeable teacher insured to basic research methodology.
- Basis of an ideal training Program will be a powerful urology service complete in every sense.

PROGRAMME OBJECTIVES

Objectives: At the end of the M.Ch. course in Urology, the student should be able to:

- Recognize the key importance of medical problems in the context of the health priority of the country;
 - Practice the specialty of Urology in keeping with the principles of professional ethics;
 - Identify social, economic, environmental, biological and emotional determinants of adult Urology and know the therapeutic, rehabilitative, preventive and promotion measures to provide holistic care to all patients;
 - Take detailed history, perform full physical examination and make a clinical diagnosis
 - Perform and interpret relevant investigations (Imaging and Laboratory).
-
- Perform and interpret important diagnostic procedures;
 - Diagnose Urological illnesses in adults based on the analysis of history, physical examination and investigative work up;
 - Plan and deliver comprehensive treatment for illness in adults using principles of rational drug therapy;
 - Plan and advise measures for the prevention of Urological diseases;
 - Plan rehabilitation of adults suffering from chronic illness, and those with special needs;
 - Manage Urological emergencies efficiently;
 - Demonstrate skills in documentation of case details, and of morbidity and

mortality data relevant to the assigned situation;

- Demonstrate empathy and humane approach towards patients and their families and respect their sensibilities;
 - Demonstrate communication skills of a high order in explaining management and prognosis, providing counseling and giving health education messages to patients, families and communities.
 - Develop skills as a self-directed learner, recognize continuing educational needs; use appropriate learning resources, and critically analyze relevant published literature in order to practice evidence-based medicine;
 - Demonstrate competence in basic concepts of research methodology and epidemiology;
 - Facilitate learning of medical/nursing students, practicing physicians, paramedical health workers and other providers as a teacher-trainer;
 - Play the assigned role in the implementation of national health programs, effectively and responsibly;
 - Organize and supervise the desired managerial and leadership skills;
 - Function as a productive member of a team engaged in health care, research and education.
 - Practice the specialty of urology surgery in keeping with the principles of professional ethics
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- Recognize and identify the various surgical problems
 - Institute diagnostic, therapeutic, rehabilitative and preventive measures to provide holistic care to the patient
 - Interpret important imaging and laboratory results
 - Independently perform basic surgical procedures
 - Manage surgical trauma emergency efficiently
 - Organize and supervise the desired managerial and leadership skills
 - Recognize the importance of Urology in the context of the health needs of the community and the national priorities in the health sector.
 - Demonstrate sufficient understanding of the basic sciences relevant to Urology.
 - Diagnose and manage majority of the conditions in Urology on the basis of clinical assessment, and appropriately selected and conducted investigations.
 - Plan and advice measures for the prevention and rehabilitation of patients suffering from disease and disability related to Urology.
 - Develop skills in using educational methods and techniques as applicable to the teaching of medical/nursing students, general physicians and paramedical health workers.
 - Function as an effective leader of a health team engaged in health care, research or training.

ELIGIBILITY CRITERIA FOR ADMISSION TO THE PROGRAMME:

(A) M.Ch. Urology Course:

Any medical graduate with MS/DNB in General Surgery qualification, who has qualified the Entrance Examination conducted by NMC (NEET-SS) and fulfill the eligibility criteria for admission to M.Ch. Super Specialty courses at various NMC accredited Medical Colleges/ institutions in India is eligible to participate in the Centralized counselling for allocation of M.Ch. Urology seats purely on merit cum choice basis.

Duration of Course: 3 Years

Every candidate admitted to the training programme shall pursue a regular course of study (on whole time basis) under the guidance of recognized post graduate teacher for assigned period of the course.

TEACHING AND TRAINING ACTIVITIES

The fundamental components of the teaching programme should include:

1. Case presentations & discussion- once a week
2. Seminar – Once a week
3. Journal club- Once a week
4. Grand round presentation (by rotation departments and subspecialties)- once a month
5. Faculty lecture teaching- once in three months
6. Clinical Audit- once in three months
7. A poster and one oral presentation at least once during their training period in a National Urology conference.

The rounds should include bedside sessions, file rounds & documentation of case history and examination, progress notes, round discussions, investigations and management plan) interesting and difficult case unit discussions.

The training program would focus on knowledge, skills and attitudes (behavior), all essential components of education. It is being divided into theoretical, clinical and practical in all aspects of the delivery of the rehabilitative care, including methodology of research and teaching.

Theoretical: The theoretical knowledge would be imparted to the candidates through discussions, journal clubs, symposia and seminars. The students are exposed to recent advances through discussions in journal clubs. These are considered necessary in view of an inadequate exposure to the subject in the undergraduate curriculum.

Symposia: Trainees would be required to present a minimum of 20 topics based on the

curriculum in a period of three years to the combined class of teachers and students. A free discussion would be encouraged in these symposia. The topics of the symposia would be given to the trainees with the dates for presentation.

Clinical: The trainee would be attached to a faculty member to be able to pick up methods of history taking, examination, prescription writing and management in rehabilitation practice.

Bedside: The trainee would work up cases, learn management of cases by discussion with faculty of the department.

Journal Clubs: This would be a weekly academic exercise. A list of suggested Journals is given towards the end of this document. The candidate would summarize and discuss the scientific article critically. A faculty member will suggest the article and moderate the discussion, with participation by other faculty members and resident doctors. The contributions made by the article in furtherance of the scientific knowledge and limitations, if any, will be highlighted.

Research: The student would carry out the research project and write a thesis/ dissertation in accordance with university guidelines. He/ she would also be given exposure to partake in the research projects going on in the departments to learn their planning, methodology and execution so as to learn various aspects of research.

SYLLABUS

The major components of the Postgraduate curriculum shall be:

- Theoretical knowledge
- Practical and clinical skills
- Thesis skills.
- Attitudes including communication skills.
- Training in research methodology.

Theory

Basic Sciences as applied to Urology

- Surgical Anatomy of Genito-Urinary Tract and Retroperitoneum
- Normal Renal Physiology
- Infections & Inflammations of G.U. Tract
- Host Defence Mechanism against Urinary Tract Infections
- Bacterial infections of the Urinary Tract – Diagnosis & Management
- Urinary Tract infections in Pregnancy – Screening, Evaluation & Management
- Management of Acute & Chronic Pyelonephritis, Emphysematous Pyelonephritis
- Approach to Management of Urinary Tract Infection in Infants & Children
- Diagnosis & Management of Prostatitis & Related disorders
- Diagnosis & Management of Sexually transmitted diseases

- Diagnosis & Management of Cutaneous diseases of External Genitalia
- Diagnosis & Management Parasitic diseases of G.U. Tract
- Diagnosis & Management of Fungal infections of Urinary Tract
- Diagnosis & Management Genito-Urinary tuberculosis
- Management of Fournier's Gangrene and other Soft Tissue Infections
- Diagnosis & Management of Interstitial Cystitis & Related Syndromes
- Antimicrobial agents used in treatment of G.U. Tract infections
- Urologic manifestations of HIV infections, AIDS and related syndromes

Genito – Urinary Trauma

- Diagnosis & Management in Blunt Renal Trauma
- Diagnosis & Management in Penetrating Renal Trauma
- Diagnosis & Management of Renovascular injuries
- Diagnosis & Management of Iatrogenic and Intraoperative Ureteral injuries
- Diagnosis & Management of Bladder injuries
- Diagnosis & Management of Urethral injuries
- Diagnosis & Management of Penile injuries
- Diagnosis & Management of Scrotal and Testicular trauma
- Diagnosis & Management of Retroperitoneal Haematoma

Adrenal Disorders

- Evaluation and Management of Adrenal Cortical Disorders
- Evaluation and Management of Adrenal Medullary Disorders
- Evaluation and Management of Adrenal Carcinoma
- Renal Failure & Renal Replacement Therapy
- Aetiology of Acute and Chronic Renal Failure
- Management of Acute Renal Failure
- Management Chronic Renal Failure
- Complications of Renal Failure and their Management
- Principles of Dialysis therapy – Haemodialysis, Peritoneal Dialysis
- Immunological considerations in Renal Transplantation
- Live Donor evaluation for Renal Transplantation
- Cadaver Donor evaluation for Renal Transplantation
- Urinary Calculus Disease
- Etiopathogenesis of Urinary Tract Calculi: Theories of Urolithiasis, Endocrine factors in development of Urolithiasis, Role of Modulators, Types of composition of Urinary Calculi, Role of Stone Analysis and types of stone analysis
- Dietary and Medical management of Calculus Disease
- Principles and Practice of Extracorporeal Shock Wave Lithotripsy (ESWL); Evolution of ESWL, Types of Lithotriptors, Indications of ESWL, Post ESWL management, Complications of ESWL and follow up.

Benign Prostatic Hyperplasia

- Pathophysiology of Benign Prostatic Hyperplasia
- Clinical evaluation of Benign Prostatic Hyperplasia
- Medical Management of Benign Prostatic Hyperplasia
- Minimally Invasive Therapy in Benign Prostatic Hyperplasia
- LASERS

Urologic Oncology

- Overview of Cancer Biology & Principles of Urologic Oncology
- Paediatric Urogenital Tumors
- Benign & Malignant tumours of the G.U. Tract in Adults: Renal tumours, Upper tract Transitional Cell Tumours, Bladder tumours, Tumours of the Prostate, Tumours of the Seminal Vesicles, Tumours of the Urethra, Tumours of the Penis, Tumours of the Penile & Scrotal Skin, Testicular tumours, Extragonadal germ-cell tumours, Retroperitoneal tumours, Metastatic tumours of the G.U. Tract.
- Radiotherapy in Genitourinary tumours
- Chemotherapy of Genitourinary tumours
- Gene therapy in Genitourinary tumours
- Other advanced therapeutic modalities in Genitourinary tumours.

Foetal & Perinatal Urology

- Prenatal & Postnatal Urologic diagnosis and Management
- Neonatal & Perinatal Emergencies – Diagnosis & Management

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Paediatric Urology

- Cryptorchidism and Ectopic Testes: Etiopathogenesis, Diagnosis and Imaging, Hormone therapy, Surgical Management
- Vesico-ureteric reflux: Primary and Secondary Vesico-ureteric reflux, Evaluation and Principles of Management of Primary Vesico-ureteric reflux, Urinary Tract Infections – Role of Chemoprophylaxis, Renal and Bladder complications in Vesico-ureteric reflux
- Megaureter : Primary obstructive Megaureter – Diagnosis & Management, Principles of Ureteric Reimplantation
- Ectopic Ureter and Ureterocoele – Diagnosis & Management
- Extrophy – Epispadias complex – Principles of Management
- Cloacal Malformations – Principles of Management
- Diagnosis & Management of Prune Belly Syndrome
- Posterior Urethral Valves & other Urethral Anomalies : Diagnosis, Complications, Principles of Management

Andrology

- Normal Physiology of Male Reproduction
- Diagnosis Approach in Male Infertility
- Varicocele – Diagnosis & Management
- Endocrine & Medical Management of Male Infertility
- Surgical Management of Male Infertility

- Overview of Assisted Reproduction Techniques
- Physiology & Pharmacology of Penile Erection and Pathophysiology of Erectile Dysfunction
- Diagnostic tests in Erectile Dysfunction
- Medical and other therapies in Erectile Dysfunction
- Peyronie's Disease
- Penile Prosthesis implantation – Types, indications and complications
- Phallic reconstruction following trauma

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Neuro – Urology

- Neurophysiology and Pharmacology of Micturition and Continence
- Pathophysiology of Neurovesical dysfunction: CNS Disorders, Spinal trauma, Spinal dysraphism, Pelvic surgery, Diabetes
- Urodynamics & its applications in Incontinence of Voiding dysfunction: Uroflowmetry, Cystometrogram, Urethral Pressure Profile & EMG, Videourodynamics, Ambulatory Urodynamics
- Medical Management of Urinary Incontinence
- Female Urinary Incontinence – Evaluation & Management: Urge Incontinence, Stress Incontinence, Mixed Incontinence
- Implantation of Artificial Urinary Sphincter in men and women
- Reconstruction of Dysfunctional Urinary Tract

Female Urology

- Management of Urologic conditions in Pregnancy
- Management of Urogenital Fistulae in women
- Gynaecological tumours & the Female Urinary Tract
- Female Lower Urinary Tract Reconstruction
- Urinary incontinence in females
- Treatment of Stress Incontinence
- Surgery for Incontinence
- Stress Incontinence and Cystocele
- Posterior Vaginal Wall Prolapse
- Enterocoele
- Uterine Prolapse
- Urethral Diverticulum
- Vesico Vaginal Fistula
- Injuries (iatrogenic) during Gynaecologic procedures and management
- Pathology affecting primarily Genital organs in females – causing secondary effects on urinary organs and management.

Renal Transplantation

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- Immunological considerations in Renal Transplantation
- Live, Donor evaluation for Renal Transplantation
- Recipient evaluation for Renal Transplantation

- Complications of Renal Transplantation and their management: Medical surgical
- Transplantation in Special Groups: Patients with Neuropathic Bladder / Urinary Diversions, Paediatric patients / Previously transplanted patients, Multiple Organ Recipients
- Cadaver Donor evaluation for Renal Transplantation: Evaluation of Cadaver Donor, Cadaver Donor Management, Certification of Brain Death, Organ retrieval, storage and transport.
- Legal and Ethical aspects of Organ Transplantation

Reconstructive Urology

- Principles of Urethral Reconstruction
- Principles of Bladder Reconstruction
- Principles of Bladder Substitution procedures
- Principles governing use of Intestinal Segments in Urological Reconstruction
- Autologous tissue transfer options in Urology
- Principles of Urinary Diversion & Undiversion
- Complications of Urinary Diversion

Endo Urology

- Endoscopic anatomy of the Upper and Lower Urinary Tract
- Physics governing Endourologic equipment
- Basic technical aspects of Endourologic equipment: Cystoscope, Resectoscope, Ureterorenoscope, Nephroscope, Laparoscope, Associated accessories
- Anaesthetic consideration in Endourologic surgery
- Endourologic procedures – Indications, Performance and Complications: Lower Urinary Tract Endoscopy, Transurethral Resection of Prostate, Transurethral Resection of Bladder Tumours, Ureterorenoscopy, Percutaneous Nephroscopy, Intracorporeal Lithotripsy devices, Endoscopic Reconstructive Procedures, Endoscopic Laser Applications
- Implants, Biomaterials and others: Urethral Catheters, Urethral Stents, Ureteric Catheters, Ureteric Stents, Baskets & Graspers, Endoscopic Laser

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Devices, Ureteric Dilators, Guide Wires, Autologous Biomaterials, Synthetic Biomaterials, Prosthesis & Sphincter Implants, Tissue Culture Products
Operative Urology

- Surgical approaches to the Kidneys
- Surgical approaches to the Adrenals
- Surgery of the Kidneys: Surgery in Renal Trauma, Surgical procedures in Renovascular disease, Auto transplantation of the kidney, Surgical procedures for Pelvic-ureteric junction obstruction, Surgical procedures on Adrenals, Nephrectomy for benign disease, Nephrectomy for malignant disease, Nephron sparing surgical procedures
- Surgical procedures for Renal Calculi: Pyelolithotomy & Extended – pyelolithotomy, Anatomic Nephrolithotomy, Coagulum Pyelolithotomy, Nephrolithotomy, Percutaneous Nephrolithotomy (PCNL)

- Surgery of the Adrenal Glands : Adrenal Tumours, Adrenal Cysts, Pheochromocytoma
- Surgery of the Ureter: Ureterolithotomy, Uretero-ureterostomy, Trans Uretero-ureterostomy, Ureteral replacement, Ureteral Tailoring and Reimplantation, Boari's Flap Reimplantation, Ureterolysis & Ureteral Transposition
- Surgery of the Urinary Bladder: Suprapubic Cystostomy, Surgery for Vesical Calculi, Bladder diverticulectomy, Augmentation Cystoplasty, Partial Cystectomy, Radical Cystectomy, Transurethral Resection of Bladder Tumour, Repair of Vesico- Vaginal Fistulae : Vaginal repair, Abdominal repair, Repair of complex fistulae: Repair of Rectovesical Fistulae, Bladder neck reconstruction
- Surgery of the Prostate: Transurethral Resection of the Prostate, Retropubic Prostatectomy, Transvesical Prostatectomy, Radical Retropubic Prostatectomy, Radical Perineal Prostatectomy, Nerve Sparing Prostatectomy
- Surgery of the Urethra : Reconstruction of Posterior Urethral Strictures, Reconstruction of Bulbar Urethral Strictures, Reconstruction of Anterior Urethral Strictures, Endoscopic Urethrotomy, Perineal Urethrotomy, Meatoplasty & Glanuloplasty, Single-stage repair of Hypospadias, Staged repair of Hypospadias, Staged repair of Hypospadias, Surgery of Urethral Carcinoma

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- Surgery of Male Infertility: Varicocele Ligation, Ejaculatory duct incision, Vaso-vasostomy, Vaso-epididymostomy, Vaso-epididymal Fistulae.
- Surgery of the Scrotum: Surgery of Hydrocoele & Chylocoele, Surgery for Haematocoele, Reconstructive procedures in trauma
- Surgery for Testes: Orchidopexy in Cryptorchidism, Orchidopexy in Torsion, Orchidectomy for benign conditions, Orchidectomy for malignant conditions, Testicular biopsy, Testicular reimplantation
- Surgery of the Penis: Surgery for Penile Curvature, Biopsy of Penile lesion, Circumcision, Partial Penectomy, Total Penectomy, Organ conserving procedures in Penile Carcinoma, Post traumatic Penile reconstruction, Penile Prosthesis Implantation Urinary Diversion : Vesicostomy, Cutaneous Ureterostomy, Ileal conduit, Continent diversions using ileum, Continent diversions using ileo-caecal valve, Orthotopic Neobladder, Mitrofanoff and Benche crom Procedures, Ureterosigmoidostomy
- Surgery for associated Conditions: Retroperitoneal Lymphadenectomy, Nerve sparing Retroperitoneal Lymphadenectomy, Ilio-inguinal Lymphadenectomy
- Renal Transplantation: Techniques of Renal Transplantation, Cadaver & LIVE Donor harvesting technique, Complications of Donor Nephrectomy & Transplantation: Medical, Surgical, Vascular access in Renal failure
- Surgery for Incontinence: Endoscopic Bladder Neck Suspension, Transabdominal Bladder Neck Suspension, Abdominal & Vaginal Sling Procedures, Endoscopic Injection Procedure, Artificial Sphincter implantation
- Basic Principles of Laparoscopic procedures in Urology
- Robotics

Newer developments in the urology

- Operative Urology-open & endoscopic Endourology
- Behavioral and social aspects of urology
- Neonatal problems in Urology.
- Electro coagulation, lasers, fiber optics, instruments, catheters, endoscopes etc.

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- Medical aspects of the kidney diseases.
- Laparoscopic Urologic Surgery.
- Energy Sources In Urology
- Robotics surgery
- Sutures in Surgery
- Medical Instrumentation
- Nutrition in Urology
- Molecular and Cellular Biology Basic
- Principles of Immunology
- Molecular Genetics and Cancer Biopsy
- Tissue Engineering Perspectives for Reconstructive Surgery

Clinical Decision Making

- Evaluation of the Urologic Patient:
- History, Physical Examination, and Urinalysis Urinary Tract Imaging
- Basic Principles Outcomes Research
- Basics of Urologic Surgery
- Basic Instrumentation and Cystoscopy
- Basic of Laparoscopic Urologic Surgery
- Recent advances and modern trends in Urology

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Apart from above mentioned subjects, each candidate should have basic knowledge of the following:

1. Biostatistics & Epidemiology.
2. Computer Sciences.
3. Experimental & Research methodology and Evidence Based Medicine.
4. Scientific presentation.
5. Cardio-pulmonary resuscitation.
6. Ethics in medicine.

Biostatistics, Research Methodology and Clinical Epidemiology (Biomedical Research Examination to be cleared before going for final M.Ch. examination).

Ethics

Medico legal aspects relevant to the discipline

- Health Policy issues as may be applicable to the discipline

First Two Years Each Candidate should spend time for basic research/skill laboratory specially related to animal laboratory or in collaboration with basic department i.e. biochemistry, biotechnology and radiology.

1-6 Months

A candidate is supposed to master following procedures. (Minimum number)

- Cystourethroscopy, (50)
- Dilatation (5)
- Retrograde pyelography (5)
- Interpretation of normal and abnormal findings in relation to gross inflammations (5)
- Obstructive and neoplastic changes in the lower urinary tract (5)

. Minor Urological Procedures: (Minimum number)

- Needle biopsy of the prostate, (5)

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- Dilatation (5)
- Trocar cystostomy (5)
- open cystostomy (1)
- orchiectomy (5)
- circumcision (5)
- meatotomy/Meatoplasty (2)
- Arterio-venous shunts (2)
- Excision of urethral caruncle (1)

Uro-Radiological & Imaging Techniques: During this period a candidate should perform various uro-radiological & Imaging procedures like

- Retrograde Urethrograms & Micturating (5)
- Cystourethrogram (5)
- Cystogram (5)
- Nephrostogram (1)
- Aantegrade pyelography (5)
- Interpretation of Ultrasound & computerized tomography's scans and renography (15)
- Renal angiography including Digital Substraction Angiography & venography (5)

06-09 Months A candidate should learn, perform and interpret urodynamic studies like Cystometrogram, electro myography & Urethral pressure profile & Video urodynamics.

He will also perform and interpret various tests of sexual dysfunction such as dynamic cavernosography, papavarin test, Penile-Brachial Index, Nocturnal penile tumescence, Regi-scan, sacral latency period and other evoked potential studies.

9-23 Months He will assist and perform following procedures.

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(a) Endoscopic Surgery:

- Internal urothrotomy, (5)
- Bladder neck Incision, (2)
- Litholopaxy (5)
- cystolithotripsy, (5)
- insertion & retrieval of bladder & ureteral stent (25)
- ureteral meatotomy, (5)
- Transurethral resection of bladder tumour (5)

(b) Surgical Procedures:

- Simple nephrectomy, (5)
- radical nephrectomy (5)
- cystolithotomy ureterolithotomy, (5)
- pyelolithotomy, (5)
- nephrostomy, (5)
- pyeloplasty, (5)
- various urethroplasties. (5)
- Retropubic & a transvesical prostatectomy,(-)
- surgery for undescended testis (-)
- , partial and total amputation of penis, (-)
- extended pyelolithotomy, (-)
- VVF repair (-)

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24-36 Months

Open Surgery

Candidate should learn more complex surgical procedures like

- transpubic urethroplasty,
- Hypospadias repair,
- Augmentation cystoplasty,
- Anatomic Nephrolithotomy under hypothermia,
- Boari's flap procedure,
- exstrophy closure,
- Urinary diversion,
- ureteroneocystostomy
- partial and total cystectomy,
- nephroureterectomy
- penile prosthesis
- Artificial urinary sphincter
- Microsurgical Vasoepididmostomy and vasovasostomy,.
- Undiversion,

- Renal transplant surgery and AV fistulae,
- retroperitoneal lymphadenectomy.
- Endoscopic Procedure Trusurethral resection of prostate
- percutaneous
- nephrolithotomy,
- Uretero-rensoscopy,
- Laser Surgery,
- other endourolocial procedures etc.

Efforts will be made that candidate is able to perform the following minimum stipulated number of procedues within three years of his training.

- Endoscopies 100
- Urethroplasties 5

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- Internal urethrotomy 5
- Internal tract reconstructions 10
- Repair of vesicovaginal fistulae
- Pyeloplasties 5
- Hypospadias repair 1
- Transurethral Resection of Prostate 25
- Uretero-Renoscopy 25
- Percutaneous Nephrolithotomy
- & endopyelotomy 10
- Donor Nephrectomies 5
- Receptient Surgery 2

In addition to above mentioned procedures candidates will perform/assist minimum of two or five of each of following procedures depending upon the availability of the case material

- Nephrectomy for pyonephrosis-Surgical treatment of stress urinary incontinence
- Radical Cystoprostatectomy
- Radical Nephrectomy
- Ureteroneocystostomy
- Retroperitoneal lymph node dissection-Ileal replacement
- Different type of Urinary diversion of orthotopic Neobaldder- Surgical management of Renal and Urethral trauma
- Transpubic urethroplasty
- Augmentation cystoplasty
- Nephroureteractomy – Undiversion
- Anatrohic Nephrolithotomy
- Laparoscopic Urologic Surgery
- Paediatric surgical procedures.

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- In course Training Since it will be a full time residency cum M.Ch. course, a candidate will be responsible for the total care of the patients.
- He will be encouraged to take independent decisions.
- Every day there will be at least one hour academic activity to a maximum of 10 hours/week in which all the faculty members & residents will participate.
- Case discussion will take place weekly with 3rd year resident as a moderator
- In OPD a candidate will see the cases independently and will make all the pertinent notes
- In problematic cases and a special referral, it is mandatory to show the case to the respective consultant.
- A candidate will not be allowed to provide independent consultations for first six months.
- A candidate will have to attend all postmortem examination done for the department.
- Interdepartmental meetings like uro radiology, uro nephrology, uro radiotherapy & medical oncology, uro pathology, uro imaging will provide an opportunity for open discussion on a common subject and it will also provide an opportunity to learn views of the specialists on these subjects.
- Posting: A candidate may be sent to the Nephrology department for one month to learn a medical aspect of kidney diseases (except renal transplantation). This posting should be after one to 1.1/2 years after joining the course. It is highly desirable to formulate a reasonable teaching curriculum for this posting and a candidate is to be evaluated by the Nephrologist at the end of the posting.

Schedule of Postings

- OPD: Twice a week
- OT: Twice a week
- Investigative urology: All Days

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- Exchange Programme: In view of expanding field of urology, it is difficult to see, observe and have training in all newer subspecialties. Therefore, it is imperative to inculcate an exchange programme and resident should be rotated to two or three centres as per advice by the department committee. It is also suggested that the department weak in some subspeciality should invite visiting professors from other centres to strengthen the course.

Practical:

- History, examination and writing of records:
- History taking should include the background information, presenting complaints and the history of present illness, history of previous illness, family history, social and occupational history and treatment history

- Detailed physical examination should include general physical and CVS examination
- Skills in writing up notes, maintaining problem-oriented medical records (POMR), progress notes, and presentation of cases during ward rounds, planning investigation and making a treatment plan should be taught
- Other Urology procedures- investigative Urological Procedures like uroflowmetry, CNG, Doppler, Ultrasound & Ultrasound guided procedures.
- Clinical Teaching General, Physical and specific examinations of Genitourinary should be mastered.
- The resident should be able to analyse history and correlate it with Clinical findings.
- He should be well versed with all radiological procedures like IVU, Nephrostogram and RGP, Ascending aortogram.
- He should present his daily admissions in morning report and try to improve management skills, fluid balance, choice of drugs.
- He should clinically analyse the patient & decide for pertinent Investigations required for specific patient.

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Job Responsibilities

Outdoor Patient (OPD) Responsibilities:

- The working of the residents in the OPD should be fully supervised.
 - They should evaluate each patient and write the observations on the OPD card with date and signature.
 - Investigations should be ordered as and when necessary using prescribed forms.
 - Residents should discuss all the cases with the consultant and formulate a management plan.
 - Patient requiring admission according to resident's assessment should be shown to the consultant on duty
 - Patient requiring immediate medical attention should be sent to the casualty services with details of the clinical problem clearly written on the card.
 - Patient should be clearly explained as to the nature of the illness, the treatment advice and the investigations to be done.
 - Resident should specify the date and time when the patient has to return for follow up.
- In-Patient Responsibilities Each resident should be responsible and accountable for all the patients admitted under his care.

The following are the general guidelines for the functioning of the residents in the ward:

- I. Detailed work up of the case and case sheet maintenance:
- II. He/She should record a proper history and document the various symptoms. Perform a proper patient examination using standard methodology. He should develop skills to ensure patient comfort/consent

for examination. Based on the above evaluation he/she should be able to formulate a differential diagnosis and prepare a management plan. Should develop skills for recording of medical notes, investigations and be able to properly document the consultant round notes

III. To organize his/her investigations and ensure collection of reports.

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- IV. Bedside procedures for therapeutic or diagnostic purpose.
- V. Presentation of a precise and comprehensive overview of the patient in clinical rounds to facilitate discussion with senior residents and consultants.
- VI. To evaluate the patient twice daily (and more frequently if necessary) and maintain a progress report in the case file.
- VII. To establish rapport with the patient for communication regarding the nature of illness and further plan management.
- VIII. To write instructions about patient's treatment clearly in the instruction book along with time, date and the bed number with legible signature of the resident.
- IX. All treatment alterations should be done by the residents with the advice of the concerned consultants and senior residents of the unit.

Admission day following guidelines should be observed by the resident during admission day.

- I. Resident should work up the patient in detail and be ready with the preliminary necessary investigations reports for the evening discussion with the consultant on duty.
- II. After the evening round the resident should make changes in the treatment and plan out the investigations for the next day in advance.

Doctor on Duty

- I. Duty days for each Resident should be allotted according to the duty roster.
- II. The resident on duty for the day should know about all sick patients in the wards and relevant problems of all other patients, so that he could face an emergency situation effectively.
- III. In the morning, detailed over (written and verbal) should be given to the next resident on duty. This practice should be rigidly observed.
- IV. If a patient is critically ill, discussion about management should be done with the consultant at any time.

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- V. The doctor on duty should be available in the ward through out the duty hours.

Care of Sick Patients

I. Care of sick patients in the ward should have precedence over all other routine work for the doctor on duty.

II. Patients in critical condition should be meticulously monitored and records maintained.

III. If patient merits ICU care then it must be discussed with the senior residents and consultants for transfer to ICU.

Resuscitation skills

I. At the time of joining the residency programme, the resuscitation skills should be demonstrated to the residents and practical training provided at various work stations.

II. Residents should be fully competent in providing basic and advanced cardiac life support.

III. They should be fully aware of all advanced cardiac support algorithms and be aware of the use of common resuscitative drugs and equipment like defibrillators and external cardiac pacemakers.

IV. The resident should be able to lead a cardiac arrest management team.

Discharge of the Patient

I. Patient should be informed about his/her discharge one day in advance and discharge cards should be prepared 1 day prior to the planned discharge.

II. The discharge card should include the salient points in history and examination, complete diagnosis, important management decisions,

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hospital course and procedures done during hospital stay and the final advice to the patient.

III. Consultants and PG Residents should check the particulars of the discharge card and counter sign it.

IV. Patient should be briefed regarding the date, time and location of OPD for the follow up visit

In Case of Death

In case it is anticipated that a particular patient is in a serious condition, relatives should be informed about the critical condition of the patient beforehand.

Residents should be expected to develop appropriate skills for breaking bad news and bereavements.

Follow up death summary should be written in the file and face sheet notes must be filled up and the nurse in charge should be requested to send the body to the mortuary with respect and dignity from where the patient's relatives can be handed over the body.

In case of a medico legal case, death certificate has to be prepared in triplicate and the body handed over to the mortuary and the local police authorities should be informed.

Autopsy should be attempted for all patients who have died in the hospital especially if the patient died of an undiagnosed illness.

Bedside Procedures The following guidelines should be observed strictly:

- Be aware of the indications and contraindications for the procedure and record it in the case sheet. Rule out contraindications like low platelet count, prolonged prothrombin time, etc.
- Plan the procedure during routine working hours, unless it is an emergency. Explain the procedure with its complications to the patient and

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his/her relative and obtain written informed consent on a proper form. Perform the procedure under strict aseptic precautions using standard techniques. Emergency tray should be ready during the procedure.

- Make a brief note on the case sheet with the date, time, nature of the procedure and immediate complications, if any
- Monitor the patient and watch for complications(s).

OT responsibilities

- The 1st year resident observes the general layout and working of the OT, understands the importance of maintaining sanctity of the OT, scrubbing, working and sterilization of all the OT Instrument, know how of endoscopes.
- He/ She is responsible shifting of OT patients, for participating in surgery as 2 nd assistant and for post operative management of patient in recovery and in ward.
- The 2nd year resident is responsible for pre op work up of the patient, surgical planning and understanding the rationale of surgery.
- He/she is the first assistant in surgery and is responsible for anticipating intra op and post op complications and managing them.
- The final year resident should be able to perform minor/medium/major surgeries independently and assist in medium/major/extra major surgeries.
- He/she should be able to handle all emergencies and post op complications independently and is responsible for supervision and guidance of his/her juniors.

Medico-Legal Responsibilities of the Residents

All the residents are given education regarding medico-legal responsibilities at the time of admission in a short workshop.

- They must be aware of the formalities and steps involved in making the correct death certificates, mortuary slips, medico-legal entries, requisition for

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autopsy etc.

- They should be fully aware of the ethical angle of their responsibilities and should learn how to take legally valid consent for different hospital procedures & therapies.
- They should ensure confidentiality at every stage

Internal Assessment

The performance of the resident during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student. The students should be observed for the following:

1. Personal Attributes
2. Clinical Work
3. Academic activities
4. End of term theory examination
5. End of term practical examination

1. Personal attributes:

- Behavior and Emotional Stability: Dependable, disciplined, dedicated, stable in emergency situations, shows positive approach.
- Motivation and Initiative: Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.
- Honesty and Integrity: Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.
- Interpersonal Skills and Leadership Quality: Has compassionate attitude towards patients and attendants, gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

2. Clinical Work:

- Availability: Punctual, available continuously on duty, responds promptly on calls and takes proper permission for leave.
- Diligence: Dedicated, hardworking, does not shirk duties, leaves no work

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pending, and does not sit idle, competent in clinical case work up and management.

- Academic ability: Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.
- Clinical Performance: Proficient in clinical presentations and case discussion during rounds and OPD work up. Preparing Documents of the case history/examination and progress notes in the file (daily notes, round discussion, investigations and management) Skill of performing bed side procedures and handling emergencies.

3. Academic Activity: Performance during presentation at Journal club/ Seminar/

Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.

4. End of term theory examination conducted at end of 1st, 2nd year and after 2 years 9 months

5. End of term practical/oral examinations after 2 years 9 months.

Marks for personal attributes and clinical work should be given annually by all the consultants under whom the resident was posted during the year. Average of the three years should be put as the final marks out of 20.

Marks for academic activity should be given by the all consultants who have attended the session presented by the resident.

The Internal assessment should be presented to the Board of examiners for due consideration at the time of Final Examinations.

Competencies

Possess complete clinical diagnostic skills for recognition of urological diseases.

Possess complete knowledge of application of biochemical, microbiological and pathological tests in the diagnosis and management of urological

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diseases.

Possess complete knowledge of the application and interpretation of imaging studies in the diagnosis and management of urological diseases.

Perform simple imaging studies like basic ultrasound evaluation of the kidney, ureter, bladder and prostate, transrectal ultrasonography of prostate and seminal vesicles, retrograde and antegrade urethrogram, cystogram and voiding cystourethrogram, nephrostogram, retrograde ureteropyelogram, etc.

Perform all commonly used urodynamic studies and apply and interpret the results appropriately.

Be able to apply sound clinical judgment to plan cost effective investigation and management of most urologic diseases.

Be able to medically treat most urologic diseases.

Be able to use ESWL and manage complications arising out of its application.

Have the skill to perform common outpatient urological procedures like urethral catheterization, suprapubic cystostomy, urethral dilatation, prostate biopsy, ultrasound and fluoroscopy guided percutaneous nephrostomy and cyst aspiration, drainage of periurethral abscess, dorsal slit etc.,

Be able to perform common urological endoscopic procedures like

1. Diagnostic cystoscopy and bladder biopsy,
2. Ureteral catheterization,
3. Endoscopic urethrotomy,
4. Ureteral stenting and stent removal,
5. Foreign body removal from bladder,
6. Cystolithotripsy,

7. Bladder neck incision,
8. Transurethral incision of prostate,
9. Resection of small prostates and bladder tumors,
10. Ureteroscopy and retrieval of ureteral calculi, etc.

Be able to perform common open ablative and reconstructive surgical procedures like

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- I. nephrectomy
- II. pyelolithotomy
- III. ureterolithotomy
- IV. open prostatectomy
- V. cystolithotomy
- VI. urethroplasties for simple urethral strictures
- VII. penectomy
- VIII. orchiectomy
- IX. orchidopexy

- Manage effectively and efficiently common urological emergencies in the casualty outpatient department and wards including patients in other disciplines.
- Manage effectively urological emergencies detected or occurring during surgery in other disciplines like bladder or ureteral injuries etc. during surgical, gynaecological procedures.
- Possess understanding of recent advances in the subject of Urology and its allied specialities.
- Possess working knowledge of consumables used in Urology and the upkeep and maintenance of the special equipment used in Urology especially the endoscopes.
- Be able to conduct research work in the field of Urology both clinical and experimental and be able to critically analyse data as well as research papers.
- Be able to teach Undergraduate students of MBBS, Postgraduate students of surgery as well as students of nursing and other paramedical courses the elements of Urology appropriate to them.
- Be able to and have demonstrated ability to conduct research studies and presented the papers in conferences or published in journals.
- Be able to recognise and refer appropriately cases that are beyond his competence.
- Be able to work as a member of a team of medical and paramedical staff as well as be able to work as a team leader for effectively and efficiently carrying

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out urological services.

THESIS PROTOCOL & THESIS

The candidates are required to submit a thesis at the end of three years of training as per the rules and regulations of KAHER University.

Guidelines for Submission of Thesis Protocol & Thesis by candidates

Research shall form an integral part of the education programme of all candidates registered for M.Ch. degrees of KAHER. The Basic aim of requiring the candidates to write a thesis protocol & thesis/dissertation is to familiarize him/her with research methodology. The members of the faculty guiding the thesis/dissertation work for the candidate shall ensure that the subject matter selected for the thesis/dissertation is feasible, economical and original.

Guidelines for Thesis Protocol

The protocol for a research proposal (including thesis) is a study plan, designed to describe the background, research question, aim and objectives, and detailed methodology of the study. In other words, the protocol is the 'operating manual' to refer to while conducting a particular study.

The candidate should refer to the KAHER Guidelines for preparation and submission of the Thesis Protocol before the writing phase commences. The minimum writing requirements are that the language should be clear, concise, precise and consistent without excessive adjectives or adverbs and long sentences. There should not be any redundancy in the presentation.

The development or preparation of the Thesis Protocol by the candidate will help her/him in understanding the ongoing activities in the proposed area of research. Further it helps in creating practical exposure to research and hence it bridges the connectivity between clinical practice and biomedical research. Such research exposure will be helpful in improving problem solving capacity, getting updated with ongoing research and implementing these findings in clinical practice.

Research Ethics: Ethical conduct during the conduct and publication of research is an essential requirement for all candidates and guides, with the primary responsibility of ensuring such conduct being on the thesis guide. Issues like Plagiarism, not maintaining the confidentiality of data, or any other distortion of the research process will be viewed seriously. The readers may refer to standard documents for the purpose.

The University reserves the right to check the submitted protocol for plagiarism, and will reject those having substantial duplication with published literature.

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PROTOCOL REQUIREMENTS

1. All of the following will have to be entered in the online template. The thesis protocol should be restricted to the following word limits.
2. It is mandatory to have ethics committee approval before initiation of the research work. The researcher should submit an appropriate application to the ethics committee in the prescribed format of the ethics committee concerned.

Guidelines for Thesis

1. The proposed study must be approved by the institutional ethics committee and the protocol of thesis should have been approved by KAHER.

2. The thesis should be restricted to the size of 80 pages (maximum). This includes the text, figures, references, annexures, and certificates etc. It should be printed on both sides of the paper; and every page has to be numbered. Do not leave any page blank. To achieve this, following points may be kept in view:

- a. The thesis should be typed in 1.5 space using Times New Roman/Arial/ Garamond size 12 font, 1” margins should be left on all four sides. Major sections viz., Introduction, Review of Literature, Aim & Objectives, Material and Methods, Results, Discussion, References, and Appendices should start from a new page. Study proforma (Case record form), informed consent form, and patient information sheet may be printed in single space.
- b. Only contemporary and relevant literature may be reviewed. Restrict the introduction to 2 pages, Review of literature to 10-12 pages, and Discussion to 8-10 pages.
- c. The techniques may not be described in detail unless any modification/innovations of the standard techniques are used and reference(s) may be given.
- d. Illustrative material may be restricted. It should be printed on paper only. There is no need to paste photographs separately.

3. Since most of the difficulties faced by the residents relate to the work in clinical subject or clinically-oriented laboratory subjects, the following steps are suggested:

- a. The number of cases should be such that adequate material, judged from the hospital attendance/records, will be available and the candidate will be able to collect case material within the period of data collection, i.e., around 6-12 months so that he/she is in a position to complete the work within the stipulated time.
- b. The aim and objectives of the study should be well defined.
- c. As far as possible, only clinical/laboratory data of investigations of

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patients or such other material easily accessible in the existing facilities should be used for the study.

- d. Technical assistance, wherever necessary, may be provided by the department concerned. The resident of one specialty taking up some problem related to some other specialty should have some basic knowledge about the subject and he/she should be able to perform the investigations independently, wherever some specialized laboratory investigations are required a co-guide maybe co-opted from the concerned investigative department, the quantum of laboratory work to be carried out by the candidate should be decided by the guide & co-guide by mutual consultation.

4. The clinical residents are not ordinarily expected to undertake experimental

work or clinical work involving new techniques, not hitherto perfected OR the use of chemicals or radioisotopes not readily available. They should; however, be free to enlarge the scope of their studies or undertake experimental work on their own initiative but all such studies should be feasible within the existing facilities.

5. The M.Ch. residents should be able to freely use the surgical pathology/autopsy data if it is restricted to diagnosis only, if however, detailed historic data are required the resident will have to study the cases himself with the help of the guide/co-guide. The same will apply in case of clinical data.

6. Statistical methods used for analysis should be described specifically for each objective, and name of the statistical program used mentioned.

General Layout of a M.Ch. Thesis:

- Title- A good title should be brief, clear, and focus on the central theme of the topic; it should avoid abbreviations. The Title should effectively summarize the proposed research and should contain the PICO elements.
- Introduction- It should be focused on the research question and should be directly relevant to the objectives of your study.
- Review of Literature - The Review should include a description of the most relevant and recent studies published on the subject.
- Aim and Objectives - The 'Aim' refers to what would be broadly achieved by this study or how this study would address a bigger question / issue. The 'Objectives' of the research stem from the research question formulated and should at least include participants, intervention, evaluation, design.
- Material and Methods- This section should include the following 10 elements: Study setting (area), Study duration; Study design (descriptive, case-control, cohort, diagnostic accuracy, experimental (randomized/non-randomized)); Study sample (inclusion/exclusion criteria, method of selection), Intervention, if any, Data collection, Outcome measures (primary and secondary), Sample size, Data management and Statistical analysis,

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and Ethical issues (Ethical clearance, Informed consent, trial registration).

- Results- Results should be organized in readily identifiable sections having correct analysis of data and presented in appropriate charts, tables, graphs and diagram etc.
- Discussion-It should start by summarizing the results for primary and secondary objectives in text form (without giving data). This should be followed by a comparison of your results on the outcome variables (both primary and secondary) with those of earlier research studies.
- Summary and Conclusion- This should be a précis of the findings of the thesis, arranged in four paragraphs: (a) background and objectives; (b) methods; (c) results; and (d) conclusions. The conclusions should strictly pertain to the findings of the thesis and not outside its domain.
- References- Relevant References should be cited in the text of the protocol (in superscripts).
- Appendices -The tools used for data collection such as questionnaire,

interview schedules, observation checklists, informed consent form (ICF), and participant information sheet (PIS) should be attached as appendices. Do not attach the master chart.

Thesis Protocol Submission to KAHER university.

1. M.Ch. candidates are required to submit their thesis protocol within 90 days of their joining M.Ch. training.
2. Enclosures to be submitted along with protocol submission form:
 - a) Form for Thesis Protocol Submission properly filled.
 - b) Thesis Protocol duly signed.
 - c) Approval letter of institutional Ethical committee. (Mandatory, non receivable of any one is liable for rejection)

Thesis Submission to KAHER

1. As per KAHER norms, writing a thesis is essential for all M.Ch. candidates towards partial fulfillment of eligibility for award of M.Ch. degree.
2. M.Ch. candidates are required to submit the thesis before the cut-off date announced by KAHER.
3. Candidates who fail to submit their thesis by the prescribed cutoff date shall NOT be allowed to appear in M.Ch. final examination.
4. Thesis should be bound and the front cover page should be printed in the standard format. A bound thesis should be accompanied with:
 - a. A Synopsis of thesis.

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- b. Form for submission of thesis, duly completed
- c. Soft copy of thesis in a CD duly labeled.
- d. Copy of letter of registration with KAHER.
5. A declaration of thesis work being bonafide in nature and done by the candidate himself/herself at the institute of M.Ch. training need to be submitted bound with thesis. It must be signed by the candidate himself/herself, the thesis guide and head of the institution, failing which thesis shall not be considered.

LOG BOOK

A candidate shall maintain a log book of operations (assisted / performed) during the training period, certified by the concerned post graduate teacher / Head of the department / senior consultant.

This log book shall be made available to the board of examiners for their perusal at the time of the final examination.

The log book should show evidence that the before mentioned subjects were covered (with dates and the name of teacher(s) The candidate will maintain the record of all academic activities undertaken by him/her in log book.

1. Personal profile of the candidate

2. Educational qualification/Professional data
3. Record of case histories
4. Procedures learnt
5. Record of case Demonstration/Presentations
6. Every candidate, at the time of practical examination, will be required to produce performance record (log book) containing details of the work done by him/her during the entire period of training as per requirements of the log book. It should be duly certified by the supervisor as work done by the candidate and countersigned by the administrative Head of the Institution.
7. In the absence of production of log book, the result will not be declared.

Leave Rules

1. M.Ch. Trainees are entitled to leave during the course of M.Ch. training as per the Leave Rules prescribed by KAHER.
2. A M.Ch. candidate can avail a maximum of 20 days of leave in a year excluding regular duty off/ Gazetted holidays as per hospital/institute calendar/policy.
3. MATERNITYLEAVE:
 - a. A female candidate is permitted a maternity leave of 90 days once during

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the entire duration of M.Ch. course.

- b. The expected date of delivery (EDD) should fall within the duration of

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maternity leave.

- c. Extension of maternity leave is permissible only for genuine medical reasons and after prior approval of KAHER. The supporting medical documents have to be certified by the Head of the Institute/hospital where the candidate is undergoing M.Ch. training. KAHER reserves its rights to take a final decision in such matters.
 - d. The training of the candidate shall be extended accordingly in case of any extension of maternity leave being granted to the candidate.
 - e. Candidate shall be paid stipend during the period of maternity leave. No stipend shall be paid for the period of extension of leave.
4. Male M.Ch. candidates are entitled for paternity leave of maximum of one week during the entire period of KAHER training.
 5. No kind of study leave is permissible to KAHER candidates. However, candidates may be allowed an academic leave as under across the entire duration of training program to attend the conferences/CMEs/Academic programs/Examination purposes.
 6. Under normal circumstances leave of one year should not be carried forward to the next year. However, in exceptional cases such as prolonged illness the leave across the M.Ch. training program may be clubbed together with prior approval of KAHER.

7. Any other leave which is beyond the above stated leave is not permissible and shall lead to extension/cancellation of KAHER course.

8. Any extension of M.Ch. training for more than 2 months beyond the scheduled completion date of training is permissible only under extraordinary circumstances with prior approval of KAHER. Such extension is neither automatic nor shall be granted as a matter of routine. KAHER shall consider such requests on merit provided the seat is not carried over and compromise with training of existing trainees in the Department.

9. Unauthorized absence from M.Ch. training for more than 7 days may lead to cancellation of registration and discontinuation of the M.Ch. training and rejoining shall not be permitted.

10. Medical Leave

a. Leave on medical grounds is permissible only for genuine medical

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reasons and KAHER should be informed by the concerned institute/hospital about the same immediately after the candidate proceeds on leave on medical grounds.

b. The supporting medical documents have to be certified by the Head of the Institute/hospital where the candidate is undergoing M.Ch. training and have to be sent to KAHER.

c. The medical treatment should be taken from the institute/ hospital where the candidate is undergoing M.Ch. training. Any deviation from this shall be supported with valid grounds and documentation.

d. In case of medical treatment being sought from some other institute/hospital, the medical documents have to be certified by the Head of the institute/hospital where the candidate is undergoing M.Ch. training.

e. KAHER reserves its rights to verify the authenticity of the documents furnished by the candidate and the institute/hospital regarding Medical illness of the candidate and to take a final decision in such matters.

11.

a. The eligibility for M.Ch. Final Examination shall be determined strictly in accordance with the criteria prescribed in the respective information bulletin.

EXAMINATION

FORMATIVE ASSESSMENT

Formative assessment includes various formal and informal assessment procedures by which evaluation of student's learning, comprehension, and academic progress is done by the teachers/ faculty to improve student attainment.

Formative assessment test (FAT) is called as "Formative" as it informs the in process teaching and learning modifications. FAT is an integral part of the effective teaching. The goal of the FAT is to collect information which can be used

to improve the student learning process.

Formative assessment is essentially positive in intent, directed towards promoting learning; it is therefore part of teaching. Validity and usefulness are

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paramount in formative assessment and should take precedence over concerns for reliability. The assessment scheme consists of Three Parts which has to be essentially completed by the candidates.

The scheme includes:-

Part I:- Conduction of theory examination

Part-II :- Clinical examination and viva voice

The performance of the resident during the training period should be monitored throughout the course and duly recorded in the log books as evidence of the ability and daily work of the student

1. Personal attributes:

Behavior and Emotional Stability: Dependable, disciplined, dedicated, stable in emergency situations, shows positive approach.

Motivation and Initiative: Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.

Honesty and Integrity: Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.

Interpersonal Skills and Leadership Quality: Has compassionate attitude towards patients and attendants, gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

2. Clinical Work:

Availability: Punctual, available continuously on duty, responds promptly on calls and takes proper permission for leave.

Diligence: Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in clinical case work up and management.

Academic ability: Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.

Clinical Performance: Proficient in clinical presentations and case discussion during rounds and OPD work up. Preparing Documents of the case history/examination and progress notes in the file (daily notes, round discussion, investigations and management) Skill of performing bed side procedures and handling emergencies.

3. Academic Activity: Performance during presentation at Journal club/ Seminar/ Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.

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FINAL EXAMINATION

The summative assessment of competence will be done in the form of M.Ch. Final Examination leading to the award of the degree of M.Ch. in Urology. The M.Ch. final is a two-stage examination comprising the theory and practical part. An eligible candidate who has qualified the theory exam is permitted to appear in the practical examination.

Theory Examination

1. The theory examination comprises of Four papers, maximum marks 100 each.

2. There are 10 short notes of 10 marks each, in each of the papers. The number of short notes and their respective marks weightage may vary in some subjects/some papers.

3. Maximum time permitted is 3 hours.

4. Candidate must score at least 50% in the aggregate of Four papers to qualify the theory examination.

a) Practical Examination:

1. Maximum Marks: 400.

2. Comprises of Clinical Examination and Viva.

3. Candidate must obtain a minimum of 50% marks in the Clinical Examination (including Viva) to qualify for the Practical Examination.

4. Appearance in practical examination is compulsory.

5. Candidates are required not to canvass with KAHER for above.

Declaration of KAHER Final Results

M.Ch. final is a qualifying examination.

Results of M.Ch. final examinations (theory & practical) are declared as PASS/FAIL.

M.Ch. degree is awarded to a M.Ch. trainee in the convocation of KAHER.

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RECOMMENDED TEXT BOOKS AND JOURNALS

BOOKS AND JOURNALS. It is also important that department should have an Internet facility which would enable residents to browse and use medline search.

BOOKS

1. Campbell urology-3 Volumes 12 th Edition

2. Scientific Basis of Urology Mundy

3. Current Urological Therapy Kaufman

4. Obstructive Uropathy O'Reilly

5. Urogenital trauma Macaminch

6. Text book of Urology Whitefield & Hendry

7. Adult & Paediatric Urology Gillenwater et al

□ Paediatric Urology

1. Pediatric Urology Kelalis & King – 2 vol.

2. Paediatric Urology Whitakar

□ Uro-oncology

1. Genito-urinary cancer management Backeman & Paulson
2. Genitourinary cancer Dekerrion et al
3. Testicular cancer Javadopor

□ Urodynamics

1. Urodynamics principle & practise Mundy
2. Controversy in Neurourology Barret & wein
3. Neurourology & urodynamics Bradly & Hald

□ Stone Diseases

1. Stone disease Diagnosis & management by Rous
2. Endourology Clayman et.al
3. Endourology Carson

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4. Extracorporeal shock wave Lithotripsy Gravernstein
5. Endourology Arthur Smith

□ Infertility

1. Male Infertility Amelar
2. Reproductive infertility Silber
3. Microsurgery in male and female

□ Reconstructive and Female Urology

1. Operative Gynaecology Te Linde
2. Female urology Blandy
3. Urinary Incontinence Dat. D.O.'Donnel
4. Urogynaecology & urodynamics Obstargard & Bent
5. Reconstructive urologic surgery Libertino

□ Renal Transplantation

1. Kidney transplantation Peter morris
2. Renal transplantation Garovoy & Guttman
3. Introduction to Dialysis Logan
4. Vascular arress in Haemodialysis Bell et Al

□ Operative Urology

1. Glen's operative urology
2. Urologic Endoscopy Bagley et al
3. Transurethral surgery Maurmayer

□ Laparoscopy

1. Laparoscopic urology Ralph V. Clayman, E.M. McDougall
2. Urologic Laparoscopy Sakti Das

3. Laparoscopic Urologic Surgery A.K.

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Hemal Uroradiology- Emmett's –Witten

-Clinical Uroradiology 3 volumes

Journals

- Indian J. Urology
- Journal of Urology
- British J. Urology
- Neurourology & Urodynamics
- Urology (Gold Journal)
- European Urology
- Urologia internationalis
- Scandinavian J. Urology & Nephrology
- Transplantation
- Transplant Proceedings
- Urological Research
- Urologic Radiology
- World Journal of Urology Periodicals
- Urological clinics of North America
- Seminars in Urology
- Controversy in Urology
- Recent Advances in Urology
- Year Book of Urology
- Modern Trend in Urology

M.Ch. IN PLASTIC AND RECONSTRUCTIVE SURGERY

Goals

M.Ch. (Plastic Surgery) course is designed to train the candidates in the principles and practice of advanced Plastic & Reconstructive Surgery to equip them to function as faculty / consultants and researcher in Plastic & Reconstructive Surgery.

Objectives

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. The Objectives may be considered under the subheadings.

1. Knowledge
2. Skills
3. Human values, ethical practice and communication abilities.

1. Knowledge:

- To train doctors in the scientific aspects of the specialty of Plastic & Reconstructive Surgery.
- To provide the candidate with the current, latest, and scientific and evidence- based knowledge pertaining to all the aspects of Plastic & Reconstructive Surgery.
- To empower the trainee in academic and research aspects of Plastic Surgery and to become an effective teacher and communicator in Plastic Surgery.

2. Skills:

- To impart the Skills to undertake independent clinical practice in the Plastic & Reconstructive Surgery and to provide opportunities to practice these skills in a graded manner and under suitable supervision to a point where the candidate is capable of practicing these skills independently.
- To provide the candidate enough practical training to empower them to practice the specialty of Plastic Surgery with competence, care and compassion thereby delivering the highest standard of Plastic Surgical care to the community.

- To empower the trainee to become an effective teacher and communicator in Plastic & Reconstructive Surgery.
- To include in the candidate an attitude of responsibility, accountability and caring, to empower the candidate with a good and sound foundation of Ethical values in the practice of Urology and to develop in the candidate the ability to effectively communicate with patients, peers, superiors and the community in the discharge of his/her clinical and research role.
- To establish the required training methods, evaluation, methodology and qualifying norms for the successful completion of M.Ch. course in Plastic & Reconstructive Surgery.

3.Human Values, Ethical Practice and Communication abilities:

- To inculcate in the candidate the attitude of responsibility, accountability and caring, to empower the candidate with a good and sound foundation of Ethical Values in the practice of Plastic & Reconstructive Surgery, and to develop in the candidate the ability to effectively communicate with patients, peers, superiors, and the community in the discharge of his/her clinical and research role.
- To adopt ethical principles in all aspects of his/her practice; professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- To develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient.
- To provide leadership and get the best out of his team in a congenial working atmosphere.
- To apply high moral and ethical standards while carrying out human or animal research.
- To be humble and accept the limitations in his knowledge and skill and to ask for help from colleagues when needed.
- To respect patient's rights, confidentiality and privileges including patient's right to information and right to seek a second opinion.

Course Contents ***Basic Sciences:***

These include anatomy, physiology, biochemistry, microbiology, pathology and radiology as found in current text books. These standard topics are recommended to the studies in as much as they are applicable to the practice of plastic surgery. The stress is on anatomy of the parts dealt with by the plastic surgeon.

General Topics:

- Historical Perspectives
- Genetics
- Tissue Engineering
- Anesthesia for Plastic Surgery including Local and Regional Anesthesia
- Photography in Plastic Surgery
- Psychological aspects in Plastic Surgical Practice.
- Radio-imaging and its role in Plastic Surgery. Prenatal Detection of Fetal Anomalies
- Ethical and Legal issues in the practice of Plastic Surgery
- Evidence- Based decision making in Plastic Surgery
- Wounds : Pathophysiology of Wound Healing, Pharmacologic and Mechanical management of Wounds. Problem wounds and their management.
- Scars : Pharmacologic, Mechanical and Surgical management
- Physical properties of Skin
- Principles of Tissue Expansion
- Transplantation in Plastic Surgery
- Skin grafts
- Vascular Territories of the Human Body
- Flaps : Physiology , Classification and Applications
- Principles and Techniques of Microvascular Surgery
- Implants : Alloplastic materials and their use in Plastic Surgery
- Robotics in Plastic Surgery
- Lasers in Plastic Surgery

- Telemedicine
- Cancer : Principles of management
- Endoscopic Surgery : Principles
- Aesthetics of Human Body
- Dermis, Fat & Fascia : Repair & Grafting
- Tendon : Repair & Grafting
- Skeletal Muscle : Repair, Regeneration and Grafting
- Cartilage : Repair, Grafting and Engineering
- Bone : Repair & Grafting
- Peripheral Nerve : Repair & Grafting

Burns :

- Classification and Epidemiology
- Thermal Burns : Pathophysiology and Management
- Electrical Burns : Pathophysiology and Management
- Radiation Injury : Pathophysiology and Management
- Cold Injuries
- Management of Burns Sequelae
- Recent Advances in Management of Burns
- Problem Wounds and Principles of Closure
- Prenatal Detection of Fetal Anomalies
- Tissue Engineering
- PATHOPHYSIOLOGY AND TREATMENT OF FETAL DISORDERS
- Telemedicine
- Embryology of Head and Neck
- Vascular Anomalies

- Cleft Lip and Palate
- Nonsyndromic Craniosynostosis and Deformational Plagiocephaly.
- Craniosynostosis Syndromes.
- Craniofacial Microstomia.
- Craniofacial Clefts and Hypertelorbitism
- Miscellaneous Craniofacial Conditions: Fibrous Dysplasia, Mobius syndrome, Rhomberg's Disease, Treacher Collins Syndrome, Dermoid Cyst, Neurofibromatosis.
- Otoplasty and Ear reconstruction
- HEAD AND NECK

Soft tissue and Skeletal injuries of the face.
Head and Neck Cancer and Salivary Gland Tumours.

Skull Base Surgery

Craniofacial and Maxillofacial Prosthetics.

Reconstructions of Scalp Calvarium and Forehead.
of the Lips

Reconstruction of the Cheeks.

Nasal Reconstruction

Reconstruction of Eyelids, Correction of Ptosis and Canthopexy.

Facial Paralysis Reconstruction

Mandible Reconstruction

Reconstruction of Defects of The Maxilla and Skull Base

Reconstruction of the Oral Cavity, Pharynx and Oesophagus.

AESTHETIC SURGERY

Cutaneous Resurfacing; Chemical Peeling; Dermabrasion; and Laser Resurfacing
Filler Materials.

Botulinum Toxin.

Blepharoplasty

Facelift.

Forehead Lift

Rhinoplasty

Liposuction

Abdominoplasty and

Facial Skeletal augmentation with implants

Osseous Genioplasty

Hair Transplantation

BREAST.

Augmentation MAMmoplasty and its Complications.

Mastopexy and MAstopexy Augmenation.

Breast Reduction-Inverted T Technique.

Vertical Reduction Mammoplasty.

Gynaecomastia

Breast Cancer for the Plastic Surgeon.

Latissimus flap Breast Reconstruction.

Breast Reconstruction TRAM Flap Techniques.

Breast Reconstruction Free Flap Techniques.

Nipple Reconstruction.

TRUNK AND LOWER EXTREMITY

Thoracic Reconstruction

Abdominal Wall Reconstruction

Lower Extremity Reconstruction

Foot and Ankle Reconstruction

Reconstruction of the Perineum.

Lymphoedema

Pressure sore.

Reconstruction of the Pelvis.

HAND

Development of Hand Surgery.

Principles of Upper Limb surgery.

Radiologic Imaging og the Hand and Wrist.

Soft Tissue Reconstruction of the Hand.

Fractures and Ligamentous injuries of the Wrist.

Fractures , Dislocationsand Ligamentous injuries of the Hand.

Tendon Healing and Fexor Tendon Surgery.

Repair of the Extensor Tendon System.

Infections of the Upper Limb.

Tenosynovitis.

Compartment Neuropathies of the Upper Limb.

Thumb Reconstruction.

Tendon Transfers.

Congenital Hand Abnormalities.

Dupuytren's Disease.

Replantation of the Upper Extremity.

Upper Limb Rathritis.

Upper Limb Amputation and Prosthesis.

Clinical history and examination – detailed systematic history taking, clinical examination of various systems, coming to a provisional working diagnosis.

Informed Consent /Medico Legal Issue – understanding the implications of acts of omission and commission in practice. Issues regarding Consumer Protection Act – implications in a medico-legal case like accidents, assaults etc.

Communication skills with patients – understanding clarity in communication, compassionate explanations and giving emotional support to at the time of suffering and bereavement.

Principles of Surgical audit – understanding journal based literature study; the value of the text book, reference book articles; value of review articles; original articles and their critical assessment.

Research Methodology & Biostatistics – understanding the value of retrospective, prospective, randomized controlled and blinded studies understanding the principles and meanings of various biostatistical tests applied in these studies.

Medical Ethics/ Social responsibilities of surgeons

Use of Computers in Plastic Surgery – Components of a Computer; its use in practice- principles of word processing, spreadsheet functions, database and presentation; the internet and its uses. The value of computer based systems in biomedical equipment value of computer in imaging and mock surgery.

Preoperative workup – concept of fitness for surgery; principles of planning, basic medical workup; workup in special situations like, diabetics, renal failure, cardiac and respiratory illness; risk stratification.

Principles of Operative Surgery –like sepsis, asepsis, antisepsis, sterilization surgical sutures, drain prosthetic grafts. Hepatitis, AIDS.

Postoperative Care – concept recovery room care; airway management; assessment of wakefulness; management of cardiovascular instability in this period; criteria for shifting to a ward; pain management.

Basic Plastic Surgical Instrumentation – Principles of surgical instrumentation; their maintenance and sterilization.

Fluid and Electrolyte balance/Aid-Base balance – the body fluid compartments; metabolism of water and electrolytes; factors maintaining homeostasis; causes for and treatment of acidosis and alkalosis. Both in adult and children.

Blood Transfusion – blood grouping; cross matching; blood component therapy; complications of blood transfusion; blood substitutes; auto transfusions; cell savers.

Surgical Infections – sepsis and asepsis and antisepsis; microbiological principles; rational use of antibiotics; special infections like synergistic gangrene and diabetic foot infections. Hepatitis and AIDS. Septicaemia and its management.

Nutrition in Health and Disease – nutritional assessment; metabolic response to stress; need for nutritional support; enteral nutrition; routes of access to GI tract; parenteral nutrition; access to central veins for nutritional support.

Principles of Oncology –cell kinetics; causation of tumours; principles of oncologic surgery; radiotherapy and chemotherapy; paraneoplastic syndrome; cancer pain management; palliative care.

Shock and Pulmonary failure –types of shock; diagnosis; resuscitation; pharmacologic support; ARDS and its causes; prevention; ventilator support.

Anaesthesia –types of anaesthesia: general, regional, local; pharmacology of inhalation; intravenous and local anaesthetic drugs; muscle relaxants. Paediatric anaesthesia and problems related to that.

Assessment of Trauma – poly trauma patients, closed abdominal and chest injuries/penetrating injuries/head injury, urological injuries; trauma scores management of poly trauma cases including lower limb trauma.

Critical Care – Cardiorespiratory failure- management of shock; including monitoring; sepsis scores; pharmacological supports.

Photography and Documentation: Principles and Techniques

PLASTIC SURGERY TOPICS

History of Plastic Surgery

HISTORY OF PLASTIC SURGERY

Clinical history and examination – detailed systematic history taking, clinical examination of various systems, coming to a provisional working diagnosis.

Informed Consent /Medico Legal Issue – understanding the implications of acts of omission and commission in practice. Issues regarding Consumer Protection Act – implications in a medico-legal case like accidents, assaults etc.

Communication skills with patients – understanding clarity in communication, compassionate explanations and giving emotional support to at the time of suffering and bereavement.
Principles of Surgical audit – understanding journal based literature study; the value of the text book, reference book articles; value of review articles; original articles and their critical assessment.
Research Methodology & Biostatistics – understanding the value of retrospective, prospective, randomized controlled and blinded studies understanding the principles and meanings of various biostatistical tests applied in these studies.
Medical Ethics/ Social responsibilities of surgeons
Use of Computers in Plastic Surgery – Components of a Computer; its use in practice-principles of word processing, spreadsheet functions, database and presentation; the internet and its uses. The value of computer based systems in biomedical equipment value of computer in imaging and mock surgery.
Preoperative workup – concept of fitness for surgery; principles of planning, basic medical workup; workup in special situations like, diabetics, renal failure, cardiac and respiratory illness; risk stratification.
Principles of Operative Surgery –like sepsis, asepsis, antisepsis, sterilization surgical sutures, drain prosthetic grafts. Hepatitis, AIDS.
Postoperative Care – concept recovery room are; airway management; assessment of wakefulness; management of cardiovascular instability in this period; criteria for shifting to a ward; pain management.
Basic Plastic Surgical Instrumentation – Principles of surgical instrumentation; their maintenance and sterilization.
SURGICAL DIATHERMY
Principles of Lasers and its use in plastic surgery
Wound Management – wound healing; factors influencing healing; basic surgical techniques; properties of suture materials; appropriate use of sutures.
Management of keloids and hypertrophic scars.
Fluid and Electrolyte balance/Aid-Base balance – the body fluid compartments; metabolism of water and electrolytes; factors maintaining homeostasis; causes for and treatment of acidosis and alkalosis. Both in adult and children.
Blood Transfusion – blood grouping; cross matching; blood component therapy; complications of blood transfusion; blood substitutes; auto transfusions; cell savers.
Surgical Infections – sepsis and asepsis and antisepsis; microbiological principles; rational use of antibiotics; special infections like synergistic gangrene and diabetic foot infections. Hepatitis and AIDS. Septicaemia and its management.

Nutrition in Health and Disease – nutritional assessment; metabolic response to stress; need for nutritional support; enteral nutrition; routes of access to GI tract; parenteral nutrition; access to central veins for nutritional support.
Principles of Oncology –cell kinetics; causation of tumours; principles of oncologic surgery; radiotherapy and chemotherapy; paraneoplastic syndrome; cancer pain management; palliative care.
Shock and Pulmonary failure –types of shock; diagnosis; resuscitation; pharmacologic support; ARDS and its causes; prevention; ventilator support.
Anaesthesia –stages of anaesthesia; pharmacology of inhalation; intravenous and regional anaesthesia; muscle relaxants. Paediatric anaesthesia and problems related to that.
Assessment of Trauma – poly trauma patients, closed abdominal and chest injuries/penetrating injuries/head injury, urological injuries; trauma scores management of poly trauma cases including lower limb trauma.
Critical Care – Cardiorespiratory failure- management of shock; including monitoring; sepsis scores; pharmacological supports.
Breast Disease – physiology and breast anatomy; benign and malignant disease; diagnosis; investigation; screening for cancer; genetics of breast cancer; principles of reconstruction, soft tissue neoplasm. Reduction and augmentation mammoplasty. Gynaecomastia and its management.
NEURO SURGERY
Cranio-Facial Deformities – including craniostenosis, complex craniofacial clefts & skull base surgery, craniofacial injury management. Management of calvarial defects
Peripheral Nerve Injuries – including anatomy and physiology of repair and regeneration. Brachial plexus injury.
Gynaecological Surgery
Vaginal agenesis; Gender Dysphoria
Genito Urinary Surgery
Undescended Testis
Hypospadias/Epispadias
Urinary Diversion
Infertility
Vasectomy
Surgery for impotence
Imaging – principles, investigations, including CT/MRI CT guided FNAB/C
Tumour –biology and management of including chemotherapy and adjuvant therapy
Breast – benign & malignant conditions
Chemotheraoy/adjuvant therapy
Head and Neck tumours , pathology and its management
Skin tumours –including basal cell carcinoma, squamous cell carcinoma and melanoma, including oral cancer and tongue cancer
Salivary gland tumors including parotid tumours
Post tumours excision-surgical reconstruction
Principles of radiotherapy
Cardio thoracic surgery
Flail chest, thoracic trauma

A V malformations – aetiology, pathology, classification and its management
Varicose veins
Chronic venous insufficiency
Vascular emergencies – trauma, embolism
Microvascular surgery – principles including/free flap and replantation, Reanimation of face, functional muscle transfer
Vascular imaging
Neuro Meningo-mylelcoels, encephalocoels
Neuro- Spinal fusion defects
Ventral defects
Ano rectal anomalies
Implants – Biocompatibility
Biology –including surgical implants, alloplastic metal and synthetic
Bone and cartilage
Hair transplant
Face lift
Rhinoplasty
Laser surgery
Endoscopy and minimally invasive surgery in plastic and reconstructive surgery

Teaching and Learning Activities

A candidate pursuing the course should work in the institution as a full time student. No candidate should be permitted to run a clinic/laboratory/nursing home while studying postgraduate course. Each year should be taken as a unit for the purpose of calculating attendance.

Every student shall attend teaching and learning activities during each year as prescribed by the department and not absent himself / herself from work without valid reasons.

A list of teaching and learning activities designed to facilitate students acquire essential knowledge and skills outlined is given below. Depending on the facilities available, any or all these methods may be employed.

1. LECTURES

Lectures are to be kept to a minimum. They may, however, be employed for teaching certain topics. Lectures may be didactic or integrated.

a. Didactic Lectures: Recommended for selected common topics for post graduate students of all specialties. Few topics are suggested as examples:

1. Bio – statistics
2. Use of library
3. Research Methods
4. Medical code of conduct and medical ethics
5. National health and disease control programmes
6. Communications skills etc.

These topics may preferably take up in the first few weeks of the 1st year.

- b. Integrated Lectures:** These are recommended to be taken by multidisciplinary teams for selected topics, example Jaundice, Diabetes mellitus, Thyroid etc.

2. JOURNAL CLUB

Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. Further, every candidate must make a presentation from the allotted journal(s) of selected articles at least four times a year and a total of 12 presentations in three years. The presentations would be evaluated using check lists and would carry weightage for internal assessment. (See check list I in chapter IV). A time table with names of the student and the moderator should be announced at the beginning of every year.

3. SUBJECT SEMINAR

Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. Further, every candidate must present on selected topics at least four times a year and a total of 12 seminar presentations in three years. The presentations would be evaluated using check lists and would carry weightage for internal assessment. (See check list II in chapter IV). A time table with names of the student and the moderator should be announced at the beginning of every year.

4. STUDENT SYMPOSIUM

Recommended as an optional multi disciplinary programme. The evaluation may be similar to that described for subject seminar.

5. WARD ROUNDS

- a. Service Rounds:** Postgraduate students and Interns should do ward rounds every day for the care of the patients. Newly admitted patients should be worked up by the PGs and presented to the seniors the following day.
- b. Teaching Rounds:** Every unit should have 'grand rounds' for teaching purpose. A diary should be maintained for day today activities by the students.

Entries of (a) and (b) should be made in the Log Book.

6. CLINIC – PATHOLOGICAL CONFERENCE

Recommended once a month for all postgraduate students. Presentation is to be done by rotation. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPCs.

7. INTER DEPARTMENTAL MEETINGS

Strongly recommended particularly with departments of Pathology and Radio-Diagnosis at least once a week. These meetings should be attended by postgraduate students and relevant entries must be made in the Log Book.

- a. Pathology:** A dozen interesting cases may be chosen and presented by postgraduate students and discussed by them as well as the senior staff of Plastic

Surgery department. The staff of Pathology department would then show the slides and present final diagnosis. In these sessions the advance immune-histo-chemical techniques, the markers other recent developments can be discussed.

- b. Radio-Diagnosis:** Interesting cases and the imaging modalities should be dicussed.

8. *TEACHING SKILLS*

Postgraduate students must teach under graduate students (Eg. Medical, Nursing) by taking demonstrations, bedside clinics, tutorials and lectures etc. Assessment is made using a check list by surgery faculty as well as students. (See model check list in chapter IV). Record of their participation be kept in Log Book. Training of postgraduate students in Educational Science and Technology is recommended.

9. *CONTINUING MEDICAL EDUCATION PROGRAMMES(CME)*

At least 2 state level CME programmes should be attended by each student in 3 years.

10. *CONFERENCES*

Attending conferences is optional. However it should be encouraged.

MONITORING LEARNING PROGRESS (See Chapter IV)

b) UNIVERSITY EXAMINATION

Eligibility: every candidate to become eligible to appear for the final examination should fulfill the following requirements.

Attendance, Progress and Conduct: every student shall attend symposia, seminars, conference, journal review meetings, grand rounds, CPC, Case presentation, clinics and lectures during each year as prescribed by the department and not absent himself/herself from work without valid reasons.

Every candidate shall maintain a work Diary and Log Book for recording his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any conducted by the Head of the department and Head of the Institution and among other things forms the basis for certifying satisfactory progress. The Log Book if demanded be presented in the University clinical or viva-voce examination.

Every candidate should have fulfilled the minimum attendance requirement prescribed by the Medical Council of India and the KLE University (80% of the training during each academic year the postgraduate course provided leave of any kind shall not be counted as part of academic term without prejudice to minimum 80% attendance of training period every year)

Scheme of Examination

The examination shall consist of:

- Written Examination (theory)
- Clinical examination and
- Viva-voce

Written Examination (Theory)

Written examination shall consist of four question papers, each of three hours duration. Each paper shall carry 100 marks. Basic medical sciences and recent advances may be asked in any or all the papers.

The distribution of topics in the question papers will be as follows:

Paper I : Basic Science and General aspects of Plastic & Reconstructive Surgery

Paper II: Plastic & Reconstructive Surgery

Paper III: Plastic & Reconstructive Surgery

Paper IV: Specialty in Plastic & Reconstructive Surgery: Burns, Hand, Esthetic Surgery, Cranio- facial surgery, Maxillo-facial surgery, Microvascular surgery.

Note: *knowledge of recent advances may be examined in any or all the papers. The above distribution is only broad and suggestive and not strict/exhaustive. Some overlapping of topics is inevitable. Candidates should be prepared to answer overlapping topics.*

Clinical Examination: It should aim at examining clinical skills and competence of candidates for undertaking independent work as a specialist. Each candidate should examine at least one long case and two short cases. The total marks for clinical examination shall be 200.

Viva Voce: Viva Voce Examination shall aim at assessing depth of knowledge, logical reasoning, confidence and oral communication skills. The total marks shall be 100.

M.Ch. Plastic & Reconstructive Surgery

Theory	Clinical/Practical	Viva-voce	Grand Total
400	200	100	700

RECOMMENDED BOOKS AND JOURNALS

I. Essential Books

1. Grabb & Smith's Plastic Surgery – 5th Edition

Editors Sherrell J. Aston, Robert W. Beasley & Charles. H.M. Thorne in 1997 by Lippincott- Raven Publishers, New York

2. Mastery of Plastic & Reconstructive Surgery Vol. 1-3 edited by Mimi Cohen & Robert M. Golwyn, 1944, 1st Edn., London Little Brown & Co.

II Reference Books

i. Flaps

1. Grabb's Encyclopedia of Flaps Vol. 1 to 3, 2nd Edition

Edited by Berish Strauch, Luiso. Vasconez & Elizabeth J. Hall – Findlay in 1998 by Lippincott – Raven – Publisher in Philadelphia. New York.

ii. Burns

1. Burn Reconstruction Bruce M. Achauer, 1991, Thieme Medical Publishers Inc. New York

iii. Breast

1. Noone Plastic & Reconstructive Surgery of Breast,

Edited by R. Barrettnoone in 1991 by Mosby Inc. Philadelphia

iv. Cleft Lip & Cleft Palate

1. Cleft Lip & Palate Vol. I & II by Samuel Berkowitz, in 1996 by Singular Publishing Group., London
2. Cleft Palate & Cleft Lip: A team approach to Clinical and Rehabilitation of the patient by Cooper, Hardeng, Krogman, London.

v. Leprosy

“The surgical management of Deformities in Leprosy” & other peripheral Neuropathics” editor Noshir H. Antia Carl D. Enna & Behman M. Daver in 1992, Bombay Oxford university press, Delhi.

vi. Hand

1. Greens Operative Hand Surgery, David P. Green, Robert N. Hotchiss & William G. Pederson 4th edition Vol. I & II 1999 by Churchill Livingstone, London.
2. The Hand – edited by Raoul Tubiana Vol. I & II in 1981 by W.B. Saunder Company, London.

JOURNALS

Essential Reading

1. Plastic and Reconstructive Surgery
2. Clinics in Plastic Surgery
3. Journal of Plastic, Reconstructive and Aesthetic Surgery
4. Burns
5. Hand

Desirable

1. Cleft and Craniofacial Surgery

POSTGRADUATE TRAINING PROGRAMME FOR M.Ch. IN PEDIATRIC SURGERY

1. PREAMBLE

The aims and objectives of M.Ch. training should be to train candidates with knowledge in surgical sciences and an aptitude to care for neonates and children with specific knowledge, skills and attitudes in the specialty of Pediatric Surgery. The training should help him/her to function as a safe Pediatric surgeon, an independent clinical consultant, a medical teacher and conduct research studies.

2. SUBJECT SPECIFIC OBJECTIVES

The aim of course is to produce Pediatric surgeons who are capable of setting a standard and demonstrate commensurate expertise in the field. The training should aim to facilitate the candidate's acquisition of a judicious mix of the three domains of learning that will be practiced ethically-

- Cognitive (knowledge),
- Psychomotor (practice) and
- Affective (communication).

2.1 Cognitive domain (Knowledge)

- Understand the basic sciences (embryology, anatomy, physiology, biochemistry, pharmaco-therapeutics etc.) and principle of pediatric medical care as applicable to pediatric surgical practice.
- Be conversant with the embryology, etiology, pathophysiology, diagnosis and management of common neonatal and pediatric surgical problems - elective or emergency.
- **Group approach:** Recognize the role of multidisciplinary and interdisciplinary approach in the management of various pediatric surgical disorders so as to obtain relevant specialist consultation, where appropriate.
- **Research Methodology:** Basic knowledge of research methodology and biostatistics; familiarity and participation in clinical and experimental research studies; involvement in scientific presentation and publication.

- Recognize the importance of family, society and socio-cultural environment in the treatment of the sick child.

2.2 Psychomotor domain(Practical)

- Evaluate a patient thoroughly (history, clinical examination), order relevant investigations and interpret them to reach a diagnosis and plan of management.
- Plan and carry out simple investigations/ procedures (bedside, laboratory, radiology suite) independently.
- Provide Basic and Advanced Life Support services in emergencies e.g. NALS, PALS.
- Acquire familiarity with and provide critical care of surgical neonates and infants - airway support, ventilation, central vascular access etc.
- Prepare a patient for an elective/emergency surgery and provide specific post-operative care.
- Provide counseling to the patient and primary caretakers for the smooth dispensation of medical care.
- Acquire skills in routine ward procedures (e.g. bladder catheterization, wound dressings, peripheral vascular access, child restraint etc.).
- Acquire proficiency in prescribed minor and major operative procedures, and provide these, initially with assistance and later independently.
- Monitor the post-operative patient in the routine post-op ward / high dependency unit / and in the intensive care setting.
- Provide specific and relevant advice to the patient and family at discharge time for proper domiciliary care, hospital reporting in emergency and routine follow up.

2.3 Affective domain(Communication)

- Develop and practice effective communication skills.
- Professionally interact and obtain relevant specialist/ancillary services' consultation where appropriate.
- While teaching others in a clinical care unit, ensure team work and establish a pediatric surgical unit.
- Establish effective communication with the caregivers of the patient including counseling and terminal care.

- **Medical Ethics and Human values:** The student will inculcate ethical principles in all aspects of pediatric surgical practice/research (professional honesty and integrity, humility, moderation, informed consent, counseling, awareness of patients' rights and privileges, etc.).

3. SUBJECT SPECIFIC COMPETENCIES

3.1 COGNITIVE (KNOWLEDGE) DOMAIN

3.1.1 Competencies to be acquired in the cognitive domain (knowledge)

a. History and Physical

- Establish rapport with child and parent/guardian who has complete knowledge of the child and obtain comprehensive history,
- Perform a complete physical examination of relevant systems based on history,
- Should have knowledge of systemic examination in a child,
- Summarize history and physical examination results to arrive at a provisional diagnosis with other differential diagnosis in order of possibility and communicate the same to the team members.

b. Evaluation and Management

- List out and order appropriate investigations towards arriving at a final diagnosis or narrowing the list of differential diagnosis. Prioritize emergency and routine investigations,
- Should know to interpret the results of the investigations ordered, including acceptable normal variations and confirm a working diagnosis,
- Plan management based on the final diagnosis arrived at,
- Communicate effectively the diagnosis, plan of management and possible outcomes to the parents/ caretakers,
- Communicate clearly the investigation results, plan of management to the team justifying the same,
- Should be able to recognise abnormal results and reports and prioritise those requiring immediate response,
- Train and mentor junior team members.

c. Documentation

- Should be able to systematically document case history, examination findings, summarize management plan based on investigations and clinical examination,
- Uses the electronic record when available to keep the team informed of progress,

- Flow chart of management with orders which are clear and understandable by juniors,
- Should be able to write appropriate cross departmental referrals,
- Should be able to write lucid discharge summaries chronicling the admission, evaluation, management and post-operative course in the hospital with clear instructions regarding medications on discharge and follow up.

d. Communication

- Communicates the diagnosis, plan of management clearly to parents/guardians,
- Communicates orally and by documentation to junior healthcare workers the treatment plan,
- Communicates appropriately while handing over to maintain uninterrupted care of patient,
- Obtain informed consent for surgery and procedures after explaining alternatives to the parents,

e. Team work.

- Should work as an active member of the professional team
- Should accept responsibilities and carry them out effectively
- Should ask for help from team members when needed and should be willing to help when asked for
- Should be actively involved in patient care and follow up

f. Others.

- Have empathy for patients and parents/guardians,
- Incorporates all the four pillars of medical ethics and practise them diligently,
- Recognizes medico-legal issues, patient confidentiality and other regulations pertaining to medical practice,
- Conceptualises and carries out research incorporating the principles of Good Clinical practices,
- Teach relevant aspects of Pediatric surgery to resident doctors, junior colleagues, nursing, and para-medical staff,
- Understand factors for hospital infection and take appropriate universal precautions to prevent hospital infection,
- Should be well versed in the administrative functioning of the department and the ward including the staffing requirements, procurement and maintenance of electro-medical equipment,

3.1.2 Competencies to be acquired in basic sciences applicable to Pediatric Surgery:

- a) Genetic basis of disease
- b) Molecular biology applicable to congenital anomalies
- c) Fetus as a patient
 - Antenatal diagnostic tools
 - Antenatal prognosticators
 - Fetal interventions
- d) Normal and anomalous embryogenesis of all systems:
 - Gastrointestinal tract
 - Hepatobiliary and pancreas
 - Respiratory system including diaphragm and related Cardiovascular system
 - Genito-urinary tract, including descent of testes, sexual differentiation.
 - Lymphatic system
 - Face and neck including lip, palate, branchial and thyroglossal apparatus
 - Abdominal wall, umbilicus and inguinal canal
 - Central nervous system and spine
- e) Surgical anatomy of all above mentioned systems
- f) Physiology and biochemistry
 - Physiology of fetus and newborn including transition from former to latter
 - Gastrointestinal physiology including deglutition, esophageal motility, antireflux mechanism, intestinal motility & defecation and neuroenteric regulation
 - Altered biochemistry in intestinal obstruction
 - Hepatic function including bilirubin metabolism.
 - Physiology of micturition and neurogenic regulation of same
 - Biochemical changes in obstructive uropathy and renal failure.
 - Cardiovascular physiology including fetal & neonatal cardiac function
 - Pulmonary physiology and basis of mechanical ventilation
 - Fluid and electrolyte balance.
 - Hemolytic disorders
 - Nutritional requirements in health and disease including parenteral nutrition.
 - Sexual differentiation including biochemical aspects in anomalous conditions.
 - Physiological changes during pre-operative and post-operative period and changes during different types of anesthesia and laparoscopic surgery

g) Microbiological principles governing:

- Pathophysiology of sepsis in neonates, infants and children, and inflammatory response,
- Maintenance of asepsis, sterility in newborn nursery, ward and operation theatre,
- Sterilization of surgical instruments including endoscopes & ventilators,
- Common surgical infections, including osteomyelitis and septic arthritis,
- Surgical tuberculosis including atypical mycobacterial infection,
- AIDS/HIV in Pediatric Surgery,
- Parasitic surgical conditions,
- Elements of immunology including its importance in organ transplantation & immunosuppression,
- Immunization and vaccination.

3.1.3 Competencies to be acquired in general patient care applicable to Pediatric Surgery

- Basic and Advanced life support in Neonates and Pediatrics
- Basics of mechanical ventilation, different types of ventilatory support
- Different types of venous access, arterial access - monitoring
- Principles and types of physiological monitoring
- Transport and restraint of the sick child

3.1.4. Trauma

A. General principles of trauma

Upon completion of this, the trainee should be able to describe & discuss:

- Epidemiology of Pediatric trauma
- Different types of trauma, presentation
- Acute care of trauma patients including immediate assessment, triaging, evaluation tools to be used, scoring systems and prognostications

B. Systemic trauma

Upon completion of this, the trainee should be able to describe & discuss the different types of trauma pertaining to, their management, indications for surgery, outcomes of :

- Head injury
- Thoracic injuries including airway, chest wall and mediastinum
- Abdominal injuries including blunt and penetrating, solid and hollow viscera, retroperitoneum

- Genitourinary trauma including kidney, ureter, bladder, urethra and genital organs
- Musculoskeletal and spine trauma
- Burns
- Child abuse
- Soft tissue and envenomation

3.1. 5 Pediatric Oncology

A. General principles

Upon completion of this, the trainee should be able to describe & discuss:

- Genetic basis of tumours
- Tumour markers
- Principles and application of chemotherapy including toxicities of routinely used chemotherapeutic drugs
- Principles and application of radiotherapy including toxicities of routinely used radiotherapy
- Immuno-therapy
- Gene therapy and newer modalities of treatment
- Various evaluation modalities in Oncology

B. Systemic oncology

Upon completion of this, the trainee should be able to describe & discuss in detail the presentations, staging, prognostication, various treatment systems applicable to specific tumours:

- Wilms' tumour
- Neuroblastoma
- Liver tumours
- Rhabdomyosarcomas
- Germcell - tumours

Upon completion of this, the trainee should be able to describe & discuss an outline of the presentation and management of the following tumours:

- Common lymphomas and leukemias
- Common bone tumours
- Central nervous system tumours

3.1.6 Evaluation methods in Pediatric Surgery

A. Radiology

Upon completion of this, the trainee should be able to describe & discuss the principles of, applications, pitfalls, modifications in specific situations, how to carryout various investigations and interpret:

1. X rays
2. Ultrasonography including Doppler
3. CT scan
4. Voiding Cystourethrography
5. Contrast upper and lower GI series
6. Intravenous pyelography
7. MRI
8. PET - CT scan

B. Nuclear Medicine

Upon completion of this, the trainee should be able to describe & discuss the principles of, applications, pitfalls, modifications in specific situations, how to carryout various investigations and interpret:

1. Renal Dynamic Diuretic Radionuclide scintigraphy with various isotopes like EC, MAG3, DTPA
2. Static Cortical renogram - DMSA
3. Direct Radionuclide Cystography (DRCG)
4. Hepatobiliary scintigraphy
5. MIBG scan
6. Lymphatic scintigraphy
7. Thyroid scintigraphy
8. Gastro-esophageal reflux scintigraphy
9. RBC blood pool scan
10. Technitium Meckel's scan
11. PET scan
12. Liver-Spleen scan
13. Bone scan

C. Urodynamics

Upon completion of this, the trainee should be able to describe & discuss the principles of, applications, pitfalls, modifications in specific situations, how to carryout various investigations and interpret:

1. Uroflowmetry

2. Cystometrogram
3. Video urodynamics

D. Others

Upon completion of this, the trainee should be able to describe & discuss the principles of, applications, pitfalls, modifications in specific situations, how to carryout various investigations and interpret:

1. 24 hour pH monitoring
2. Esophageal and anorectal manometry
3. Intracranial pressure monitoring
4. Basics of pathological biopsies, examination including frozen section immunohistochemistry

3.1.7 Transplantation

Upon completion of this, the trainee should be able to describe & discuss:

1. Principles of transplantation including immunology and selection of recipients
2. Organ procurement and preservation
3. Outcomes including complications of transplantation
4. Immuno-suppression and its toxicities
5. Indications, preparation of recipient, techniques and post transplantation management and outcomes of the following:
 - a. Kidney transplantation and liver transplantation in detail
 - b. An outline of pancreatic transplantation, intestinal transplantation, bone marrow transplantation, heart & heart-lung transplantation

3.1.8 Regional and Special Pediatric Surgery

At the end of the training, the student should be able to describe, discuss, analyse and present pathogenesis, clinical presentations, differential diagnosis, diagnostic approach, roles of specific diagnostic tools, interpretation of the test results, management options (both non-operative and surgical), indications for surgery, preparation for surgery, peri- and post-operative management, surgical steps, complications and their management, outcomes (short and long - term) of the various congenital and acquired pathologies in each system as below (elaborated in detailed in the syllabus sections):

- A: Head and Neck:
B: Thorax:

- C: Abdomen:
- D: Genitourinary Tract
- E. Special Pediatric Surgery

3.1.9 Recent Advances

Upon completion of this, the trainee should be able to describe & discuss the advanced technology, its applications in diagnosis and treatment, complication and research options related to the fields outlined above. In addition, he must be conversant with:

- Minimal Access surgery of all areas including laparoscopy, thoracoscopy, ventriculoscopy, STEALTH and endoscopic surgeries, gastrointestinal endoscopy including ERCP (endoscopic retrograde cholangio-pancreatography), Bronchoscopy and Endourology.
- Robotics in Pediatric Surgery
- Use of newer energy sources in surgery including LASER, harmonic scalpel etc.
- Use of various types of staplers: Intestinal, Vascular, Endo GI etc.

3.2 AFFECTIVE DOMAIN (ATTITUDES AND VALUES)

The post graduate student should imbibe the following:

- **Group /Team approach:** function as a part of a team, co-operate with colleagues, and interact with the patient to provide the optimal medical care.
- **Ethical practice:** Abide by ethical principles in medical practice, maintain proper etiquette in dealings with patients, caretakers and other health personnel including due attention to the patient's right to information, consent and second opinion. Maintain professional integrity while dealing with patients, colleagues, seniors, pharmaceutical companies and equipment manufacturers.
- **Skills:** Preparation of oral presentation, medical documents, professional opinion in interaction with patients, caretakers, peers and paramedical staff – both for clinical care and medical teaching. Effective communication with the patient/caretakers regarding the nature and extent of disease, treatment options available and realistic outcome following optimal management is essential.

- During the course of three years the post graduate student is expected to attend instructive courses that facilitate proficiency relevant to this domain, eg., communication skills, biomedical ethics, patient counseling etc.

3.3 PSYCHOMOTOR DOMAIN (SKILLS)

The trainee pursuing MCh. in Pediatric Surgery course must acquire the following evaluations and skills - procedural and non-procedural skills - in the management of surgical diseases of children -

3.3.1. Clinical examination, outpatient and inpatient evaluation

Upon completion of the course, the post graduate student should be able to perform the following:

- Assess the child patient with surgical problems by:
 - Eliciting pertinent history.
 - Performing correct physical examination.
 - Making a working diagnosis.
 - Determining the type of care that is appropriate – outpatient/ inpatient /daycare.
 - Initiate and institute life-saving emergency care, including CPR.
 - Requesting appropriate investigations and interpretation of their result.
 - Identify pre-operative and post-operative complications promptly and deal with them safely.
 - Document and maintain a record of patients systematically.
 - Seek professional help from other colleagues where needed.
 - Treat patients and their relatives with respect and empathy.
 - Able to counsel caretakers and the family of patient and obtain requisite consent for care.

3.3.2 Radiological procedures

Upon completion of the course, the post graduate student should be able to perform the following:

- Apply knowledge of imaging modality (USG,CT,MR) to investigate surgical diseases of childhood,
- Interpret the radiological images to correctly identify normal structures, abnormalities and pathology,

- Familiarity with conduct and interpretation of intra-operative imaging – radiography and ultrasonography,
- The postgraduate student should be able to perform certain investigative and therapeutic procedures in the radiology suite with due precautions -
 - Esophageal swallow
 - Upper GI contrast study
 - Contrast enema
 - Therapeutic contrast enemas in meconium ileus
 - Reduction of select idiopathic intussusception with radiological (air/contrast enema) or ultrasonography (hydrostatic)
 - Voiding cystourethrogram
 - Retrograde urethrogram
 - Antegrade studies through drainage tubes
 - Percutaneous drainage, biopsy

3.3.3 Physiological studies:

The post graduate student should be able to perform a uroflowmetry and cytometry with standard precautions and interpret the results real time.

3.3.4 Operative procedures:

This includes elective, semi-emergency and emergency procedures.

- Minor surgery
- Major surgery
- Endoscopic procedures
- Minimally invasive surgery

The actual numbers performed may vary according to the patient load of the training unit and related departments.

At the end of his training period, the candidate must be able to PERFORM THE FOLLOWING PROCEDURES INDEPENDENTLY

General:

- Peripheral and central venous access, chemoport and Hickman catheter placement
- Arterial line placement
- Wound debridement and suturing
- Incision and drainage of abscess
- Excision of superficial lesions of skin / subcutaneous planes

- Limb amputation
- Percutaneous/open tumor, viscera (e.g. liver) and lymph node biopsy
- Skin grafting
- Fasciotomy
- Contracture release
- Muscle biopsy
- Nerve biopsy
- Umbilical vein cannulation
- Peritoneal dialysis catheter insertion
- Restraint of the sick child

Head and Neck:

- Repair of cleft lip
- Repair of cleft palate
- Salivary duct / orifice dilatation
- Ranula - marsupialization
- Release of ankyloglossia
- Sistrunk's procedure
- Excision of branchial remnants
- Excision of superficial head and neck masses
- Sternomastoid muscle release
- Diagnostic laryngoscopy
- Esophagostomy
- Cricothyroidotomy
- Injection sclerotherapy of accessible vascular lesions
- Tracheostomy

Thorax:

- Mastectomy
- Bronchoscopy - diagnostic, lavage
- Esophagoscopy - diagnostic
- Diagnostic thoracoscopy
- ICTD insertion
- Repair of eventration diaphragm
- Decortication
- Primary repair of TEF
- Diversion for TEF – esophagostomy, gastrostomy

Abdomen:

- Exploratory laparotomy for acute abdomen
- Laparoscopy - diagnostic, therapeutic minor
- Gastrostomy,
- Fundoplication
- Pyloromyotomy
- Ladd's procedure
- Repair of cong. diaphragmatic hernia -Bochdalek, Morgagni

- Repair of eventration diaphragm
- Per op cholangiogram
- Cholecystectomy, cholecystostomy
- Cystogastrostomy, cystojejunostomy
- Surgery for Vitello-intestinal duct remnants
- Feeding tube jejunostomy
- Ileostomy, colostomy
- Surgery for meconium ileus
- Mesenteric cyst excision
- Appendectomy
- Appendicular abscess – drainage
- Bowel resection, anastomosis
- Secondary suturing (burst abdomen)
- Surgery for inguinal hernias and hydrocele, Umbilical hernia, Femoral hernia
- Rectal biopsy
- Anoplasty for low anorectal malformation
- Splenectomy

Genitourinary

- Cystoscopy - Diagnostic, stent removal
- Nephrostomy
- Suprapubic cystostomy
- Vesicostomy
- Urolithiasis- pyelolithotomy, cystolithotomy
- Meatotomy/meatoplasty
- Distal hypospadias repair
- Urethral fistula repair
- Urethral calibration / dilatation
- Circumcision, preputioplasty and dorsal slit, reduction of paraphimosis
- Orchidopexy- open
- Fowler Stephen Stage 1 (open, laparoscopic) orchidopexy
- Exploration for torsion testes, orchidectomy

Neurosurgery

- Ventriculoperitoneal stunts.
- External ventricular drainage
- Repair of spina bifida

At the end of his training period, the post graduate student must be able to PERFORM THE FOLLOWING PROCEDURES UNDER SENIOR SUPERVISION:

General

- Vascular anastomosis
- HD catheter insertion

Trauma:

- Laparotomy for trauma

- Thoracotomy for trauma

Head and Neck:

- Salivary gland excision
- Excision of lymphatic malformations/ neck masses
- Thyroidectomy
- Repair of H-type TEF

Thorax:

- Bronchoscopy - foreign body extraction
- Esophagoscopy - foreign body extraction , dilatation
- Repair of Pectus Excavatum
- Repair of Pectum Carinatum
- Thoracoscopic procedures, VATS for empyema
- Mediastinal mass excisions
- Pulmonary resection
- Esophageal replacement.

Abdomen:

- Abdominal wall defects - Silo construction
- Surgery for varicocele
- Orchidopexy- lap assisted
- Duodeno-duodenostomy
- Neonatal small bowel atresia – resection, anastomosis
- Laparoscopy - therapeutic, major
- Pull through for Hirschsprung disease
- Excision of duplication cyst
- Operations for necrotizing enterocolitis
- Anorectal myectomy
- Surgery for high anorectal malformation: PSARP, ASARP, AP Pull through etc.
- Colonic resections
- Kasai's portoenterostomy
- Operations for choledochal cyst
- Liver abscess drainage
- Operation for liver hydatid
- Hepatic resection
- Operation for portal hypertension
- Operation for pancreatic pseudocysts
- Pancreatic resection
- Pancreatico-enteric anastomosis
- Adrenalectomy

Genitourinary

- Nephrectomy Nephroureterectomy
- Partial nephrectomy
- Cystoscopy, fulguration of PUV
- Pyeloplasty
- Ureterocele incision

- Ureterostomy
- Ureteric reimplantation
- Urolithiasis - nephrolithotomy, ureterolithotomy
- Exstrophy repair (turn in)
- Bladder augmentation
- Mitrofanoff procedure
- Bladder neck repair
- Ureterosigmoidostomy
- Epispadias repair
- Colonic conduit
- Urethroplasty for Hypospadias
- Operation for intersex disorder
- Correction of penoscrotal transposition

Oncosurgery

- Pediatric solid tumour surgery for Wilms' tumour, Neuroblastoma, Hepatoblastoma, Sacrococcygeal teratoma, Germ cell tumours, Thoracic tumours, Head & Neck tumours, Genitourinary tumours, Soft tissue tumours, Common bone tumours, Lymphomas

Neurosurgery

- Repair of encephalocele
- Repair of occult spinal dysraphism

In addition to the above procedures, the student must be familiar with, prepared a patient for and should have witnessed procedures like:

- UGI endoscopy and variceal sclerotherapy / banding,
- Colonoscopy,
- Extracorporeal shock wave lithotripsy, Percutaneous nephrolithotomy.

4. SYLLABUS

Course contents:

A. Cognitive domain

The following is a broad outline of the syllabus:

1. Basic sciences as applied to Pediatric Surgery

- Medical genetics and gene therapy.
- Antenatal diagnosis and fetal intervention
- Developmental and transitional physiology of the respiratory, cardiovascular and renal systems

- Neonatal physiology and assessment of the surgical neonate.
- Neonatal sepsis
- Nutrition – enteral, parenteral
- Vascular access

- Principles of imaging (radiodiagnosis, nuclear) in Pediatric practice
- Pharmacology and use of common drugs , antibiotics and policy
- Pediatric analgesia and anaesthesia , critical care , mechanical ventilation
- General principles of Endoscopy and Minimal Access Surgery – fetoscopy, genitourinary endoscopy, tracheo-bronchoscopy, laparoscopy, thoracoscopy, robotic surgery

- Biomedical ethics and legal issues in Pediatric surgical practice.
- The organisation of a Pediatric Surgical unit
- HIV/AIDS in children
- National health policy-programs pertinent to Pediatric practice
- Telemedicine and telesurgery - principles , practice and limitations

2. Trauma

- Birth trauma
- Pediatric trauma – general principles.
- Thoracic, abdominal, genitourinary, central nervous system trauma
- Soft tissue and envenomation injuries
- Musculoskeletal and vascular trauma
- Burns
- Child abuse.

3. Pediatric Oncology

- General principles of oncology, radiotherapy and chemotherapy
- Wilms' tumor
- Neuroblastoma
- Liver tumours

- Rhabdomyosarcoma
- Germ cell tumours
- Other tumor of childhood (outline)-Leukemias, Lymphomas, Bone tumours, CNS tumours,
- Retinoblastoma

4. Transplantation

- General principles
- Kidney and liver transplantation
- Outline of other solid organ and bone marrow transplantation

5. Head and Neck Disorders

- Craniofacial anomalies
- Cleft lip and palate
- Disorders of the upper airway and oral cavity.
- Salivary glands
- Disorders of lymph nodes.
- Thyroid and parathyroid gland
- Cysts and sinuses of the neck
- Torticollis

6. Thoracic Disorders

- Congenital chest wall deformities.
- Disorders of the breast.
- Diaphragmatic hernia and eventration
- Mediastinal mass lesions.
- Endoscopy of the upper aerodigestive tract.
- Congenital tracheal and Bronchopulmonary/ foregut malformations
- Infective pleuro-pulmonary condition.
- Congenital oesophageal anomalies

- Oesophageal motility disorders ,achalasia cardia , gastro-esophageal reflux
- Oesophageal rupture, injury, stricture, perforation.
- Oesophageal replacement.

7. Abdominal Disorders

- Umbilical disorders and abdominal wall defects.
- Inguinal hernias and hydroceles
- Testicular maldescent, torsion
- Hypertrophic pyloric stenosis.
- Duodenal atresia, annular pancreas.
- Jejunoileal atresia and stenosis
- Meconium ileus
- Meckel's diverticulum
- Intussusception.
- Disorder of midgut rotation.
- Short bowel syndrome
- Gastrointestinal endoscopy and laparoscopy.
- Gastrointestinal bleeding
- Gastrointestinal duplications.
- Mesenteric and omental cysts
- Ascites
- Polypoid disease of the GIT
- Necrotising enterocolitis.
- Intestinal stomas
- Primary peritonitis.
- Inflammatory bowel disease in children.
- Colonic atresia and functional obstruction.
- Appendicitis
- Hirschsprung disease, neuromuscular disorders of intestines
- Anorectal malformations.
- Congenital short colon /pouch colon

- Colonic and rectal tumours
- Neonatal/Infantile obstructive cholangiopathy
- Congenital biliary dilatation.
- Infective and inflammatory hepatobiliary disorders
- Benign liver tumours
- Portal hypertension
- Disorders of the pancreas
- Splenectomy and post-splenectomy sepsis.
- Adrenal gland.

8. Genitourinary and related disorders

- Renal agenesis, dysplasia, cystic disease, ectopia
- Pelvic ureteral junction obstruction
- Vesicoureteric reflux
- Infective and inflammatory renal disorder.
- Pediatric urolithiasis
- Congenital ureteric anomalies.
- Prune belly syndrome
- Urinary diversion and undiversion, bladder augmentation
- Disorders of bladder function.
- Structural bladder disorders
- Exstrophy – epispadias complex
- Hypospadias.
- Anomalies of the external genitalia
- Disorders of Sex Differentiation
- Abnormalities of the female genital tract.

9. Miscellaneous Pediatric Surgical Disorders

- Spina bifida
- Hydrocephalus
- Congenital heart disease

- Congenital orthopaedic deformities
- Amputation, bone and joint infections
- Conjoined twins
- Hemangiomas & vascular malformations.

5. TEACHING AND LEARNING METHODS

Teaching programs will need to be held on all working days (at least one hour per day)

Activities
Journal Club
Didactic lectures
Seminars/ Webinars
Hospital (Grand Rounds/Clinical meeting/Audit meet)
Clinical Case Presentation/ presentation to multidisciplinary tumour boards

5.1 TEACHING AND LEARNING METHODS

General principles - Acquisition of practical competencies being the cornerstone of post graduate medical education, PG training should be skills oriented. Learning in PG program should be essentially self-directed and primarily emanating from clinical and academic work. The formal sessions are merely meant to supplement this core effort. The post graduate student should be given the responsibility of managing and caring for patients in a gradual manner under supervision.

Formal teaching sessions: This should include regular bedside case presentations and demonstrations, didactic lectures, seminars/Webinars, journal clubs, clinical meetings, and combined conferences with allied departments, Audit meet, clinical case presentation etc. as per sample schedule given below:

Didactic Lectures by faculty: In addition, lectures covering recent advances in all aspects of pediatric surgical conditions would be taken by faculty. All post graduate students will be required to attend these lectures.

Short term courses on the following basic and clinical aspects must be included:

- Research methodology and bio-statistics
- Laboratory medicine techniques/courses relevant to Pediatric Surgery
- Use of computers/ data science management in medicine,
- Bioethics, ethical issues involved in pediatric surgery
- Hospital waste management,
- Health economics.

5.1. The M.Ch. Pediatric Surgery training program will include two main arms:

5.1.1. Formal training and learning

5.1.2. Experiential learning

5.1.1. Formal training and learning will include the topics listed in the syllabus: The **modalities for formal training** will be as follows:

- 1. Seminars/Webinars:** To be held once a week and presented by the trainee under supervision of teaching faculty.
- 2. Journal Review:** To be held once a week under supervision of teaching faculty. It should include discussion on recent articles, which relate to various topics in Pediatric Surgery and allied disciplines.
- 3. Clinical Case presentation:** Representative clinical cases shall be presented and discussed in detail in presence of faculty.
- 4. Operative procedures:** This session, recommended once a month, aims at discussing common operative procedures and practical details.
- 5. Treatment Planning:** The trainee must discuss the planning of a given patient who is being worked up for surgery. The idea of this academic exercise is to familiarize the trainee with the objectives of planning in a given patient through group discussion/ multidisciplinary tumour boards based on evidence-based medicine.
- 6. Pediatric Radiology/Nuclear Medicine conferences** should be held once a week in which the radiological and nuclear medicine investigations of various cases are discussed in consultation with the faculty of Radiology and Nuclear Medicine.

7. **Clinical grand rounds:** A clinical grand round, involving presentation of unusual and difficult cases, is to be done by a post graduate student, once a week, in the presence of all the clinical staff belonging to the department of Pediatric surgery. The exercise is to develop the clinical acumen of the trainee.
8. **Clinico-pathological conference:** Special emphasis is made on the surgical pathology, histology review and autopsy discussions.
9. **Lecture/discussion:** Lectures on newer topics by faculty, in place of seminar, is to be arranged as per need.
10. **Teaching and training responsibilities (Pedagogy skills):** A final year M.Ch. trainee should be entrusted with the responsibilities of teaching post graduate students of General Surgery and allied disciplines.
11. **Training in research methodology:** The purpose of the exercise is to impart proficiency in research methodology to the trainee. This would be a mandatory component of training. All M.Ch. trainees must complete research projects as per requirement of concerned Universities, under the supervision of a principal supervisor and appropriate number of co-supervisors which would enable the trainee to attain proficiency in collecting clinical / experimental data and analyze them in a scientific way using appropriate statistical methods.
12. **Attendance and presentation at academic meets:** The student must attend accredited scientific meetings (CME, symposia, and conferences) once or twice a year. He should present at least one poster or read one paper at a national/state conference in Pediatric Surgery or sub-speciality (Pediatric Urology, Pediatric Surgical Oncology etc.) during the second and third year of the training period.
13. **Research Publication (Research skills):** A student has to present one paper which is published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate degree examination. The research has to be done under the direct supervision of the supervisor or his associate(s). Through this exercise, the trainee would learn how to collect and analyze data, make observations in a scientific manner, and use appropriate statistical methodology. The trainee would learn the

art of putting the outcome of observations and results in an appropriate format of a scientific paper that is relevant to a particular journal.

14. **Use of Skills lab stations:** The skills lab must facilitate training and acquisition of both common (e.g. endotracheal intubation, ICT drainage, Central line insertion) skills in real life situations and uncommon skills (laparoscopic suturing, cricothyroidotomy etc.) that the student may not encounter often.
15. **Mortality and morbidity (Audit) meetings:** Departmental and interdepartmental / institutional

5.1.2. Experiential learning

Apart from routine postings in ward, OPD, operation theatre and speciality clinics, the M,Ch (Pediatric Surgery) trainee will be posted in the following allied specialities. The total duration of these postings shall not exceed three months. There is no specified compulsory posting in Emergency Medicine/Casualty; however, the student will attend the emergency cases pertaining to/referred to their department at the Emergency/Casualty in the course of the routine clinical duties.

1. **Pediatric Intensive Care Unit: Duration- 2-4 weeks.** This is intended to familiarize the student to the principles of pediatric medical intensive care and its applications to pediatric surgical care.
2. **Neonatology Intensive Care Unit: Duration- 2-4 weeks.** During this posting, the candidate will receive training on care of the sick neonates, particularly premature and small for date.
3. **Optional External Posting:** Other postings may be scheduled as deemed necessary for the fulfilment of curricular demands, e.g. Pediatric Oncology, etc. in the third year, in the same or in another tertiary teaching Centre/Institute. The posting in another institute may be for a special training that is currently not available at the home institute. It may be for 4-8 weeks with the prior approval of the Head of the Institution. Prescribed institutional regulations will be adhered to for such an external posting.
4. **Administrative experience:** The final year post graduate student should be entrusted with administrative responsibilities including preparation of academic

programme, patient management, functioning of the ward and outpatient department. These may include:

- Admission of patients,
- Preparing the operation theatre lists,
- Improving the functioning in the ward through the supervisor,
- Preparing list of topics for teaching of junior trainees posted in the department,
- Organizing the posting of trainees in various work stations of the department as per the demand of the situation.

5. Log Book

The trainees must maintain a log book of the work carried out by them and the training program undergone during the period of training including details of the surgical operations assisted or done independently. The log book should be checked and assessed periodically by the faculty members imparting the training.

During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently. For this purpose, provision of skills laboratories in medical colleges is mandatory.

6. ASSESSMENT

A. FORMATIVE ASSESSMENT during the training includes:

- | | |
|-----------------------------------|--------------------------------------|
| • Personal attributes | Ongoing after each clinical posting |
| • Clinical skills and performance | -do- |
| • Academic activities | -do- |
| • Theory assessment | End of 1-, 2- and at 2years 9 months |
| • Practical assessment | -do- |

Clinical skills and performance, academic performance and personal attributes shall be graded on a scale of 1 to 5 (5 being the highest). The academic presentations shall be graded at the time of presentation by the faculty in-charge. Evaluation on clinical skills and personal

attributes etc. shall be done by the unit/department in-charge at the end of every semester. The student to be assessed periodically as per categories listed in post graduate student appraisal form (Annexure I).

B. SUMMATIVE ASSESSMENT at the end of the training will be as follows:

The **M.Ch. examination** shall be in two parts:

1. **Theory:** There shall be four theory papers as follows:

Paper I: Basic Sciences in Pediatric Surgery, Trauma, Transplantation

Paper II: Regional Pediatric Surgery (Head and Neck, Thorax),
Pediatric Oncosurgery

Paper III: Regional Pediatric Surgery (Abdomen, Genitourinary)

Paper IV: Recent advances in Pediatric surgery

The theory examination shall be held in advance before the clinical and practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/practical/oral examination. The post graduate students for M.Ch in Pediatric surgery will be examined also in surgical procedures.

2. **Practical:** The practical examination should consist of the following and should be spread over two days, if the number of candidates appearing is more than one:

a. Four cases from various sections of Pediatric surgery/subspecialities: History taking, physical examination, interpretation of clinical findings, differential diagnosis, investigations, prognosis and management.

b. Ward rounds comprising of discussion of practical problems in the management of pediatric patients undergoing surgery.

c. Viva-voce examination

- Instruments and operative procedures
- Radiology and imaging
- Surgical Pathology

- Thesis and logbook evaluation

3. Theory and Practical examination will be conducted as per University guidelines.

Other recommendations: Systematic and periodic formative assessment should be done every 6 months and feedback should be given to trainee.

Recommended Reading:

Books (latest edition)

1. Coran AG, Adzick NS, Krummel TM, Laberge JM, Shamberger RC, Caldamone AA. Pediatric Surgery, 7Ed: Elsevier - Health Sciences Division; 2012.
2. Holcomb GW, Murphy JP, Peter SD. Holcomb and Ashcraft's Pediatric Surgery, 7Ed: Elsevier; 2019.
3. Hutson JM, Brien MO, Woodward AA, Beasley SW. Jones Clinical Pediatric Surgery: Diagnosis and Management, 6Ed: Wiley-Blackwell;2008.
4. Docimo SG, Canning D, Khoury A, Salle JLP. The Kelalis-King-Belman Textbook of Clinical Pediatric Urology, 6Ed: CRC Press; 2018.
5. Pizzo PA, Poplack DG, Adamson PC, Blaney SM, Helman L. Principles and Practice of Pediatric Oncology, 7Ed: Wolters Kluwer; 2016.
6. Davenport M, Spitz L, Coran A. Operative Pediatric Surgery, 7 Ed: CRC Press;2013
7. Holcomb GW, Rothenberg SS. Atlas of Pediatric Laparoscopy and Thoracoscopy, 2 Ed: Elsevier;2021.
8. Eichenwald EC, Hansen AR, Stark AR, Martin C. ClohertyandStark's Manual of Neonatal Care, 8Ed: Wolters Kluwer; 2017.
9. Kliegman RM, Stanton BMD, Geme JS, Schor NF. Nelson Textbook of Pediatrics: Elsevier Health Sciences, 21 Ed; 2019.
10. Farquharson M, Hollingshead J, Moran B. Farquharson's textbook of Operative General Surgery, 10 ed: CRC Press;2015.
11. Gray SW, Skandalakis JE. Embryology for surgeons: the embryological basis for the treatment of congenital defects, 2 ed: Lipincott Williams and Wilkins; 1994.
12. Glover T, Mitchell K. An Introduction to Biostatistics, 3 ed: Waveland Press;2015.

13. David L. Katz, Joann G. Elmore, Wild D, Sean C Lucan. *Jekel's Epidemiology, Biostatistics, Preventive Medicine, and Public Health: Elsevier Health Sciences*; 2013.
14. Coley BD. *Caffey's Pediatric Diagnostic Imaging*, 13 ed: Elsevier; 2018.
15. Husain AN, Dehner LP. *Stocker and Dehner's Pediatric Pathology*, 5 ed: LWW; 2021.
16. Holschneider AM, Hutson JM. *Anorectal Malformations in Children: Embryology, Diagnostics, Surgical Treatment and Follow up: Springer*, 2006.
17. Puri P. *Newborn Surgery*, 4 ed: CRC Press;2019.
18. Hadidi A, David MA. *Hypospadias Surgery: An Illustrated Guide: Springer*;2013.
19. Barry P, Morris K. *Pediatric Intensive Care (Oxford Specialist Handbooks in Pediatrics)*, 1 ed: Oxford University Press; 2017.
20. Papandria DJ, Besner GE, Moss RL, Diefenbach KA. *Operative Dictations in Pediatric Surgery*, 1 ed: Springer; 2019.

Journals

3-5 international and two national journals (all indexed).

Essential

- Journal of Indian Association of Pediatric Surgeons
- Journal of Pediatric Surgery
- Pediatric Surgery International
- European Journal of Pediatric Surgery
- Journal of Pediatric Urology
- Seminars in Pediatric Surgery
- British Journal of Urology International Indian Pediatrics
- Indian Journal of Pediatrics

Optional

- The Journal of Pediatrics
- Pediatrics
- Pediatrics Clinics of North America
- Any other relevant journal pertaining to pediatric surgery

**Postgraduate Students Appraisal Form
Clinical discipline**

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory			Satisfactory			More Than Satisfactory			Remarks
		1	2	3	4	5	6	7	8	9	
1.	Journal based / recent advances learning										
2.	Patient based /Laboratory or Skill based learning										
3.	Self directed learning and teaching										
4.	Departmental and interdepartmental learning activity										
5.	External and Outreach activities / CMEs										
6.	Thesis / Research work										
7.	Log Book maintenance										

Publications

Yes/ No

Remarks* _____

*REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT

SIGNATURE OF HOD

**COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR
M. Ch. (CVTS)**

Preamble

M. Ch. (CVTS) course is designed to train post graduates of cardiac surgery in principles and practice of cardiovascular and thoracic care.

Incidence of cardiac, vascular & thoracic disease is found to be increasing in India over the past decade. Atherosclerosis affects coronary arteries, aorta and peripheral arteries resulting in aneurysmal and occlusive diseases. Advanced age, smoking, consumption of alcohol, over eating, obesity, physical inactivity coupled with diabetes and hypertension are found to enhance the disease process. Aneurysm eventually ruptures threatening life and arterial blockade leads to malfunction of organ leading to stroke, heart attack, kidney failure and leg ischemia. In addition, varicose veins and deep vein thrombosis with serious potential complications involving veins are also on the rise. Chronic smoking, consumption of tobacco may lead to COPD and lung cancers.

Beyond the current schedules for teaching and managing patients in select centres, the speciality needs to be revamped by Structured Programmes at national level to train super specialists for optimal healthcare delivery to scores of patients affected with cardiac illnesses, lung and vascular surgery. Cardiovascular & thoracic afflictions lead to enormous morbidity and mortality currently because of increased prevalence of risk factors along with demographic transition in our society. In addition, management of cardiovascular and thoracic trauma is attaining critical attention in view of the escalating accidents and injuries resulting in loss of young lives and man power. In a large country like ours, a concerted approach to train cardiovascular and thoracic surgeons at several centres is mandatory to meet the growing needs of our patients in future in order to provide quality of life and ability to pursue their profession.

Goal:

M.Ch. (Cardio Vascular & Thoracic Surgery) course is designed to train the candidates in the principles and practice of Cardiovascular & Thoracic Surgery, to equip them to function as faculty / consultants and researchers. The aim of Post graduate Medical Education shall be to produce competent specialists and Medical teachers who shall:

1. recognize the health needs of the community, and carry out professional obligations ethically and in keeping the objectives of the national health policy.
2. have mastered most of the competencies pertaining to the specialty that are required to be practiced at the secondary and the tertiary levels of the health care delivery system;

3. be aware of the contemporary advances and developments in the discipline concerned;
4. have acquired a spirit of scientific enquiry and is oriented to the principles of research methodology and epidemiology.
5. have acquired the basic skills in teaching of the medical and paramedical professionals.

SCOPE OF CARDIO VASCULAR AND THORACIC SURGERY

Diseases concerning heart, arteries, veins, lungs and lymphatics in the human body.

SUBJECT SPECIFIC OBJECTIVES

The objectives are:

1. To have scientific approach in cardiovascular and thoracic illness.
2. To be able to decide on optimal therapeutic strategy ranging from the risk factor modifications, medical intervention and surgical options appropriately.
3. To train and perform elective and emergent cardiovascular and thoracic surgery procedures (CABG, valve replacement / repair, congenital heart procedures, lung diseases like pneumothorax, empyema, bronchiectasis, tumours of lung, embolectomy, peripheral vascular reconstructions, repair of abdominal aortic aneurysm, carotid revascularization, surgery for venous insufficiency, endovascular therapies for occlusive, aneurysmal diseases and AV malformations).
4. To be able to develop interdisciplinary partnership with Cardiac anaesthetist, Neurologist, Cardiologist, Radiologist, Pulmonologist, Perfusionist and Nephrologist.
5. To train specialists to handle common cardiovascular and thoracic illnesses, emergencies including chest trauma, vascular trauma, at respective institutions. To update recent knowledge and to keep pace with rapid advances in the progress of cardiovascular and thoracic surgery.
6. To train specialists to handle common cardiovascular and thoracic illnesses, emergencies including chest trauma, vascular trauma, at respective institutions. To update recent knowledge and to keep pace with rapid advances in the progress of cardiovascular and thoracic surgery.
7. To sensitize the trainee to newer learning methods and research tools and to encourage clinical research.
8. To plan and execute mass screening programmes and organise preventive methodology.
9. To publish papers in indexed journals during the training period.

SUBJECT SPECIFIC LEARNING METHODS

a) Cognitive domain (Knowledge)

The trainee should already possess knowledge of basic sciences and the training in general surgical skills. Trainee will learn the anatomy and physiology of heart, lungs and arteries, the pathological changes in these and the effects on end organs. The spectrum of pathologies to be mastered during the course are heart, thoracic and vascular diseases.

b) Clinical Diagnosis

The mainstay of cardiovascular and thoracic diagnosis is clinical examination and most of the time the symptoms dictate the therapy rather than the diagnostic tests. The art of clinical examination of cardiovascular & thoracic patients should be efficiently learned by the students.

c) Non-invasive Laboratory

It is an indispensable part of cardiovascular and thoracic diagnosis and many times supersedes the more invasive and sophisticated techniques. The use of electrocardiogram, echocardiogram (transthoracic / transesophageal), CT/MRI, PET scan, duplex scan, hand held Doppler is an essential part of training of cardiovascular and thoracic surgeons.

d) Prevention of cardiovascular and thoracic diseases

Cardiovascular & thoracic surgeons should actively be involved in risk factor modification of their patients by counselling and referral to rehabilitation, to prevent progression or recurrence of the diseases namely cessation of smoking, control of diabetes & hypertension, regular exercise and lifestyle modification and food habits.

e) Cardiovascular and thoracic surgical techniques:

The spectrum involves surgical management of heart and lung diseases, repair of all blood vessels of the body with the exception of intracranial vessels. The student should learn the exposure of heart, lungs and all vessels. The basic suturing techniques and use of various types of synthetic materials and grafts in elective and emergency situations. He should be able in handling chest and vascular trauma and embolectomy. Trainee should be well trained in initiation of ECMO, minimally invasive surgery and managing the patients on ventricular assist devices.

f) Endovascular Intervention:

Cardiovascular and thoracic surgeons should learn rapidly advancing interventional procedures. Many diseases which are treated surgically might be treated by endovascular procedures. Every trainee should be familiar with techniques of TAVR and TAVI. They should also possess theoretical knowledge of advanced procedures like stent grafting of aneurysm, use of rota ablator, IVUS and other emerging modalities of endovascular therapies.

g) Cardiovascular and thoracic Medicine & General Management

Cardiovascular and thoracic surgeons should be trained in the use of pharmacotherapeutic agents like anti-anginal, anti-hypertensive, anti-arrhythmic, anticoagulants, anti-platelet, lipid lowering drugs and use of bronchodilators and use of steroids & anti-failure drugs. Cardiovascular and thoracic surgeons should also learn to supervise physical therapy exercise programmes.

SYLLABUS

SUBJECT SPECIFIC THEORETICAL COMPETENCIES

1. Cognitive Domain:

A list of objectives related to knowledge and higher cognitive abilities that are expected to be achieved during the course is given.

At the end of the training, the candidate must be able to:

- Describe etiology, pathophysiology, principles of *diagnosis* and management of common surgical problems including emergencies, in adults and children.
- Describe cardiac, vascular and thoracic benign and malignant neoplasms in the country and their management including prevention.
- Demonstrate understanding of basic sciences relevant to Cardio Vascular & Thoracic Surgery
- Recognize conditions that may be outside the area of his specialty/competence and to refer them to the proper specialist.
- Advice regarding the operative or non-operative management of the case and to carry out this management effectively.

- Update by self-study and by attending courses, conferences and seminars relevant to cardiac surgery.
- Teach and guide his / her team, colleagues and other students.
- Undertake audit, use information technology tools and carry out research, both basic and clinical, with the aim of publishing his/her work and presenting his/her work at various scientific forum.

A. Applied Basic Sciences:

❖ Anatomy:-

- Cardiovascular & Thoracic Anatomy.
- Functional & Surgical Anatomy related to Cardiovascular & Thoracic Surgery.
- Development of Cardio Thoracic Vascular Systems & related developmental anomalies.
- Vascular System & related anatomy in Nervous system, Spinal Cord.

❖ Physiology: -

- Cardiac system:- eg: Physiology of the heart
- Respiratory System:- i.e., physiology of respiratory system.
- Physiological functions of heart in normal & abnormal conditions, various congenital anomalies.
- Physiology & Respiratory system in normal & abnormal conditions
- Biochemistry of Acid Base –Balance
- Normal & Abnormal Cardiovascular & Thoracic related diseases in Renal, Gastrointestinal system & its involvement,

- Pathology & Microbiology: - Related to Cardiovascular & Thoracic Surgery in normal & abnormal conditions.
- Pharmacology: Effect of Drugs, Pharmacological actions, role in various Cardiovascular & Thoracic Surgery related conditions.

❖ Cardio Thoracic & Vascular Radiology

- Plain- Radiology
- Angiography
- CT Angiography
- CT Scans
- Digital Subtraction Angiography
- M.R.I.
 - Conventional MRI
 - MRI- Angiography
 - Functional MRI
- Doppler Study
- Pathology

B. Clinical competencies- Knowledge in subject

- Ischemic heart disease :
 - Stenotic coronary artery disease
 - Left ventricular aneurysm
 - Post infarction VSD
 - Ischemic Mitral regurgitation
- Valvular heart disease
 - Mitral valve disease
 - Tricuspid valve disease
 - Aortic valve disease
 - Multivalvular disease
- Congenital heart disease
 - Sequential segmental analysis
 - ASD and PAPVC
 - TAPVC
 - Cor triatrium
 - Unroofed coronary sinus syndrome
 - A V canal defect
 - VSD
 - Congenital RSOV
 - Patent ductus arteriosus
 - Tetralogy of Fallot and its variants
 - Pulmonary atresia with and without intact IVS
 - Tricuspid atresia and the Fontan operation and its variants
 - Ebstein's anomaly
 - Truncus arteriosus

- Aortopulmonary window
 - Congenital coronary anomalies
 - Congenital aortic stenosis
 - HOCM
 - Congenital mitral valve disease
 - Congenital pulmonary vein stenosis
 - Vascular rings and slings
 - Transposition of the great vessels
 - DORV
 - CTGA
 - A V discordant connections
 - Single ventricle variants
 - Anatomically corrected Malposition of great arteries
- Vascular Surgery
 - Surgical approach to Vascular disease, the vascular consultation and evaluation and selection for vascular surgery
 - Hemodynamics and Diagnosis of arterial diseases including diagnostic modalities.
 - Vascular physiology
 - Vascular surgical anatomy and embryology
 - Pathology of arterial diseases
 - Atherosclerosis,
 - Buerger's disease,
 - Nonspecific arteritis,
 - Arterial fibrodysplasia
 - Pathological intimal hyperplasia as a response to vascular injury and reconstruction
 - Uncommon arteriopathies
 - Fundamental therapeutic and technical considerations including anti thrombotic therapy, circulation enhancing drugs, thrombolytic therapy, PTCA, basic surgical techniques in vascular surgery including micro vascular techniques, Fogarty embolectomy, endarterectomy and vascular anastomosis
 - Perioperative management and intensive care of patients undergoing major vascular surgery.
 - Blood replacement in vascular surgery and management of hemostasis
 - Intraoperative assessment of technical adequacy
 - Evaluation of results and reporting
 - Vascular grafts
 - Complications of vascular surgery and their management
 - Acute Ischemia and its sequelae including arterial trauma and Thromboembolism
 - Chronic Ischemia of the lower extremities and its management
 - Neurovascular conditions involving the upper extremity
 - Arterial aneurysms
 - Arteriovenous communications
 - Visceral Ischemic syndromes
 - Reno vascular disorders
 - Extra cranial cerebrovascular disease
 - Extremity amputation for vascular disease
 - Recent advances in vascular surgery

- TEVAR
- **Thoracic Surgery**
 - Surgical Anatomy of the thoracic organs including embryology
 - Physiology of gas exchange, mechanics of breathing and Oesophageal motility.
 - Radiology and imaging of the chest
 - Diagnostic procedures in the management of thoracic diseases
 - Surgical Pathology of thoracic organs
 - Assessment of the thoracic surgical patient
 - Anesthetic management of the thoracic surgical patient
 - Postoperative management including ventilatory support and physical therapy
 - Operative procedures in thoracic surgery
 - Thoracic incisions, pulmonary resections, sleeve resection and, conservative lung surgery, superior sulcus tumors, thoracoplasty, decortication, tracheal surgery, esophageal surgery including resection and its replacement. Endoscopy and VATS'
 - Thoracic trauma, ARDS, foreign bodies in the aero-digestive tract.
 - Chest wall disorders- deformities, infections, thoracic outlet syndrome, Chest wall tumours and chest wall reconstruction
 - Diaphragmatic disorders -paralysis, congenital diaphragmatic hernia and diaphragmatic pacing
 - Pleural disorders- benign and malignant effusions and tumors, chylothorax, infections of the pleura, empyema, primary pleural tumours
 - Tracheal disorders including benign and malignant disease - tracheal resections and other surgical modalities
 - Pulmonary disorders- congenital lesions, compressive vascular lesions, bullous disease, bacterial diseases, bronchial compressive diseases, pulmonary tuberculosis and the surgeon, hydatid disease, diffuse lung disease and lung transplantation, bronchial adenoma. Carcinoma of the lung, benign and other malignant tumours of the lung, pulmonary secondary tumours.
 - Esophageal disorders
 - Congenital anomalies, motility disorders, diverticula, hiatus hernia and GERD, esophageal strictures, Barrett's esophagus, benign tumours, cysts and duplication of the esophagus, Esophageal cancer
 - Mediastinum – mediastinal infections, primary tumours, thymic disorders including myasthenia gravis, thymic tumours
 - Radiation therapy including basic principles of radiation therapy for cancer, radiation for carcinoma of the lung. esophagus and other thoracic disorders. Chemotherapy - Principles and chemotherapy for NSCLC and small cell lung cancer, esophagus and mediastinal tumours.
 - Immunotherapy
 - Recent advances in thoracic surgery
- Cardiac Arrhythmias and their surgical correction
- Cardiac trauma
- Cardiac neoplasms -benign and malignant - their management including prevention
- Cardiomyopathy
- Surgical management of the failing heart, Cardiac and Lung transplantation, ventricular

assist devices, IABP, cardiomyoplasty

- Pericardial disease
- Acute traumatic aortic transection
- Acute aortic dissection
- Chronic thoracic and thoraco-abdominal aneurysms
- Genetics, gene therapy
- Recent advances in cardiac surgery
- Conduct and monitoring of CPB.
- Counter pulsation techniques
- ECMO
- Ventricular assist devices

2. Affective Domain

- The candidate should :
 - Adopt ethical principles in all aspects of his/her surgical practice. Professional honesty and integrity are to be fostered. Surgical care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
 - Develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient.
 - Provide leadership and get the best out of his/her team in a congenial working atmosphere.
 - Apply high moral and ethical standards while carrying out human research.
 - Be humble and accept the limitations in his/her knowledge and skill and to ask for help from colleagues when needed.Respect patient's rights and privileges including patient's right to information and right to seek a second opinion.

3. Psychomotor Domain

The post graduate student should acquire the following practical competencies:

- The candidate should :
 - Take a proper clinical history, examine the patient, perform essential diagnostic procedures and order relevant tests and interpret them to come to a reasonable diagnosis about the surgical condition.
 - Perform minor and major operative procedures independently or with the help from a senior surgeon.
 - Provide both basic and advanced life support
 - Manage cardiovascular and thoracic emergencies and trauma
 - Under take wound management
 - Be able to perform peri-operative and postoperative patient monitoring.

- Undertake complete patient monitoring including the preoperative and postoperative care of the patient.
Undertake innovative / clinical outcome oriented research projects and publishing them in indexed journals.

Exposure to cardiovascular and thoracic procedures:

Candidates shall be familiarized in the following procedures.

- Cardiac

Repair of :

- Ischemic heart disease :
 - Stenotic coronary artery disease
 - Left ventricular aneurysm
 - Post infarction VSD
 - Ischemic Mitral regurgitation
- Valvular heart disease
 - Mitral valve disease
 - Tricuspid valve disease
 - Aortic valve disease
 - Multivalvular disease
- Congenital heart disease
 - Sequential segmental analysis
 - ASD and PAPVC
 - TAPVC
 - Cor triatrium
 - Unroofed coronary sinus syndrome
 - A V canal defect
 - VSD
 - Congenital RSOV
 - Patent ductus arteriosus
 - Tetralogy of Fallot and its variants
 - Pulmonary atresia with and without intact IVS
 - Tricuspid atresia and the Fontan operation and its variants
 - Ebstein's anomaly
 - Truncus arteriosus
 - Aortopulmonary window
 - Congenital coronary anomalies
 - Congenital aortic stenosis
 - HOCM
 - Congenital mitral valve disease
 - Congenital pulmonary vein stenosis
 - Vascular rings and slings

- Transposition of the great vessels
- DORV
- CTGA
- A V discordant connections
- Single ventricle variants
- Anatomically corrected Malposition of great arteries

- Thoracic

- Thoracic Incisions
- Pulmonary Resections
- General Features of Pulmonary Resections Technical Aspects of Lobectomy
- Sleeve Lobectomy
- Pneumonectomy and Its Modifications Tracheal Sleeve Pneumonectomy
- Segmentectomy and Lesser Pulmonary Resections
- Emphysema Surgery
- Instruments and Techniques of Video-Assisted Thoracic Surgery Video-Assisted Thoracic Surgery for Wedge Resection, Lobectomy, And Pneumonectomy
- Median Sternotomy and Parasternal Approaches to the Lower Trachea and Main Stem
- Bronchi
- Extended Resection of Bronchial Carcinoma in the Superior Anterior Approach to Superior Sulcus Lesions
- Complications of Pulmonary Resection
- Management of Perioperative Cardiac Events
- Chest Wall
 - Chest Wall Deformities Infections of the Chest Wall
 - Thoracic Outlet Syndrome
 - Thoracoscopic Sympathectomy
 - Anterior Transthoracic Approaches to the Spine
 - Chest Wall Tumors
 - Chest Wall Reconstruction
- The Diaphragm
 - Diaphragmatic Function, Diaphragmatic Paralysis, and Eventration of the Diaphragm
 - Pacing of the Diaphragm
 - Congenital Posterolateral Diaphragmatic Hernias and Other Less
 - Common Hernias of the Diaphragm in Infants and Children
 - Foramen of Morgagni Hernia
 - Tumors of the Diaphragm
- The Pleura
 - Pneumothorax
 - Parapneumonic Empyema
 - Postsurgical Empyema
 - Tuberculous and Fungal Infections of the Pleura
 - Fibrothorax and Decortication of the Lung
 - Thoracoplasty: Indications and Surgical Considerations

- Localized Fibrous Tumors of the Pleura
- Diffuse Malignant Mesothelioma
- Technique of Extrapleural Pneumonectomy for Diffuse Malignant Pleural Mesothelioma
- Uncommon Tumors of the Pleura
- Malignant Pleural Effusions
- Malignant Pericardial Effusions

- Thoracic Trauma
 - Blunt and Penetrating Injuries of the Chest Wall, Pleura, and Lungs
 - Barotrauma and Inhalation Injuries
 - Acute Respiratory Distress Syndrome
 - Management of Foreign Bodies of the Airway
 - Diaphragmatic Injuries

- The Trachea
 - Tracheostomy
 - Techniques of Resection and Reconstruction of trachea
 - Management of Nonneoplastic Diseases of the Trachea
 - Benign and Malignant Tumors of the Trachea
 - Compression of the Trachea by Vascular Rings

- Congenital, Structural, and Inflammatory Diseases of the Lung
 - Congenital Lesions of the Lung
 - Pulmonary Complications of Cystic Fibrosis
 - Congenital Vascular Lesions of the Lungs
 - Chronic Pulmonary Emboli
 - Bullous and Bleb Diseases of the Lung
 - Emphysema of the Lung and Lung Volume Reduction Operations
 - Bacterial Infections of the Lungs and Bronchial Compressive Disorders
 - Pulmonary Tuberculosis and Other Mycobacterial Diseases of The Lungs
 - Surgery for the Management of Mycobacterium Tuberculosis and Nontuberculous Mycobacterial Infections of the Lung
 - Thoracic Mycotic and Actinomycotic infections of the Lung
 - Pleuropulmonary Amebiasis
 - Hydatid Disease of the Lung
 - Pulmonary Paragonimiasis and Its Surgical Complications
 - Solitary Pulmonary Nodule
 - Diffuse Lung Disease
 - Lung Transplantation

- Carcinoma of the Lung
 - Surgical Treatment of Non-Small Cell Lung Cancer
 - Mediastinal Lymph Node Dissection
 - Endoluminal Management of Malignant Airway Disease
 - Basic Principles of Radiation Therapy in Carcinoma of the Lung
 - Radiation Therapy for Carcinoma of the Lung
 - Chemotherapy of Non-Small Cell Lung Cancer

- Multimodality Therapy for Non-Small Cell Lung Cancer
- Novel Systemic Therapy for Advanced Non-Small Cell Lung cancer
- Small Cell Lung Cancer
- Novel Strategies for Lung Cancer Immunotherapy

- Other Tumors of the Lung
 - Carcinoid Tumors
 - Adenoid Cystic Carcinoma and Other Primary Salivary Gland-Type
 - Tumors of the Lung
 - Benign Tumors of the Lung
 - Uncommon Primary Malignant Tumors of the Lung
 - Secondary Tumors of the Lungs
 - Lung Tumors in the Immunocompromised Host

- Mediastinum
 - Invasive Diagnostic Investigations and Surgical Approaches**
 - Cervical Substernal “Extended” Mediastinoscopy
 - Sternotomy and Thoracotomy for Mediastinal Disease
 - Posterior Mediastinotomy
 - Video-Assisted Thoracic Surgery for Mediastinal Tumors and Cysts And Other Diseases within the Mediastinum
 - Mediastinal Infections, Overview of Mass Lesions in the Mediastinum and Control of Vascular Obstructing Symptomatology
 - Acute and Chronic Mediastinal Infections
 - Overview of Primary Mediastinal Tumors and Cysts
 - Diagnostic Investigation of Mediastinal Masses
 - Lesions Masquerading as Primary Mediastinal Tumors or Cysts
 - Vascular Masses of the Mediastinum
 - Superior Vena Cava Syndrome: Clinical Features, Diagnosis, and Treatment
 - Vein Grafts for the Superior Vena Cava
 - The Use of Prosthetic Grafts for the Replacement of the Superior Vena Cava

- **Primary Mediastinal Tumors**
 - Myasthenia Gravis
 - Standard Thymectomy
 - Transcervical Thymectomy
 - Video-Assisted Thymectomy
 - Extended Transsternal Thymectomy
 - Transcervical-Transsternal Maximal Thymectomy for Myasthenia Gravis
 - Evaluation of Results of Thymectomy for Nonthymomatous Myasthenia Gravis
 - Benign Lymph Node Disease Involving the Mediastinum
 - Biological Markers and Pathology of Mediastinal Lymphomas
 - Diagnosis and Treatment of Mediastinal Lymphomas
 - Benign Germ Cell Tumors of the Mediastinum Primary Seminomas of the Mediastinum
 - Nonseminomatous Malignant Germ Cell Tumors of the Mediastinum
 - Poorly Differentiated Carcinoma of the Mediastinum

- Benign and Malignant Neurogenic Tumors of the Mediastinum in Children and Adults
- Excision of Hourglass Tumors of the Paravertebral Sulcus
- Mediastinal Paragangliomas and Pheochromocytomas
- Mesenchymal Tumors of the Mediastinum
- Mediastinal Parathyroid Adenomas and Carcinomas
- Mediastinal Cysts
 - Foregut Cysts of the Mediastinum in Infants and Children
 - Foregut Cysts of the Mediastinum
 - Gastroenteric Cysts and Neurenteric Cysts in Infants and Children
 - Mesothelial and Other Less Common Cysts of the Mediastinum
- Vascular
 - Embolectomy
 - Femoro-popliteal bypass
 - Aorto-femoral bypass
 - Femoro-distal bypass
 - Aorto-renal bypass
 - Aorto-visceral bypass
 - Repair of abdominal aortic aneurysm & thoraco-abdominal aortic aneurysm
 - Repair of popliteal artery aneurysm
 - Carotid endarterectomy and surgery for Carotid diseases
 - Decompression of thoracic outlet syndrome
 - AV access surgery/transplant surgery
 - Repair of arteries and veins (Trauma)
 - Extra-anatomic bypass
 - Thrombectomy/ Re-do procedures.
 - Surgical and non-surgical management of Varicose veins
 - Angioplasty with or without stenting of FP, Iliac, aortic stenosis
 - Carotid artery stenting
 - Iliac vein stenting
 - Endovascular repair of AAA (abdominal aortic aneurysm), thoracic aortic aneurysm, peripheral aneurysms
 - Catheter Directed Thrombolysis (CDT)

Minimum number of procedures to be performed by the candidate in 3 years

Operative Experience

The total operative experience must be recorded in the Trainee logbook, which will be assessed every six months by the programme director. It is emphasized that these numbers are only a general guide

Year 1

Assistant to 100 open Heart cases

Perform the following under supervision:

1	Sternotomy	10
2	Closure of Sternotomy	10
3	Vein harvest	25
4	Cannulation for cardiopulmonary bypass	2

Year 2

First assistant at 150 open Heart cases

Perform the following under supervision:

1	Cannulation for cardiopulmonary bypass	30
2	Sternotomy and closure	30
3	ASD closure	05
4	Proximal Anastomosis in CABG	10
5	Vein harvest	50
6	IMA harvests	10
7	Thoracotomy (Anterolateral / posterolateral)	06
8	Bronchoscopy (Rigid and fiber optic under supervision)	10
9	Conduct of cardiopulmonary bypass	05

Year 3

First assistant at 200 Open Heart cases

Perform the following under supervision:

1	Proximal Anastomosis in CABG	20
2	IMA harvest	30
3	ASD Closure	10
4	VSD closure	05
5	MVR	05
6	AVR	05

Thoracic and Vascular surgery requirements in 3 yrs

1	Asst to Major cardiac and thoracic procedures	25
2	Perform Lobectomy/Pneumonectomy	5
3	Assistant to Major vascular Procedures	20

TEACHING LEARNING METHODS

A. FORMAL TEACHING

All the post graduate trainees pursuing M.Ch. in Cardiovascular and thoracic Surgery will undergo formal teaching at the departmental and institutional level

Teaching programs held on all working days 8.00 AM to 9.00 AM

Day	Duration	Activity
Every 1 st and 3 rd Monday of the month	1 hour	Journal Club
Every 1 st Tuesday of the month	1 hour	Specific topic Lecture
Every 4 th Wednesday of the month	1 hour	Subject Seminar
Every 1 st Thursday of the month	1 hour	Mortality meeting
Every Friday of the month	1 hour	Clinical Case Presentation / Cath meeting
Every Saturday of the month	1 hour	Grand rounds

Journal Club: The trainee will present a journal article from an indexed journal with high citation factor, either an original article (RCT/Systematic review/prospective study / innovative technique) or a short study along with a review article. The trainee is expected to present the article citing the relevance, background/context, study methods and statistical analysis, interpret results and discussion, summarize, present limitation and critically analyze the study methods and outcomes.

Specific topic Lecture: Invited lectures on basic sciences, biostatistics, research methodology, teaching methodology in the department with involvement of the external faculty of specialties related to the subject (as per availability in person / online), medical ethics and

legal issues related to cardiovascular and thoracic surgery practice etc. are conducted once in 3 months/ as on the need arises.

Subject Seminar: The trainee will present a subject topic allocated after doing a comprehensive preparation, relevant literature search and presents the topic in detail covering all the relevant aspects, clinical applications and engages audience and answers questions

Mortality meeting: All the mortalities in the previous month will be presented by the Assistant Professor / 3rd Year Resident and the main operating surgeon will discuss the respective case. The salient outcomes of the discussion will be implicated in clinical practice and protocols to avoid future events.

Clinical Case Presentation: The post graduate student will present a long and short clinical case every week after performing thorough history and physical examination. The post graduate students will elicit physical and non-physical aspects in history, all physical signs, formulate diagnosis/differential diagnosis and plan a comprehensive care plan for the patient.

Cath meeting: In the presence of all faculty of CVTS, Cardiac Anaesthesiology, Cardiology (Adult and paediatric) and Perfusion technology the complex surgical cases planned for the next week / fortnight will be discussed and comprehensive plan will be written down.

Grand rounds: All the post graduate trainees will carry out their clinical work under supervision of faculty. This involves around 2 hours of dedicated teaching ward rounds in the morning in presence of faculties of all the multidisciplinary team departments (CVTS, Cardiology, Cardiac Anaesthesiology, Dietician, Physiotherapist and Nurses), on the run teaching in outpatients, consultation liaison, home care, and hospice.

B. ADDITIONAL TEACHING/TRAINING

All the post graduate trainees pursuing M.Ch. Cardiovascular and thoracic Surgery are expected to attend regular CMEs, Conferences, Workshops; Small group teaching organized by local/national/international institutes and required to be abreast with the current knowledge and recent advances in the field of cardiovascular and thoracic Surgery.

Core Training:

Education - Both learning and teaching should be integral part of the programme. The chain of learning from peers and teaching the juniors should never be broken.

- Ward rounds and hands-on teaching in the operating theatre should be the main stay of the teaching programme, rather than specific topic lectures.
- Journal Club Meetings should be held at least twice a month.

- A mortality/morbidity review and departmental audit should be held at least monthly to review all deaths and complications.
- Subject seminars to be held monthly to review selected topics.
- The unscheduled and informal discussions to be held as often as possible depending upon the variety and the number of diseases/procedures seen. This method could be an excellent teaching tool rather than totally regimented scheduling at this level of education.
- The candidates should be encouraged to undertake epidemiological and clinical research programme on selected topics. They should be taught the basic methods of research and reporting.
- A post graduate student of super specialties would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his post graduate studies so as to make him eligible to appear at the final examination for super specialty course.
- The Department should encourage e-learning activities.

LOGBOOK

Logbook serves as a document of the trainee's work. The trainee shall maintain this Logbook of the special procedures/ operations performed during the training period right from the point of entry and its authenticity shall be periodically verified by the faculty and certified by the concerned postgraduate Teacher / Head of the Department. This shall be made available to the Board of Examiners for their perusal at the time of trainees appearing at the final Examination. The logbook should record details of clinical cases, details of surgical operations assisted or done independently, procedures or tests performed, and Seminars and journal clubs attended. Logbook entries must be qualitative and not merely quantitative, focusing on learning points and recent advances in the area and must include short review of recent literature relevant to the entry. It should also contain detailed documentation of relevant photographs of interesting clinical and operative procedures. The Log books shall be checked and assessed periodically by the faculty members imparting the training.

RESEARCH

The post graduate student shall present at least two papers/posters at conferences of national or international levels. He/she should be encouraged to undertake retrospective/prospective study of clinical paradigm. Each post graduate student should be exposed to Modern principles of Clinical epidemiology, Biostatistics and Research methodology by Medical epidemiology Unit of the Institution.

Posting in Allied Departments:

The post graduate student should be posted by rotation to various allied departments/units of Cardiology, Radiology, and Cardiac Anaesthesia to acquire related knowledge.

Training timeline during three years of residency

1st Year	9 months	Cardiovascular & thoracic surgery
	1 month	Cardiology
	1 month	Radiology
	1 month	Cardiac Anaesthesiology
2nd Year	11 months	Cardiovascular & thoracic surgery
	1 month	Perfusion Technology
3rd Year	12 months	Cardiovascular & thoracic surgery

1. Cardiology:

The postgraduate trainee in CVTS should have knowledge and orientation about clinical cardiology, imaging (Echocardiography, cath study, coronary / peripheral angiography, IVUS, OCT). The trainee should also have good knowledge and practical orientation about wire skills.

2. Radiology - To learn the basic and advanced skills in imaging techniques.

- a) Principles of duplex imaging and technical skills.
- b) Contrast imaging of Vascular System - Arteriography, Venography, Lymphangiography
 - 'Tools' used in contrast imaging and interventions.
 - Basics in other imaging modalities, such as CT angio and Cardiac MRI, Coronary CT angiography.
- c) Endovascular Interventions.

3. Cardiac Anaesthesiology:

Cardiac Anaesthesiology posting is designed to train post graduates of CVTS in principles and practice of cardiac anesthesia and intensive cardiovascular and thoracic care. In order to provide basic and advanced clinical skills, thorough knowledge in core subject of cardiac anaesthesiology and perioperative transesophageal echocardiography.

4. Perfusion Technology

Trainee should learn principles and practice of safe extracorporeal cardiopulmonary bypass,

ECMO, various heart assists devices.

Schedule of postings

Cardiology

- Echocardiography room learning- modes, probes, standard views. Practicing echocardiography on outpatients with patients' consent.
- Catheterization laboratory- Observing coronary angiogram in adults- access, technique, injections, views and TAVR related radiological and wire techniques.
- Cath study in paediatric cardiac patients- oximetry, hemodynamics, calculation of left to right shunt (Qp:Qs), calculation of pulmonary vascular resistance.
- Observing Interventional procedures like percutaneous coronary angioplasty, percutaneous trans-septal mitral commissurotomy, ASD/VSD/PDA device closures.
- Assisting cardiologists for transvenous pacemaker insertions and helping them to create the generator box pectoral pocket.

Radiology

- The post graduate student will learn basis of vascular imaging including Duplex scan, CT scan, Magnetic resonance and digital subtraction angiogram, to observe minimal access endovascular intervention like angioplasty, stenting and thrombolysis.
- The post graduate student will familiarize with indications, endovascular techniques, and post-procedural management and also to enhance imaging techniques and their interpretation and state of art advances in technology.
- The post graduate student will assist in endovascular procedures, perform angioplasties and provide access for major aortic endovascular procedures.

Cardiac Anaesthesiology

- Mastering the art of tracheal intubation insertion of central venous catheters / pulmonary artery catheters, putting radial and femoral arterial lines for invasive blood pressure monitoring.
- Demonstrate understanding of the basic sciences related to cardiovascular system and anaesthesia.
- Reveal comprehension of the anaesthetic management of non-complex and complex cardiovascular and thoracic surgical procedures in patients belonging to all age groups,

with a thorough knowledge of the etiology, pathophysiology and medical as well as surgical management of the diseases.

- Describe theory, of the underlying etiology, mechanism and management of critical conditions requiring cardio-pulmonary-cerebral resuscitation (CPCR) in coherence with the latest practicing guidelines.
- Demonstrate understanding of principles, pathophysiology, components, conduct, and complications of cardiopulmonary bypass, extracorporeal circulation, cardiac assist devices and cardiac and/or lung transplantation.

Perfusion Technology

Trainee should learn principles and practice of safe extracorporeal cardiopulmonary bypass, ECMO, various heart assists devices. Trainee should assist sterile techniques of pump assembling under supervision of senior perfusionists, conduct of the cardiopulmonary bypass and safe termination from cardiopulmonary bypass. Trainee should be well versed with the pre, intra and post-operative complications during conduct of cardiopulmonary bypass.

Cardiovascular & thoracic surgery

OPERATION THEATRE

- Making sure all paperwork including the operation consent is obtained
- Participation in time-out process
- Marking of the surgical site
- Displaying essential imaging investigations in the theatre
- Discussing cardiac angiogram/ echocardiography/ Thoracic CT scan views with the operating surgeon
- Assisting the operating surgeon
- Sternotomy/ thoracotomy and closing of the surgical wound (assisted or independently)
- Perform surgical procedure (assisted or independently)
- Learning aspects of cardiopulmonary bypass and myocardial protection
- Accompany the patient to surgical ICU after the procedure
- Participation in giving hand-over of the patient to ICU team
- Informing & counselling relatives of the patient regarding the surgical procedure
- Document the operation notes, postoperative orders including analgesics and antibiotics and feeding instructions
- Attending emergencies for postoperative patients like re-exploration, cardiopulmonary

resuscitation

CARDIAC SURGICAL ITU

1. Monitor postoperative patients for bleeding, adequacy of urine output, stability of hemodynamics throughout the day
2. Recognition of emergency situations like cardiac tamponade, tension pneumothorax, low cardiac output state, cardiac arrhythmias
3. Conducting cardioversion and external defibrillatory shock
4. Monitoring arterial blood gas analysis and correcting the acid-base deficits, electrolyte imbalances
5. Morning rounds and presenting surgical cases to the senior postgraduate trainee onsite or to the consultant
6. Performing emergency procedures such as CPR, sternal re-opening, and internal cardiac massage, xyphoidotomy to drain pericardial space, endotracheal intubation, intercostal tube drain insertion for hemothorax/pneumothorax/pleural effusion, insertion of venous and arterial lines in emergency situations, paracentesis for peritoneal effusions, tracheostomy
7. Peritoneal dialysis catheter insertion in paediatric cardiac patients
8. Recognition of pulmonary hypertensive crisis especially in paediatric cardiac patients and its management
9. Insertion & removal of Intra-aortic balloon pump (IABP) in adult cardiac patients
10. Insertion of urinary catheter, blood sampling, ordering investigations/ imaging
11. Liaising with the multi-disciplinary teams
12. Management of the ventilation, endotracheal tube suctioning/ lavage
13. Inotropic management and fluid management
14. Documentation and prescription
15. Counselling of the patients (if conscious) and/or their relatives

SURGICAL INPATIENTS IN PRE-OPERATIVE & POSTOPERATIVE WARD

1. Detailed history taking and physical examination of new admissions
2. Deciding about surgical procedure after thorough investigations and diagnosis
3. To get cardiac catheterization/ angiography/echocardiography done whenever required
4. Taking informed, detailed, written consent for surgery
5. Transfer critically ill patients to ICU
6. Encouraging and counselling about preoperative chest physiotherapy using spirometry
7. Preparation of the surgical site
8. Daily morning rounds, detailed examination of the surgical site in postoperative patients in

addition to the complete physical examination

9. Presenting cases to the senior onsite or to the consultant
10. Formulating further plan of management
11. Monitoring daily calorie intake and optimizing the nutrition
12. Sending additional investigations daily as per the patients progress such as blood sampling, imaging etc
13. Performing relevant procedures not requiring ICU care such as pleural tapping or drain insertion, insertion of IV cannula, removal of epicardial pacing wires
14. Review of postoperative echocardiography
15. Documentation and prescriptions
16. Liaising with the multi-disciplinary teams
17. Counselling of the patients and their relatives
18. Discharge planning and follow-up planning

SURGICAL OUTPATIENTS

1. History taking and physical examination of patients presenting to surgical outpatient department
2. Ordering relevant investigations
3. Obtaining consent for surgery from the patient (if major) and from the patients' parents/ guardians (if minor)
4. Prescribing medications- specific monitoring of oral anticoagulant medications in valve replacement patients- educating the patient regarding dosage, frequency, self-monitoring for side-effects of increased bleeding tendency, dietary changes to be followed, monitoring INR values through regular follow-ups, explaining deleterious effects of poor compliance
5. Counselling the patient/ relatives
6. Surgical plan and follow up plan
7. Dressing change for postoperative patients coming for follow up
8. Thorough examination of the sternotomy/ thoracotomy wound
9. Informing senior onsite/ consultant regarding concerns about surgical wound
10. Ordering postoperative investigations
11. Planning further follow-ups
12. Counselling patients/ relatives

THORACIC SURGERY RESPONSIBILITIES

1. History taking and physical examination of patients presenting to surgical outpatient department

2. Ordering relevant investigations
3. Obtaining consent for surgery from the patient (if major) and from the patients' parents/guardians (if minor)
4. Referring to the physician to obtain fitness for surgical procedure
5. Performing all the roles as in the 'Operation Theatre' above
6. Daily morning rounds, detailed examination of the surgical site in postoperative patients in addition to the complete physical examination
7. Presenting cases to the senior onsite or to the consultant
8. Formulating further plan of management
9. Specific importance to chest physiotherapy and management of chronic intercostal drainage tubes
10. Liaising with the multi-disciplinary teams
11. Documentation and prescription
12. Counselling of the patient relatives or the patient himself
13. Discharge planning and follow-up planning

Note: The exact duration of postings for a particular activity will be decided by the division of academic affairs in consultation with the Head of the Department at the commencement of each year.

A copy of the report of all the procedures performed shall be submitted by the candidate to the Head of the Department in the form of a periodically certified log book at least one month before the yearly internal assessment Examination. The Head of the Department will certify the completion of the minimum number of procedures specified. He will point out deficiency, if any and give his recommendations with reasons as to whether or not the candidate should be allowed to sit in the internal assessment examination. The Head of the Department will forward the Log book within a week of receipt, to the division of Academic affairs. Towards the conclusion of this period, the post graduate student shall have carried out the minimum required number of surgeries/ procedures for that academic year.

During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently; for this purpose, provision of surgical skills laboratories in medical colleges is mandatory.

ASSESSMENT

FORMATIVE ASSESSMENT, i.e., during the training

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

Half yearly assessment during the M.Ch. training should be based on:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning
3. Self-directed learning and teaching
4. Departmental and interdepartmental learning activity

5. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in post graduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT, at the end of the course

The summative examination would be carried out as per the Rules given in **POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.**

Scheme of Examination

i) Theory 400 Marks

There shall be 4 theory papers of 100 marks each and allotted time of 3 hours each.

Paper – I : Basic science as applied to Cardio Vascular & Thoracic Surgery

Paper – II : General and Operative Cardio Thoracic & Vascular Surgery (Adult)

Paper – III : General and Operative Cardio Thoracic & Vascular Surgery (Paediatric)

Paper – IV : Recent advances in Cardio Vascular & Thoracic Surgery

Each paper will be consisting of 10 questions with 10 marks each totaling to 100 marks

Total marks of theory examinations: - 400 marks.

2. Clinical/Practical and Oral Examination:-

A) Clinical Presentation: - One long case (duration 1 hour) (100 marks)

Two short cases (duration 30 minutes each) (75 x2 = 150 marks)

B) Oral Examination: - Viva –Voce (duration 30 min) (100 marks)

C) ICU rounds: - Duration 15 minutes (50 marks)

Total marks of clinical/practical examination: - 400 marks.

M.Ch. Cardio Vascular and Thoracic Surgery	Theory	Clinical/Practical/ ICU rounds	Oral Examination	Grand Total
	400	300	100	800

Log book

Date	Name	IP No.	Procedure	1st Year				2nd Year				3rd Year					
				O	A	PA	PI	O	A	PA	PI	O	A	PA	PI		

Key:

O – Washed up and observed

A – Assisted a senior surgeon

PA – Performed under senior surgeon’s assistance

PI - Performed independently

RECOMMENDED BOOKS (Latest Editions)

Sl.No.	Name of the Books.
01.	Cardiac Surgery, JW Kirklin and BG Barratt Boyes, Churchill Livingstone
02.	Cardiopulmonary Bypass - Principles and Practice, Gravlee and Utley, Williams and Wilkins.
03.	Glenn's Thoracic and Cardiovascular surgery, Appleton Lange.
04.	Surgery of the Chest - Sabiston
05.	Vascular Surgery - Rutherford, WB Saunders
06.	Shields- General Thoracic Surgery, Lea and Febiger
07.	Heart disease: A Textbook of Cardiovascular Medicine, Braunwald, WB Saunders
08.	The Clinical Recognition of Congenital Heart Disease - Perloff
09	Miller Anaesthesia - Ronald Miller
10	Mastery of Cardiothoracic Surgery - Lary, Kaiser
11	Pediatric Cardiac Surgery Mavroudis and Backer 4 th Edition – Constantine Mavroudis Carl L. Backer will illustrations from Rachid F. Idriss
12	Cardiac Surgery Operative Technique 2 nd Edition - Donald B. Doty John R. Doty
13	Manual of Perioperative Care in Adult Cardiac Surgery 5 th Edition - Robert M. Bojar
14	Rutherford's Vascular Surgery 7 th Edition- Cronenwett and Johnston
15	Comprehensive Surgical Management of Congenital Heart Disease - Richard Jonas
16	Cardiac Surgery in Adults – Fifth Edition- Lawrence H. Cohn, David H. Adams
17	Anatomic exposures in vascular surgery- Fourth edition- R. James Valentine, Gary G. Wind
18	Carpentier's reconstructive valve surgery- Carpentier, Adams, Filsoufi
19	Pediatric Cardiac Surgery- Fourth edition- Constantine Mavroudis, Carl Backer
20	Surgical Management of Aortic Pathology – Olaf H. Stanger, John R. Pepper, Lars G. Svensson
21	Wilcox's Surgical Anatomy of the Heart- Robert H. Anderson- Fourth edition

RECOMMENDED JOURNALS

01	Journal of Thoracic and Cardiovascular Surgery
02	Indian Journal of Thoracic and Cardiovascular Surgery

03	Annals of Thoracic Surgery
04	European Journal of Cardio- Thoracic Surgery
05	Journal of Heart and Lung Transplantation
06	World journal of paediatric and congenital heart surgery

Annexure- 1

**Postgraduate Students Appraisal Form
Clinical Disciplines**

Name of the Department/Unit :
Name of the PG Student :
Period of Training : FROM.....TO.....

ASPECTS ASSESSED	POOR	BELOW AVERAGE	AVERAGE	ABOVE AVERAGE	EXCELLENT
A) PERSONAL ATTITUDES					
1. Caring					

2. Initiative					
3. Organizational ability					
4. Stress response					
5. Professionalism					
6. Reliability					
7. Ability to communicate					
8. Team approach					
9. Relationship with staff					
10. Leadership ability					
B) ACQUISITION OF KNOWLEDGE					
1. Journal Club presentation					
a. Reading ability					
b. In-depth study					
c. Presentation skills					
d. Use of audio-visual aids					
2. Seminar presentation					
a. Reading ability					
b. In-depth study					
c. Presentation skills					

d. Use of audio-visual aids					
3. Conference presentation					
a. Reading ability					
b. In-depth study					
c. Presentation skills					
d. Use of audio-visual aids					
C) CLINICAL SKILLS					
1. History taking					
2. Eliciting clinical findings					
3. Diagnostic judgement					
4. Appropriateness of investigations ordered					
5. Documentation					
6. Case presentation skills					
7. Sincerity					
8. Punctuality					
9. Communication skills					
10. Approach to patient care					

11. Ability to take informed and written procedural consent					
D) OPERATIVE SKILLS					
1. Preparedness for surgery					
2. Knowledge of procedure					
3. Display of important investigations in operating room					
4. Surgical efficiency					
5. Knot tying skills					
6. Surgical judgement					
7. Anticipation of problem					
8. Seeking timely assistance					
9. Patient safety approach					
10. Efficiency to handle emergency					
11. Ability to interact with					

surgical colleague					
E) TEACHING SKILLS					
1. Willingness to teach					
2. Interest towards teaching					
3. Teaching undergraduate students					
4. Teaching nursing staff					
F) RESEARCH SKILLS					
1. Inclination towards research					
2. Awareness of importance of research					
3. Original research ideas					
4. Publications in preparation					
5. Readiness to present at meetings					
G) PERIODIC TESTS					
1. Theory					
2. Practical					
3. Viva voce					

D.M. IN NEUROLOGY

I. GOALS:

DM (Neurology) course is designed to train the candidates in the principles and practice of advanced Neurology to equip them to function as faculty / consultants and as researcher in Neurology.

- To train physicians in the scientific aspects of the specialty of Neurology.
- To empower them to practice the specialty of Neurology with competence, care, and compassion thereby delivering the highest standard of Neurological care to the community.
- To empower the trainee in academic and research aspects of Neurology; to empower the trainee to become an effective teacher and communicator in Neurology.
- To establish the required training methods, evaluation methodology, and qualifying norms for the successful completion of the DM course in Neurology.

II. OBJECTIVES:

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. The objectives may be considered under the subheadings

1. Knowledge
2. Skills
3. Human values, ethical practice and communication abilities.

1. Knowledge

The candidate shall be proficient in all the fields of Neurology including general neurology, epilepsy, cerebrovascular disorders, cognitive and behavioral neurology, neuro-endocrinology, movement disorders, pediatric neurology, neuro-ophthalmology, neuro-otology, neuro-degenerative disorders, spinal and neuromuscular disorders, neurochemistry, neurophysiology, neuroanatomy, neuropathology, neurogenetics, electrophysiology, neuroradiology and related fields that form the specialty of Neurology.

- To provide the candidate with the current, scientific and evidence based knowledge pertaining to the above-mentioned areas in Neurology.

- To impart the skills to undertake independent clinical practice in the above areas of Neurology and to provide opportunities to practice these skills in a graded manner and under suitable supervision to a point where the candidate is capable of practicing these skills independently.
- To inculcate in the candidate an attitude of responsibility, accountability and caring, to empower the candidate with a good and sound foundation of ethical values in the practice of Neurology to develop in the candidate the ability to effectively communicate with patients, peers, superiors, and the community in the discharge of his / her clinical and research role.

2. Skills: The candidate admitted to the DM Neurology course shall master the following skills

- Clinical evaluation and management of diverse neurological disorders.
- Be proficient in the management of common neurological emergencies.
- Perform diagnostic investigations like lumbar puncture, biopsies of the nerve and muscle, etc.
- Perform and interpret the neurodiagnostic investigations including nerve conduction studies, electromyography, electroencephalography and evoked potentials.

3. Human values, ethical practice and communication abilities.

- Adopt ethical principles in all aspects of his/her practice; professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- Develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient.
- Provide leadership skills and get the best out of his / her team in a congenial working atmosphere.
- Apply high moral and ethical standard while carrying out research.
- Be humble and accept the limitations in his / her knowledge and skill and to ask for help from colleagues when needed,
- Respect patient's rights and privileges including patient's right to information and right to seek a second opinion.

III. COURSE CONTENTS:

Basic Sciences

- **Neuroanatomy**
 - Neuroanatomy
 - Cerebral gross and ultrastructural anatomy
 - Basal nuclei
 - Thalamus
 - Cerebellum
 - Brainstem
 - Spinal cord
 - Peripheral nerves including brachial and lumbosacral plexuses
 - Autonomic nervous system
 - Neuromuscular junction
 - Muscle
 - Histology of central and peripheral nervous system
 - Functional Neuroanatomy
 - Cerebrospinal fluid
 - Blood brain barrier
 - Embryology & development of nervous system
 - Cerebral circulation
- **Neurophysiology & Neurochemistry**
 - Neuronal signaling
 - Synapse
 - Chemical Neurotransmission
 - Electrical neurotransmission
 - Somatosensory physiology
 - Visual perception
 - Auditory perception
 - Generation and control of movements
 - Tone
 - Posture and Gait
 - Higher cerebral functions
 - Sleep
 - Neuro-endocrinology
 - Autonomic nervous system
- **Neuropharmacology**
- **Neuro-Genetics**
- **Neuroradiology**
 - Plain radiography of skull & spine
 - Angiography
 - C.T. Scan
 - Magnetic resonance imaging

- Neurosonology
- Functional cerebral imaging (PET, SPECT, Functional MRI)
- **Neuropathology:**
 - Interpretation of gross specimens of cerebral pathology
 - Histology of nerve, muscle, and brain.
 - Histopathology of muscle
 - Histopathology of brain
 - Histochemistry and immuno-histochemistry
- **Neurology**
 - Disorders of consciousness
 - Disorders of cortical functions
 - Language disorders
 - Cerebrovascular disorders
 - Epilepsies
 - Headache
 - Movement disorders
 - Ataxias and disorders of cerebellum
 - Gait disorders
 - Cranial Neuropathies
 - Demyelinating disorders of central nervous system
 - Dysmyelinating disorders of central nervous system
 - Infections of central and peripheral nervous system
 - Metabolic disorders of nervous system
 - Nutritional disorders of the nervous system
 - Diseases due to toxins, chemicals & drugs
 - Congenital disorders of nervous system
 - Developmental disorders of nervous system
 - Neurogenetics
 - Neoplasia of nervous system
 - Craniospinal trauma
 - Cerebrospinal Fluid disorders
 - Hydrocephalus
 - Mental retardation
 - Cerebral palsy
 - Disease of peripheral nerves
 - Disorders of Neuromuscular junction
 - Disease of muscles
 - Sleep disorders
 - Neuropsychology
 - Neuropsychiatry
 - Autoimmune neurology
 - Artificial intelligence in Neurology
 - Stem cell therapy
 - Neuro-rehabilitation
- **Clinical Neurophysiology:**

- **Electroencephalography (EEG)**
 - Neurophysiological basis of EEG
 - EEG Recording techniques
 - Normal awake and sleep EEG
 - Maturation of EEG
 - EEG in epilepsies
 - EEG in non-epileptic disorders
 - Video EEG and Long-term recording
 - Quantitative EEG
 - Brain death
 - Electrocoricography
- **Magnetoencephalography**
- **Nerve Conductions**
 - Motor and sensory nerve conduction studies
 - Late responses
 - Evaluation of neuromuscular junction disorders
 - Autonomic nervous system evaluation
- **Electromyography (EMG)**
 - Principles of needle EMG
 - EMG in neuromuscular diseases
 - EMG in central nervous system diseases
 - Qualitative EMG
 - Quantitative EMG
 - Single Fiber EMG
- **Evoked potentials**
 - Visual evoked potentials
 - Somatosensory evoked potentials
 - Brainstem auditory evoked potentials
 - Event related potentials
 - Vestibular evoked myogenic potentials
 - Movement related cortical potentials
- **Magnetic Stimulation of peripheral and central nervous system**

IV. TEACHING AND LEARNING ACTIVITIES:

A) Theoretical Teaching:

1. **Lectures:** Certain selected topics can be taken as lectures which may be didactic or integrated.
2. **Journal Club:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book the relevant details. The

presentations would be evaluated using checklists. A timetable with names of the students and the moderator should be announced in advance.

3. **Subject Seminar:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using checklists. A timetable for the subject with names of the students and the moderator should be announced in advance.
4. **Case Discussion:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists. A timetable for the case presentation with names of the students should be announced in advance.
5. **Ward Rounds:** Ward rounds may be service or teaching rounds.
 - a) **Service Rounds:** Postgraduate students should do service rounds every day for the care of the patients. Newly admitted patients should be worked up by the post graduate student and presented to the faculty members the following day.
 - b) **Teaching Rounds:** Every unit should have ‘grand rounds’ for teaching purpose at the bed side. A diary should be maintained for day-to-day activities by the post-graduate students.

Entries of 5(a) and 5(b) should be made in the Log book.

6. **Clinicopathological Conference:** Recommended once a month for all post graduate students. Presentation to be done by rotation. Presentations will be assessed using checklist. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPCs.
7. **Inter-Departmental Meetings:** Recommended particularly with departments of Pathology and Radio-Diagnosis at least once a month. These meetings should be attended by post-graduate students and relevant entries must be made in the Log Book.

Radio-diagnosis: Interesting cases and the imaging modalities should be discussed. Emphasis should be given for the radiological differential diagnosis.
8. **Mortality Meeting:** The mortality meeting should be conducted in the department every month. The post graduate student should prepare the details regarding the cause of death after going through the case records in detail, and should present during the mortality meeting. The death records will be discussed in detail during this meeting.
9. **Teaching Skills:** Postgraduate students shall teach undergraduate students (e.g. Medical, Nursing and Allied Course) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as by the students. Record of their participation is to be kept in Log Book. Training of postgraduate students in Educational Science and Technology is recommended.

10. **Continuing Medical Education Programs (CME):** Recommended that at least one national

level CME program should be attended by each student during the course.

11. **Conferences:** Attending conference is compulsory. Post-graduate student should attend at least one national and one state level conference during the course and present papers / posters.

Research Activities: The Post-graduate students to be encouraged to carry out research activities in the department. Every candidate shall carry out work on an assigned research project under the guidance of a recognised Post Graduate Teacher.

The candidate

- a. A pPostgraduate student is required to present one poster presentation, to read one paper at a national / state conference

The Postgraduate student shall publish at least one research paper in an indexed or peer reviewed journal during the course period

B) Clinical / Practical Training:

1. Rotational Postings

i. Neurology	30 months
ii. Neurosurgery	1 month
iii. Psychiatry	1 month
iv. Clinical Neurophysiology	1 month
v. Radiology	1 month
vi. Neuropathology	15 days
vii. Neuropsychology	15 days
viii. Optional postings	1 month

2. List of minimum number of procedures to be performed by the postgraduate student

i. Nerve conduction study	50
ii. Electromyography	25
iii. Evoked potentials	25
iv. Electroencephalography reporting	200

V. Other Criteria to Fulfill for the Degree Course:

1. Internal evaluation:

During the course of three years, the department will conduct three tests. Two of them will be annual, one at the end of first year and other at the end of second year. The third test will be a preliminary examination which may be held three months before the final examination. The test may include the written papers, practicals / clinical examination and viva-voce. Records and marks obtained in such tests will be maintained by the head of the department and will be sent to the University when called for.

Results of all evaluations should be entered into PG's diary and departmental file for documentation purposes. Main purpose of periodic examination and accountability is to ensure clinical expertise of students with practical and communication skills and balance broader concept

of diagnostic and therapeutic challenges.

2. Maintenance of Log Book:

Every candidate shall maintain a Log book and record his / her participation in the training programs conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any, conducted by the candidate. All the procedures performed by the postgraduate students should be entered in the Log book. All the daily activities including the ward rounds and the routine procedures performed on day to day basis should be entered in the Log book and it should be verified and signed by the faculty member. The Log book shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the University practical/clinical examination.

VI. SCHEME OF EXAMINATION:

Candidates will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and research / publication work is satisfactory.

i) Theory : 400 Marks

The theory examination shall consist of four question papers, each of three hours duration. Each paper shall carry maximum of 100 marks and the total maximum marks would be 400. The format for the theory paper shall be as follows:

Type of Questions	No. of Questions	Marks for each question	Total Marks
Short essay	10	10	100
Grand Total			100

- Paper I - Basic Neurosciences (Neuroanatomy, Neurophysiology, Neurochemistry, Neuropathology, Neuropharmacology)
- Paper II - Clinical Neurology
- Paper III - Clinical Neurology and Investigative Neurology
- Paper IV - Recent Advances

Note: The distribution of topics shown against the papers is suggestive only and may overlap or change.

B. Practical Examination : 300 Marks

1. Clinical Examination

Types of Cases	No. of Cases	Marks	Duration
Long Case	1	100	1 Hour
Short Case	2	100 (50x2)	30 minutes each
2. Spotters		50	
3. Ward Rounds		50	

C. Viva- Voce Examination (including specimen, radiology, electrophysiological data)

100 Marks

Aims: To elicit candidate's knowledge and investigative/ therapeutic skills.

All examiners will conduct viva-voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may be given gross specimens, histopathology slides, clinical neurophysiological investigations like electroencephalogram, nerve conduction studies, electromyography and evoked potentials; Radiological investigations including CT scan and Magnetic Resonance Imaging, etc., for interpretation and questions on these as well as use of instruments will be asked. Student's knowledge on use of instruments and drugs will also be evaluated during viva-voce examination.

D. Maximum Marks:

Theory	Clinical Examination	Viva including spotters	Grand Total
400	300	100	800

E. Passing criterion

To pass the examination the candidate must secure at least 50% of marks in each head of theory and practicals separately or as per the existing Medical Council of India regulations for the postgraduate medical education.

VII. RECOMMENDED BOOKS

A. Essential Books (Latest Editions)

Sl.No.	Title	Author	Publisher
1	Adams and Victor's Principles of Neurology	Allan Ropper, Martin Samuels, Joshua Klein, Shashank Prasad	Mc Graw –Hill
2	Bradley and Daroff's Neurology in Clinical Practice	Joseph Jankovic, John Mazziotta, Scott L Pomeroy, Nancy Newmam	Butterworth Heinemann
3	Localisation in clinical Neurology <i>South Asian Edition</i> <i>Edited by Dr. Lakshminarsimhan</i>	Paul Brazis, Joseph Masdeu, Jose Biller	Wolters Kluwer
4	De Jong's Neurological Examination	William Campbell, Richard Barohn,	Lippincott –Raven
5	Principles of Neural Sciences	Kandel E, Koester J, Mack S, Siegelbum S	Mc Graw –Hill
6	Core Text Book of Neuroanatomy	Carpenter	Churchill Livingstone
7	Merritt's Textbook of Neurology	Elan D Louis, Stephen A Mayer, James N Nobel	Wolters Kluwer

8	Pediatric Neurology	Swaiman K, Ashwal S, Donna M Ferriero	Elsevier
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The authors / editors may change with newer editions.

B. References (Latest Editions)

1	Mayo Clinic Examination in Neurology	Andrea C Adams	Mosby , Oxford University Press
2	Technique of the Neurologic Examination (De Myer's)	Jose Biller, Gregory greener, Paul Brazis,	Mc Graw Hill
3	Current Therapy in Neurologic Disease	Richard T, Johnson, John W Griffin, Gustin C, Mc Arthur, Mosley	Elsevier
5	Introduction to clinical neurology	Douglas J Gelb	Oxford University Press
6	Current Practice of Clinical Electroencephalography	John Ebersole, Aatif M Husain, Douglas R Nordi	Wolters Kluwer
7	Atlas and Classification of Electroencephalography	Hans O. Luders , Soheyl Noachtar	Saunders
8	Epilepsy A comprehensive Text book	Gerome Engel, Timothy A, Pedley,	Lippincott, William and Williams
9	Aminoff's Electrodiagnosis in Clinical Neurology	Michael J Aminoff	Elsevier
10	Peripheral Neuropathy Vol I and II	Peter J Dyck, PK Thomas	Saunders (24/03/2005)
11	Myology: Basic and Clinical	Andrew Engel, Clara Franzini Armstrong	Mc Graw Hill Professional
12	Sleep and Movement disorders	Chokroverty S, Richard Allen, Walters A, Montagna P	Oxford University Press
13	Behavioural Neurology Practical Science of Mind and Brain	Howard S Kirshner	Butterworth Heinemann
14	Dementia A clinical Approach	Mario F Mendez, Geoeffrey L Cummings	Butterworth Heinemann
15	Clinical Neurophysiology of Infancy, Childhood and Adolescence	Gregroy Holmes, Soloman Moshe,	Butterworth Heinemann

		H Royden Jones Jr	
18	Text Book of neurology in Tropics	Chopra J S, Inder M S Sawhney	Elsevier
19	Kryger's Principles and Practice of sleep Medicine	Kryger Meir R Roth Tom, Goldstein Cathy	Elsevier
20	Principles and Practice of Behavioral Neurology, Neuropsychology	Mathew Rizzo, Paul J Eslinger	Saunders
21	Neurologic and Neurosurgical Emergencies	Cruz	Saunders
23	Neurological and Neurosurgical Intensive Care	Ropper A, Gress D, Diringer M, Green D, Mayer S, Bleck T	Lippincott William
24	Neurological complications	Brian Hainline, Edward Feldmann, Orrin Devinsky	Lippincott Williams and Wilkins
25	Handbook of dystonia	Mark Stacey	CRC Press
26	Handbook of tremor disorder	L J Findley, Leslie J Findley	CRC Press
27	Therapy with Botulinum Toxin	Jankovic J, Albanese A, M Zouhair Stassi, Dolly JO, Hallet M, Mayer NH	Saunders
29	Parkinson's Disease	Duvoisin RC, Jacob Sage	Lippincott Williams and Wilkins
30	Amnioff's Neurology and General Medicine	Michael Aminoff, S Andrew Josephson	Elsevier
31	Diagnostic testing in neurology	Randolph rvans	Saunders
32	Neuroimaging	W W Orison Jr	Saunders
33	Neuroradiology	Robert Grossman, Dvid M Yousem	Mosley
34	Textbook of Neurological Surgery	Youmans and Ulinn	Elsevier
35	Clinical Neurology of older adult	Joseph Sirven, Barbara Malamut,	Lippincott Williams and Wilkins
36	Mechanism and Management of Headache	James Lance, Peter Goadsby	Butterwoth Heineman

37	Channelopathies of Nervous system	Michael Rose, Robert Griggs	Butterworth Heinemann
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The authors / editors may change with newer editions.

C. Reference Series

Sl. No.	Reference Series	Publisher
1	Handbook of Clinical Neurology	Elsevier
3	Annual Review of Neurosciences	Annual Review, Palo Alto
4	Neurologic Clinics	Elsevier
5	Butterworth's International Medical Reviews in Neurology	Butterworth Heinemann

VIII. RECOMMENDED JOURNALS:

Sl.No.	Journal	Publisher
1	Neurology	Lippincott Williams Wilkins
2	Journal of Neurology, Neurosurgery and psychiatry	B.M.J. Publishing Group
3	Brain	Oxford University Press
4	Annals of Neurology	Wiley Blackwell
5	Stroke	American Medical Association
6	Neurology India	Medknow Publications
7	Annals of Indian Academy of Neurology	Medknow Publications
8	Journal of Neurological Sciences	Elsevier
9	JAMA Neurology	American Medical Association
10	Epilepsia	Wiley Blackwell
11	European Neurology	Karger
12	Clinical Neurophysiology	Elsevier
13	Muscle and Nerve	Wiley Blackwell

GUIDELINES FOR COMPETENCY BASED POSTGRADUATE SUPER-SPECIALTY TRAINING PROGRAMME FOR MCH IN NEUROSURGERY

• Preamble

The aim of the MCH Programme is to impart advanced training in neurosurgery to produce competent super-specialists who can provide clinical care of the highest order to patients with neurosurgical diseases and serve as future teachers, trainers, researchers, and leaders in the field of neurosurgery. After successfully completing the course, they would work as productive members of interdisciplinary teams consisting of physicians, neurologists, geriatric specialists, psychiatrists, psychologists, rehabilitation experts, and other specialists, nurses, and other healthcare functionaries providing care to the patients with various neurosurgical disorders in any setting of the health care system.

SUBJECT SPECIFIC OBJECTIVES

The training program is designed to facilitate the ‘acquisition of learning’ by the postgraduate student in the following three domains of learning:

- Cognitive (knowledge),
- Affective (communication),
- Psychomotor (practice).

Predominant in Cognitive domain (Knowledge)

The student should:

- Understand the basic sciences (embryology, anatomy, physiology, biochemistry, pharmaco-therapeutics, etc.) related to the field of neurosurgery.
- Be conversant with the etiology, pathophysiology, diagnosis, and management of common neurosurgical problems.
- Should understand the importance of providing acute care with the goal of ‘full recovery of function’.
- Know the common problems in Neurosurgery, the acute, life threatening conditions which require redressal in a “time sensitive” manner as well as the transdisciplinary acute medical and surgical conditions which requires team work of different specialities.
- Know the chronic problems encountered in the out patients clinics of Neurosurgery and Medicine including specific neurosurgical disorders and neurosurgical complaints in various systemic diseases spanning a host of medical and surgical conditions.
- Know neurosurgical end of life care and bereavement follow up.

Group/team approach:

At the end of the course, the postgraduate student should be able to:

- Recognize the role of multi-disciplinary and interdisciplinary approaches in managing various neurosurgical disorders and recognize the importance of family, society, and socio-cultural environment in treating the sick patient.

Evidence-based approach:

At the end of the course, the postgraduate student should be able to critically appraise medical literature in order to provide evidence-based care.

Research Methodology:

The postgraduate student should acquire:

- (a) Basic knowledge of research methodology and biostatistics,
- (b) Familiarity and participation in clinical and experimental research studies, and
- (c) Knowledge in scientific presentation and publication.

Skills:

At the end of the course, the postgraduate student should acquire (a) skills necessary for neurosurgical patient care. He/she should be able to undertake preparation of oral presentation, medical documents, professional opinion in interaction with patients, caretakers, peers, and paramedical staff - both for clinical care and medical teaching. Effective communication with the patient/caretakers regarding the nature and extent of disease, treatment options, realistic outcomes, and optimal management is essential.

Predominant in Affective domain (Communication)

The PG student should:

- Acquire adequate communication skills to counsel and support the parents and families of the neurosurgical patients. Regular clinical rounds and academic presentations during the teaching program should help the trainees to develop patient-centric and family-centric attitudes, knowledge, and communication skills.
- Establish effective communication with the patient's caregivers, including appropriate counselling for sickness, terminal illness, and bereavement care.
- Interact professionally and obtain relevant specialist/ancillary 'services' consultation where appropriate.
- Ensure effective communication and teamwork while teaching others, including undergraduates in a clinical care unit.
- Be able to communicate and work effectively with a multi-disciplinary team and understand the role of other team members, including nurses, physiotherapists, dieticians, psychologists, and others.
- Inculcate ethical principles in all aspects of neurosurgical, paediatric and adult, medical and surgical care/research (professional honesty and integrity, humility, moderation, informed consent, counselling, awareness of 'patients' rights and privileges) and be a role model for other health care team members and respect patient confidentiality.

- Maintain proper etiquette in dealings with patients, caretakers, and other health personnel, including due attention to the 'patient's right to information, consent, and second opinion. Maintain professional integrity while dealing with patients, colleagues, seniors, pharmaceutical companies, and equipment manufacturers.
- Take rational decisions in the face of ethical dilemmas in neurosurgical practice.
- Develop a communication style - both verbal and written, to ensure that the content is accurately understood by the audience.

2.3 Predominant in Psychomotor domain (Practice)

The PG student should:

- Evaluate a patient thoroughly (history, clinical examination), order relevant investigations, and interpret them to reach a diagnosis and plan of management.
- Plan and carry out simple investigations/procedures (bedside, laboratory, imaging) independently.
- Plan and carry out Neurointerventions such as Digital Subtraction Angiography (DSA) procedures through femoral route and assist in diagnostic and therapeutic procedures such as Mechanical Thrombectomy in acute ischemic stroke with large vessel occlusion (AIS with LVO).
- Provide Basic and Advanced Life Support services in emergencies.
- Acquire familiarity with and provide critical care of post neurosurgery and neurointervention patients, including airway support, ventilation, and central vascular access.
- Prepare a patient for an elective/emergency surgery and provide specific post-operative care.
- Provide counselling to the patient and primary caretakers for the smooth dispensation of medical care.
- Acquire skills in neurosurgical procedures (including but not limited to invasive and non-invasive respiratory support, peripheral and central venous access, resuscitation, bladder catheterization, DSA, interpretation of acute stroke imaging, (ASPECTS etc.), planning and preparation of nutrition (swallowing test, Tube feeds etc.), insertion of chest tubes, sepsis workup, suprapubic urine sampling for culture, lumbar puncture, use of medical equipment such as ventilators, including high-frequency ventilation, exchange transfusion, therapeutic hypothermia, etc.).
- Monitor and manage patients in the standard ward / high dependency unit / and in the intensive care setting.
- Provide specific and relevant advice to the patient and family at discharge time for proper domiciliary care, hospital reporting in an emergency, and routine follow-up.

SUBJECT-SPECIFIC COMPETENCIES

3.1 Predominant in Cognitive (knowledge) domain:

After completing the MCH (Neurosurgery) course, the student be able to:

- Know and analyse neurosurgical health problems scientifically, considering the biological basis and socio-behavioural epidemiology of the neurosurgical disease, and be able to advise and implement strategies to prevent neurosurgical morbidity and mortality.
- Acquire knowledge on providing evidence-based primary, secondary, and tertiary care of highest quality, including intensive care of the highest standard to the critically sick patients with neurosurgical diseases using advanced therapeutic and supportive modalities and skills.
- Acquire knowledge on developmental assessment of sensory and motor function of paediatric patient with neurosurgical diseases and coordinate post discharge comprehensive follow up.
- Acquire knowledge to be able to take rational decisions in the face of ethical dilemma in neurosurgical practice.
- Plan and carry out research in neurosurgical/brain health in the clinical, community, and laboratory settings.
- Teach basics and critical/mandatory information on common neurosurgical diseases and neurosurgical emergencies to the medical and the nursing students and other paramedical/community health functionaries, and develop learning resource materials.
- Plan, establish, and manage acute neurosurgical emergency units independently.
- Contribute toward the development and adaptation of neurosurgical care technologies.
- Organize head injury, spine trauma and degenerative diseases care in the community and at the secondary health system level and play the assigned role in the national programs aimed at the non – communicable diseases.
- Work as a focal point for a multi-disciplinary endeavour for clinical care, education, research, and community action with other stakeholders and partners.
- Seek and analyse new literature and information on neurosurgery, update concepts, and practice evidence-based neurosurgery.
- Lead development of quality improvement projects & develop standard care practices/ protocols for the unit.
- Develop skills to train nurses in key components of essential neurosurgical care.

3.2 Predominant in Affective domain (communication and values)

During the course of three years, the postgraduate student is expected to attend instructive courses that facilitate proficiency relevant to this domain (e.g., communication skills, biomedical ethics, patient counselling).

After completing the MCH (Neurosurgery) course, the student should be able to do the following:

- Have empathy for patients and their family and should address them as worthy human beings.
- Discuss options, including the advantages and disadvantages of each investigation and treatment. She/he should be able to discuss medical issues with them in 'layperson's language'.
- Become **confident communicator** and well-accomplished professional.
- Acquire communication skills to be able to debate & deliver a scientific lecture and participate in panel discussions, hold group discussions and be able to deliver the knowledge received by him/her during the course.
- Be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
- Always adopt ethical principles and maintain proper etiquette in dealing with patients, relatives, and other health personnel and respect the patient's rights, including the right to information and second opinion.
- Acquire communication skills of a high order to write reports, interact with peers, and paramedical staff, and with students for effective teaching.
- Demonstrate humane and compassionate attributes befitting a caring neonatologist.
- Acquire communication skills to give a professional opinion and interact with patients and relatives in a caring manner.

3.3 Predominant in Psychomotor domain (skills)

Minimum operative surgical exposure required for the trainees:

Mandatory:

- 200-250 cases exposure at least for the whole training program.
- Minimum 30 independent surgeries for 3-year course; performed independently/ under supervision in the OT.
- At least 2 OTs a week including trauma
- About 1/3 cranial and 1/3 spinal cases
- Spectrum of surgeries should include Neuro-trauma, Neuro-oncology, Stroke and cerebrovascular surgery, Paediatric Neurosurgery, Spinal surgery and peripheral nerve surgery.
- If any of the sub specialities is not available, the trainee may be posted to other centres where such sub speciality is available for 4 weeks and 8 weeks respectively for 3 years and 6 years course.

Desirable:

- 1st Year Basic Neurosciences (Neuroanatomy, Neurophysiology, Neurochemistry, Neuropathology, Neuropharmacology, Clinical Neurology), by way of didactic lectures, symposia, etc. Patient care, history taking and neurological examination, case-sheet writing, preparing discharge summaries, supervised emergency calls, Academic activity.
- 2nd Year Overall in-charge of ward work, OPD, Emergency calls, Neurology posting for one month at the end of the second year and 2 weeks posting in neuro interventional lab.
- 3rd Year Academic activity, Emergency calls, assisting and managing operation theatres, Posting in other Neurosurgical centre(s) for 1 month in the beginning of final year.

Desirable: Training in skill lab

- **Exposure to sub-specialties including - Cerebrovascular surgery including endovascular procedures - Functional Neurosurgery and Epilepsy surgery - Neuro-endoscopy - Peripheral nerve surgery - Minimal invasive spinal & cranial surgery.**

Practical Surgical training curriculum: 3 years

1st Year

- Lumbar puncture, external ventricular drainage, tracheostomy, endotracheal intubation, emergency scalp suturing, Simple neuro-trauma including chronic subdural hematoma, extradural hematoma, learning elective case exposures, VP shunt (under supervision).

2nd Year

- Neurotrauma: contusion and intracerebral hematoma, Elective craniotomy and spinal exposures

3rd Year

- Elective exposures, supervised surgery, Subspecialty exposure depending on interest, independent elective surgical procedures (as outlined below) Independent surgery (supervised): Neuro-trauma: Chronic SDH, EDH, depressed fractures, ICH, contusions, (Experience with conventional craniotomy required). Elective cases: VP shunt, Gliomas (at least 2 anatomical regions), Surface meningiomas, Chiari malformation, Midline suboccipital exposure and surgery, Lumbar disc and cervical disc surgery. Simple spinal instrumentation, laminectomy, extradural intradural spinal exposure.

NEUROSURGERY COMPETENCIES

Key and Enabling Competencies: Neurosurgeons are able to...

1. Practise medicine within their defined scope of practice and expertise

- 1.1. Demonstrate a commitment to high-quality care of their patients
- 1.2. Integrate the Intrinsic Roles into their practice of Neurosurgery

- 1.3. Demonstrate the competencies of Surgical Foundations
- 1.4. Apply knowledge of the clinical and biomedical sciences relevant to Neurosurgery
 - 1.4.1. Embryology of the nervous system and the pathogenesis of congenital anomalies
 - 1.4.2. Anatomy and physiology of the nervous system
 - 1.4.2.1. Cerebral cortex, subcortical regions, basal ganglia, thalamus, brain stem, cerebellum and cranial nerves
 - 1.4.2.2. Pituitary gland and neuroendocrine function
 - 1.4.2.3. Meninges
 - 1.4.2.4. Spinal cord
 - 1.4.2.5. Spine and skull
 - 1.4.2.6. Cerebral and spinal vessels
 - 1.4.2.7. Nerve roots, peripheral nerves and associated muscles
 - 1.4.2.8. Neurotransmission
 - 1.4.2.9. Formation, circulation and absorption of cerebrospinal fluid (CSF)
 - 1.4.2.10. Autonomic nervous system
 - 1.4.2.11. Motor and sensory systems
 - 1.4.2.12. Special senses
 - 1.4.2.13. Consciousness, sleep and mechanisms of wakefulness
 - 1.4.2.14. Speech, memory, learning and behaviour
 - 1.4.2.15. Pain
 - 1.4.3. Fundamentals of clinical neuroendocrinology
 - 1.4.4. Gross and microscopic pathology of neurosurgical conditions
 - 1.4.5. Clinical and molecular genetics of neurosurgical conditions
 - 1.4.6. Microbiology and pathology of infectious diseases of the nervous system
 - 1.4.7. Clinical epidemiology of neurosurgical conditions
 - 1.4.8. Clinical features, including symptoms, signs, natural history, and prognosis, of neurosurgical conditions in the following categories:
 - 1.4.8.1. Neurosurgical emergencies
 - 1.4.8.2. Trauma
 - 1.4.8.3. Infection and inflammation
 - 1.4.8.4. CSF disorders
 - 1.4.8.5. Pediatric and congenital
 - 1.4.8.6. Neuro-oncology
 - 1.4.8.7. Cerebrovascular
 - 1.4.8.8. Functional neurosurgery
 - 1.4.8.9. Peripheral nerve
 - 1.4.8.10. Spinal neurosurgery
 - 1.4.9. Common neurological conditions, with particular emphasis on those neurological entities which have important differential diagnostic considerations with respect to neurosurgical care
 - 1.4.10. Principles of neuro-ophthalmology and neuro-otology

- 1.4.11. Principles of neuropsychology relevant to Neurosurgery
- 1.4.12. Fundamental principles of neuroanesthesia
- 1.4.13. Principles of neuro-critical care
- 1.4.14. Clinical pharmacology: the indications for, mechanism(s) of action of, side effects of, and dosages of drugs and agents used in neurosurgical therapeutics
- 1.4.15. Principles of radiation safety and protection
- 1.4.16. Fundamental knowledge of imaging modalities, techniques, and contrast agents, including benefits and risks, for care of neurosurgical patients
- 1.4.17. Therapeutic and toxic effects of radiation therapy on the nervous system and supporting structures
- 1.4.18. Principles of, and procedures for, surgical management of functional neurosurgical conditions
 - 1.4.18.1. Epilepsy
 - 1.4.18.2. Pain and spasticity
 - 1.4.18.3. Movement disorders
- 1.4.19. Principles of physical medicine and rehabilitation in the treatment of neurosurgical patients
- 1.4.20. Pathophysiology and principles of the declaration of neurologically determined death
- 1.5. Perform appropriately timed clinical assessments with recommendations that are presented in an organized manner
- 1.6. Carry out professional duties in the face of multiple, competing demands
- 1.7. Recognize and respond to the complexity, uncertainty, and ambiguity inherent in Neurosurgery practice

- 2. Perform a patient-centred clinical assessment and establish a management plan
 - 2.1. Prioritize issues to be addressed in a patient encounter
 - 2.1.1. Identify patients at risk of clinical deterioration
 - 2.1.2. Triage patients based on clinical presentation and medical imaging to determine priorities and the appropriate setting of care
 - 2.2. Elicit a history, perform a physical exam, select appropriate investigations, and interpret their results for the purpose of diagnosis and management, disease prevention, and health promotion
 - 2.2.1. Identify and interpret the clinical significance of the findings of a neurological examination
 - 2.2.2. Assess patients preoperatively and determine the significance of pre-existing medical conditions, and their impact on perioperative risk
 - 2.2.3. Select and interpret general diagnostic tests for the management of neurosurgical patients
 - 2.2.4. Select and interpret neuroimaging investigations
 - 2.2.4.1. Radiography
 - 2.2.4.2. Computerized tomography

- 2.2.4.3. Magnetic resonance imaging
- 2.2.4.4. Angiography
- 2.2.5. Select specific diagnostic investigations for the management of neurosurgical patients and interpret their reports
 - 2.2.5.1. Cerebrospinal fluid studies
 - 2.2.5.2. Clinical electrophysiology
 - 2.2.5.2.1. Electroencephalography
 - 2.2.5.2.2. Electrocorticography
 - 2.2.5.2.3. Evoked potentials
 - 2.2.5.2.4. Electromyography
 - 2.2.5.2.5. Nerve conduction studies
 - 2.2.5.3. Ultrasonography
 - 2.2.5.4. Advanced neuroimaging techniques
 - 2.2.5.4.1. Positron emission tomography (PET)
 - 2.2.5.4.2. Single-photon emission computed tomography (SPECT)
 - 2.2.5.4.3. Functional magnetic resonance imaging (fMRI)
 - 2.2.5.4.4. Magnetic resonance (MR) spectroscopy
 - 2.2.5.4.5. Perfusion imaging
- 2.2.6. Synthesize clinical information and diagnostic investigations to determine the appropriateness of surgical intervention, and to plan perioperative management and risk mitigation. Establish goals of care in collaboration with patients and their families which may include slowing disease progression, treating symptoms, achieving cure, improving function, and palliation
- 2.3.1. Recognize and respond to changes in patient status that indicate a need to reassess goals of care
- 2.4. Establish a patient-centred management plan
 - 2.4.1. Determine the appropriate setting of care for the patient's clinical status, and arrange admission or transfer to alternative levels of care, as appropriate
 - 2.4.2. Provide initial and definitive management for patients with cranial emergencies
 - 2.4.3. Provide initial and definitive management for patients with spinal emergencies. 1 Throughout this document, phrases such as "patients and their families" are intended to include all those who are personally significant to the patient and are concerned with his or her care, including, according to the patient's circumstances, family members, partners, caregivers, legal guardian, and substitute decision-makers.
 - 2.4.4. Provide neuro-critical care
 - 2.4.4.1. Medical stabilization of patients, including airway management, ventilation and spinal precautions
 - 2.4.4.2. Prevention and/or treatment of increased intracranial pressure
 - 2.4.4.3. Prevention and/or treatment of cerebral vasospasm
 - 2.4.5. Recommend surgical or non-surgical approaches
 - 2.4.6. Recommend neuroradiological interventions

- 2.4.7. Provide supportive and/or postoperative management in the critical care setting and on the inpatient ward
- 2.4.8. Provide appropriate follow-up care, including evaluations for rehabilitation
- 3. Plan and perform procedures and therapies for the purpose of assessment and/or management
 - 3.1. Determine the most appropriate procedures or therapies
 - 3.1.1. Fluids for correction of metabolic abnormalities, volume management and resuscitation
 - 3.1.2. Blood products, recombinant factors, and anticoagulants
 - 3.1.3. Medications and relevant therapeutics
 - 3.1.4. Tissue sampling for pathological diagnosis
 - 3.1.5. Injection of therapeutic substances
 - 3.1.6. Neurointerventional procedures
 - 3.1.7. Radiosurgery
 - 3.1.8. Surgical intervention
 - 3.1.9. Rehabilitation
 - 3.2. Obtain and document informed consent, explaining the risks and benefits of, and the rationale for, a proposed procedure or therapy
 - 3.2.1. Demonstrate comprehensive knowledge of the indications for and contraindications of neurosurgical procedures
 - 3.3. Prioritize procedures or therapies, taking into account clinical urgency and available resources
 - 3.4. Perform procedures in a skilful and safe manner, adapting to unanticipated findings or changing clinical circumstances
- General:
 - 3.4.1. Utilization of image guidance technology
 - 3.4.2. Utilization of intraoperative monitoring
 - 3.4.3. Utilization of intracranial pressure monitoring
 - 3.4.4. Fine needle aspiration and tissue biopsies and resections
 - 3.4.5. Treatment of simple and compound depressed skull fractures
 - 3.4.6. Drainage of epidural, subdural and intraparenchymal abscesses
 - 3.4.7. Evacuation of epidural, subdural and intraparenchymal hematomas
 - 3.4.8. Decompressive craniectomy
 - 3.4.9. Cerebrospinal fluid management:
 - 3.4.9.1. CSF sampling
 - 3.4.9.2. Placement of external ventricular drains and lumbar drains; tapping of reservoir systems
 - 3.4.9.3. Placement of ventricular/cyst/spinal shunts
 - 3.4.9.4. Endoscopic third ventriculostomy
 - 3.4.9.5. Cyst fenestration
 - 3.4.9.6. Repair of cerebrospinal fluid leak repair
 - 3.4.10. Surgical treatment of Chiari malformations
 - 3.4.11. Cranioplasty

Functional:

- 3.4.12. Application of a stereotactic frame
- 3.4.13. Cranial nerve microvascular decompression
- 3.4.14. Percutaneous techniques for trigeminal neuralgia
- 3.4.15. Troubleshoot/maintain neuromodulation devices

Spinal:

- 3.4.16. Application of Gardner–Wells tongs or halo ring for traction, closed reduction, and intraoperative reduction of spinal deformity
- 3.4.17. Application of a halo ring and vest
- 3.4.18. Bone harvesting
- 3.4.19. Cervical decompression
- 3.4.20. Thoracic decompression
- 3.4.21. Lumbar decompression
- 3.4.22. Spinal instrumentation
 - 3.4.22.1. Occipito-cervical
 - 3.4.22.2. Anterior cervical
 - 3.4.22.3. Posterior cervical
 - 3.4.22.4. Posterior thoraco-lumbar
- 3.4.23. Surgical management of intradural lesions

Peripheral nerve:

- 3.4.24. Carpal tunnel decompression
- 3.4.25. Ulnar nerve decompression and transposition
- 3.4.26. Nerve and muscle biopsy
- 3.4.27. Sural nerve harvest
- 3.4.28. Resection of simple nerve tumours

Neuro-oncology:

- 3.4.29. Open biopsy
- 3.4.30. Stereotactic biopsy
- 3.4.31. Endoscopic biopsy
- 3.4.32. Intra-axial tumour removal
- 3.4.33. Extra-axial tumour removal
- 3.4.34. Transsphenoidal removal of pituitary tumours

Vascular:

- 3.4.35. Surgical clipping of cerebral aneurysms
- 3.4.36. Surgical management of intracranial vascular malformations
- 3.4.37. Carotid endarterectomy

Paediatric:

- 3.4.38. Surgical treatment of spinal dysraphism
- 3.4.39. Surgical treatment of craniosynostosis

- 4. Establish plans for ongoing care and, when appropriate, timely consultation

4.1. Implement a patient-centred care plan that supports ongoing care, follow-up on investigations, response to treatment, and further consultation

4.1.1. Recognize and manage complications of neurosurgical conditions, interventions and treatments

4.1.1.1. Bleeding

4.1.1.2. Neurologic deficits

4.1.1.3. Endocrine and metabolic disturbances

4.1.1.4. Infection

4.1.1.5. Vasospasm

4.1.2. Identify indications for consultation with other health care professionals

4.1.2.1. Provide referral for advanced neurosurgical procedures

4.1.2.2. Identify indications for and timing of consultation with medical and/or radiation oncologists

4.1.2.3. Identify indications for and timing of intraoperative pathology consultation

4.1.3. Provide follow-up on results of investigations and response to treatment

4.1.4. Provide management and/or referral for end-of-life care

SYLLABUS

Course contents

AIM:

To produce specialists with necessary skills, judgement and sense of dedication to tackle all major and minor neurosurgical problems. The candidates will be trained in all aspects of Neurosurgery starting from Basic Sciences to recent advance.

1. Basics in Neuroanatomy, Neurophysiology, Neuropathology, Electrophysiology, Neuropharmacology, Neurobiochemistry, Neuroimmunology with reference to neurosurgery

2. Neuroradiology: Normal skull & spine, changes in skull and spine due to SOL, special views. Contrast studies – DSA, Isotopic scanning & diagnostic procedures – C.T. Scan, M.R.I & P.E.T Scan etc.

3. Neurology Methods of clinical examination, General diagnostic principles, Localisation With specific reference to function of brain & spinal cord.

4. Neurosurgery

a. Basic principles

b. Vascular Neurosurgery

- c. Neuro- oncology
- d. Surgery for congenital malformation like Hydrocephalus, craniovertebral anomalies, syringomyelia , spinal dysraphism management etc.
- e. Traumatic brain and spinal & peripheral nerve Injuries
- f. Spinal instrumentation
- g. Different approaches for disc surgeries
- h. Management of brain secondaries
- i. Infection of CSF
- j. Pediatric neurosurgery
- k. Minimal Invasive and neuroendoscopy.
- l. Functional neurosurgery

Other areas in which knowledge is to be acquired:

- Biostatistics, Research Methodology and Clinical Epidemiology
- Ethics
- Medico legal aspects relevant to the discipline
- Health Policy issues as may be applicable to the discipline

Clinical Service

- History and physical examination.
- Differential diagnosis of altered states of consciousness
- Neuro ophthalmology
- Neuro Otology
- Neuro urology
- Neuro psychological assessment of the neurosurgical patient
- Brain death
- Legal issues

Fundamentals of radiology

- Radiology of the skull
- Computed tomography
- Magnetic resonance imaging of the brain, functional MR, Mr perfusion

- Molecular imaging of the brain and positron emission tomography
- Radiology of spine
- Angiography modalities : digital subtraction angiography, CT angiography, MR Angiography

Perioperative evaluation and treatment

- Neuroanesthesia; preoperative evaluation
- Complication avoidance in neurosurgery
- Neurosurgical intensive care management

Surgical exposures and positioning

- General principles of operative positioning, micro neurosurgery instruments
- Surgical positioning and exposures for cranial procedures
- Surgical exposures and positioning for spinal surgery
- Peripheral nerves
- Suture materials and implants in neurosurgery
- Operating microscope, cavitron suction apparatus, intraoperative electrophysiology, neuronavigation – image guided, intraoperative MR and DSA, Lasers in neurosurgery
- Sterotaxy procedures

Neuro anatomy and physiology

- Embryology of the nervous system and the pathogenesis of congenital anomalies
- Anatomy and physiology of the nervous system
- Cerebral cortex, subcortical regions, basal ganglia, thalamus, brain stem, cerebellum and cranial nerves
- Pituitary gland and neuroendocrine function
- Meninges
- Spinal cord
- Spine and skull
- Cerebral and spinal vessels
- Nerve roots, peripheral nerves and associated muscles
- Neurotransmission
- Formation, circulation and absorption of cerebrospinal fluid (CSF)
- Autonomic nervous system
- Motor and sensory systems
- Special senses
- Consciousness, sleep and mechanisms of wakefulness
- Speech, memory, learning and behaviour
- Pain

- Fundamentals of clinical neuroendocrinology
- Gross and microscopic pathology of neurosurgical conditions
- Clinical and molecular genetics of neurosurgical conditions
- Microbiology and pathology of infectious diseases of the nervous system
- Clinical epidemiology of neurosurgical conditions

Basic science of neuro oncology

- Brain tumors; general considerations
- Histopathology classification of brain tumors
- Central nervous system immunology
- Proliferation marker in evaluation of gliomas
- Molecular genetics and development of targets for glioma therapy
- Growth factors and brain tumors
- Tumor suppressor genes and genesis of brain tumors
- Molecular and cytogenetic techniques
- Invasion in malignant glioma
- Angiogenesis and brain tumors
- Brain edema and tumor host interactions
- Brain tumors: population based epidemiology, environmental risk factors, genetic and hereditary syndromes.
- Principles of gene therapy
- Clinical features and neurology of brain tumor and paraneoplastic
- Radiologic features of central nervous system tumors
- Endovascular techniques for brain tumors
- Brain tumor during pregnancy
- Principles of chemotherapy
- Aspects of immunology applicable to brain tumor pathogenesis and treatment
- Basic principles of cranial surgery for brain tumors
- Basic principles of skull base surgery
- Surgical complications and their avoidance
- Surgical navigation for brain tumors.

Intra axial tumors

- Low grade gliomas : astrocytoma, oligodendroglioma and mixed gliomas
- Malignant gliomas: anaplastic astrocytoma, glioblastoma multiforme, gliosarcoma, malignant oligodendroglioma
- Primitive neuroectodermal tumors
- Pineal tumors

- Medulloblastoma
- Ependymoma
- Haemangioblastoma
- Lymphoma
- Metastatic brain tumor

Extra axial tumors

- Meningioma
- Meningeal haemangio-pericytoma
- Meningeal sarcoma
- Acoustic neuroma
- Pituitary tumors: functioning and non-functioning
- Caraniopharyngoma in the adult
- Epidermoid, dermoid and neuroenteric cyst
- Neoplastic meningitis – diagnosis and treatment

VENTRICULAR TUMORS

Skull base tumors

- Chordoma and chondrosarcoma
- Glomus jugulare tumors
- Neoplasm of paranasal sinuses
- Esthesioneuroblastoma
- Trigeminal schwannoma
- Juvenile angiofibroma
- Osseous tumors
- Orbital tumors
- Skull tumors
- Scalp tumors

Non neoplastic disorders mimicking brain tumors

- Pseudotumor cerebri
- Sarcoidosis, tuberculosis and xanthogranuloma
- Multiple sclerosis

Vascular

- Cerebral blood flow and metabolism
- Acute medical management of ischemic disease and stroke
- Anesthesia in cerebrovascular disease
- Intraoperative cerebral protection
- Deep hypothermic circulatory arrest
- Transcranial Doppler ultrasonography
- Neurosonology
- Xenon computed tomography
- Magnetic resonance angiography
- Positron emission tomography

Occlusive vascular disease

Carotid occlusive disease, carotid endarterectomy, angioplasty, stenting, traumatic carotid injury, vertebral artery disease, intracranial arterial disease, moyamoya, cerebral venous and sinus thrombosis.

Intra cerebral haemorrhage

Spontaneous intracerebral haemorrhage; non arteriovenous malformation, non-aneurysm
Hemorrhagic vascular disease; aneurysms

- Genetic of intracranial aneurysm
- Natural history of unruptured saccular cerebral aneurysm
- Management of subarachnoid haemorrhage
- Cerebral vasospasm
- Surgical approaches for anterior circulation aneurysm
- Treatment of intracavernous and paraclinoid internal carotid artery aneurysm
- Aneurysms of anterior communicating artery, anterior cerebral artery, distal anterior cerebral artery and middle cerebral artery aneurysms
- Posterior circulation aneurysms, including the vertebral, basilar and PICA aneurysm.
- Endovascular treatment of aneurysm
- Giant aneurysm

- Infectious intracranial aneurysm
- Revascularization techniques for complex aneurysm and skull base tumors

Arterio venous malformation

- Natural history of intracranial vascular malformations
- Classification and treatment, surgical and radiosurgical
- Endovascular management of AVM
- Surgical treatment
- Dural AVMs

Cavernous malformation

- Epidemiology and natural history, genetics, surgical management of intracranial cavernous malformation.
- Cavernous carotid fistulas
- Spinal AVM
- Classification, endovascular treatment, surgery

Epilepsy

- General, historical, basic science, classification, approaches to diagnosis, anti-epileptic medications,
- Preoperative evaluation for epilepsy surgery; wada test, functional magnetic resonance imaging
- Candidates for epilepsy surgery
- Intraoperative mapping and monitoring for cortical resections
- Epilepsy surgery: outcome and complications
- Amygdalohippocampectomy, topectomy, multiple subpial resection, vagus nerve stimulation for intractable epilepsy.

Functional neurosurgery

- History
- Anatomy of basal ganglia
- Neuropathology of movement disorder
- Rationale for surgical interventions in movement disorder
- Approach to movement disorders, patient selections
- Thalamotomy for tremor
- Pallidotomy for parkinson's disease
- Surgery for dystonia

- Deep brain stimulation
- Cellular transplantation, stem cell therapy
- Neurosurgery of psychiatric disorders
- Neurosurgical treatment of spasticity, spasmodic torticollis, intractable vertigo

Pain

- Physiologic anatomy of pain
- Chronic pain – medical management
- Trigeminal neuralgia – non operative management, percutaneous techniques, microvascular decompression
- Surgical management of intractable pain

Pediatric neurosurgery

- Neurological examination in infancy and childhood
- Developmental and acquired anomalies – encephalocele, myelomeningocele, tethered spinal cord, occult spinal dysraphism, dandy walker syndrome, arachnoid cyst.
- Craniosynostosis, chiari malformation and achondroplasia
- Hydrocephalus
- Vein of galen malformations, AVM and aneurysm in childhood
- Head and brain trauma
- Birth trauma
- Tumors – optic gliomas, germ cell tumors, choroid plexus tumors, ependymomas, medulloblastoma, cerebellar astrocytoma, brain stem glioma, craniopharyngioma, intraspinal tumors, skull tumors.
- Cerebral palsy
- Surgical treatment in epilepsy in children
- Pediatric neuro rehabilitation

Peripheral nerves

- History – physiology, evaluation, investigations of peripheral nerve disorders.
- Carpel tunnel syndrome, entrapment syndromes peripheral nerve tumors, acute peripheral nerve injury.

Radiation therapy and radiosurgery

- General, historical considerations
- Radiobiology
- Principles of radiotherapy
- Radiosurgery for tumors, functional radiosurgery, radiosurgery for AVMs
- Interstitial and intracavitary irradiation for brain tumors
- Techniques of radiosurgery – linac, gamma knife, proton radiosurgery, stereotactic

Spine

- Overview and history
- Concepts and mechanisms of biomechanics
- Intraoperative electrophysiology – monitoring
- Bone metabolism
- Approach to patient with spinal order
- Failed back surgery syndrome
- Infections of spine and spinal cord
- Degenerative disease – cervical spondylosis, lumbar spinal stenosis, ossification of posterior longitudinal ligament, spondylolysis and spondylolisthesis, treatment of disc disease.
- Acquired abnormalities of craniovertebral junction – basilar invagination, AAD
- Principles of spinal internal fixation, bone graft harvest and spinal fusion
- Instrumentation – anterior cervical, posterior cervical, occipito cervical, anterior thoracic, posterior thoracic, anterior lumbar and posterior lumbar.
- Image guided spinal navigation
- Endoscopic approaches, percutaneous treatment of disc disease.
- Tumors of spine – haemangiomas, multiple myeloma, metastases
- Spinal trauma, approach and diagnosis, treatment of fractures and spinal cord trauma.

Peripheral nerves

- Acute and chronic injuries of peripheral nerves, brachial plexus and lumbosacral plexus
- Electromyography, nerve conduction studies
- Peripheral nerve tumors and compressive neuropathies

Trauma

- Modern neurotraumatology – brief historical view
- Cellular basis of injury and recovery from trauma
- Clinical pathophysiology of traumatic brain injury
- Mild head injury in adults
- Moderate and severe traumatic brain injury – initial resuscitation and patient evaluation, critical care management, surgical management.
- Sequels of traumatic brain injury – cerebro vascular injury, cranio facial trauma and cerebro spinal fluid fistula.
- Rehabilitation and prognosis after traumatic brain injury

Infections of the central nervous system

- Diagnosis and management
- Acute : pyogenic and viral meningitis
- Chronic : tuberculous, fungal, parasitic
- Human immunodeficiency related pathologies

Practical and oral examinations

- Clinical neurosurgery including history taking, physical examination, diagnosis, selections and planning of relevant investigations, appropriate treatment and rehabilitation of patients with neurosurgical disorders including those presenting as emergencies.
- Essentials of clinical neurology especially with reference to disorders common in India and those likely to present to the neurosurgeons.
- Basic medical sciences relevant to the practice of neurosurgery
- Surgical neuropathology and the essentials of the pathology of neurological disorders likely to present to the neurosurgeons.
- Performance and interpretation of neuroradiological procedures and its interpretation
- Principles and interpretation of common neurophysiological, neuro-ophthalmological, neurootological and neuroendocrinological test especially with reference to neurosurgical disorders.
- Principles and interpretation of computerized axial tomography, MRI and other modern investigations.
- Performance of common neurosurgical operations in the supra and infra-tentorial compartments in the spinal canal and on the peripheral nerves – initially under supervision and later independently. Ability to use the operating microscope is mandatory.
- Familiarity with various types of anaesthesia used in neurosurgery their indications and contraindications, the use ventilators and techniques of monitoring and resuscitation.
- Pharmacology of various drugs used in neurosurgery

- Knowledge of the history of neurological surgery and its allied disciplines with special reference to India
- Knowledge of recent advances in the field of neurological surgery
- Preparation of papers of presentation at scientific conference and for publications.
- Introduction to the techniques involved in the organization and development of a department, its subsections and newer facilities.
- It is desirable to have microsurgical laboratory training where candidates learn dissection / suturing of fine arteries / nerves under microscope and skull base dissections.
- Development of proper attitudes towards patients, subordinates, colleagues and seniors
- Should have basic knowledge about application of computers.

Training on sub-speciality of neurosciences

- Neuro – anesthesiology
 - Resuscitation
 - Life support system
 - Monitoring of patients
 - Neuro-anaesthetic drugs and interaction s
- Neuro – radiology
 - X-rays (skull / spine / chest)
 - CT
 - MRI (Including perfusion techniques / functional MR)
 - Angiograph (CT/MR/DSA)
- Neuro – pathology
- Brain cutting and anatomy methods
- Frozen sections
- Staining procedures
- Identification of histologic features of common neurological disorder

IV) Teaching and learning activities:

- Theoretical teaching :
- Lecture: Lectures are to be kept to a minimum. Certain selection topics can be taken as lectures. Lectures may be didactic or integrated.
- Didactic lectures: Recommended for selected common topic for post graduate students of all specialities. Few topic are suggested as examples:
 - Bio – statistic
 - Use of library
 - Research methods

- Medical code of conduct and medical ethics
- National health and disease control programmes
- Communications skills etc.
 - Journal clubs: Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the log book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable with name of the students and the moderator should be announced in advance.
 - Subject seminars: Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the log book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable with names of students and the moderator should be announced in advance.
- Case Discussion: Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the log book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable with names of students and the moderator should be announced in advance.
 - Ward Rounds: Ward rounds may be service or teaching rounds.
 - Service Rounds: Postgraduate students should do service rounds every day for the care of patients. Newly admitted patients should be worked up by the post graduate students and presented to the faculty members the following day.
 - Teaching Rounds: every unit should have ‘grand rounds’ for teaching purpose at the bed side. A diary should be maintained for day-to-day activities by the post graduate students.

Entries of (a) and (b) should be made in the log book.
- Inter – departmental meetings: recommended particularly with departments of neurology, pathology and radio-diagnosis at least once a month. These meetings should be attended by post – graduate students and relevant entries must be made in the log book.

Radio-diagnosis: interesting cases and the imaging modalities should be discussed. Emphasis should be given for the radiological differential diagnosis.
- Mortality Meeting: The mortality meeting should be conducted in the department every month. The post graduate student should prepare the details regarding the cause of death

after going through the case records in details, and should present during the mortality meeting. The death records will be discussed in detail during this meeting.

- Teaching skills: Post graduate students must teach under graduate students (e.g. medical, nursing) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as by the students. Record of their participation is to be kept in log book. Training of post graduate students in educational science and technology is recommended.
- Operating skills: The candidate in the 1st year will assist the different surgeries in the department; during 2nd year he may perform surgeries under supervision and in 3rd year he may be allowed to do it independently at the discretion of concerned teaching staff. He has to maintain in log book the list surgeries seen, assisted and done (both under supervision and independently).
- Continuing medical education (CME) programs: Recommended that at least one national level CME program should be attended by each student during the course.
- Conference: Attending conference is compulsory. Postgraduate student should attend atleast one national conference during the course.
- Research Activities: The post graduate students to be encourage to carry out research activities in the department.
- Every candidate shall carry out work on an assigned research project under the guidance of a recognized post graduate teacher, the result of which shall be written up and submitted in the form of a thesis. Thesis shall be submitted at least six months before the theory and clinical / practical examination.
- In addition, the candidate shall have atleast two presentation (paper/poster, one paper compulsory) in the national or international conference.
- The candidate shall publish at least one research paper in a national indexed journal (submission proof compulsory).

B) Clinical and practical training:

During the course duration of three years, the candidate will be posted to various departments as mentioned below:

- Parent department (Neurosurgery) 30 ½ months.
- Rotational / external postings:
- Internal (KLE)

Clinical neurology and neurophysiology

- Candidates should have 2 months (1 month in the beginning and 1 month in the middle of course) training under neurology department to familiarize themselves regarding common neurological disorders. During this period candidate should also familiarize themselves

with the technique and interpretation of EEG/EMG/NCV and evoked potentials (end of 1st year).

- Paediatric Neurology – 15 days posting
 - Neuro Radiology – 15 days posting
 - External – Neurosurgical institute posting (1 month)
 - Pathology – NIMHANS 15 days posting
 - Candidate in 3rd year (post MS) should visit other neurosurgical centers recognized by MCI for about 4 weeks to be able to observe difference in approaches to various neurosurgical problems. It is desirable to have training in certain special areas to be arranged outside the institutes, when necessary like micro surgical lab training if not available within the department.

ASSESSMENT

FORMATIVE ASSESSMENT

Internal evaluation: during the course of three years, the department will conduct three test. Two of them will be annual, one at the end of first year and other at the end of second year. The annual test at the end of first year shall consist of basic neuroscience subjects. The candidate has to clear this exam at least six months prior to the final exams in order to make him / her eligible to appear for the final exams. In case he / she does not clear this exam in the first attempt, a subsequent exam in the same subject which may be conducted at six monthly intervals. The third test will be a preliminary examination which may be held three months before the final examination. The test may include the written papers, practicals / clinicals and viva-voce. Records and marks obtained in such test will be maintained by the head of the department and will be sent to the university when called for.

Results of all evaluations should be entered into PG's diary and departmental file for documentation purposes. Main purpose of periodic examination and accountability is to ensure clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.

Maintenance of log book:

Every candidate shall maintain a log book / work diary and record his / her participation in the training programs conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any, conducted by the candidate. All the procedures performed by the post graduate students should be entered in the log book. All the daily

activities including the ward rounds and the routine procedures performed on day to day basis should be entered in the log book and it should be verified and signed by the faculty member. The log book shall be scrutinized and certified by the head of the department and head of the institution, and presented in the university practical / clinical examination.

Thesis presentations:

Every candidate shall submit his / her duly completed thesis to the university six month prior to the final examination, which will be sent to the external expert, for their approval by the university

SUMMATIVE ASSESSMENT

Candidates will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and research / publication work is satisfactory.

A. Theory

400 Marks

After completing of 3 years the theory examination shall consist of four question papers, each of three hours duration. Each paper shall carry maximum of 100 marks and that total maximum marks would be 400 marks. The format for the theory paper shall be as follows

Types of Questions	No. of Questions	Marks for each Question	Total Marks
10 Questions (all questions compulsory / no choice)	10	10	100
Grand Total			100

Paper I Basic sciences (Neuro-anatomy, Physiology, Biochemistry, +/- pathology / microbiology and pharmacology)

Paper II General Neurosurgery (clinical neurology and neurosurgery)

Paper III Allied Neurosciences (Radiology, Radiotherapy, Pharmacotherapy, Chemotherapy)

Paper IV Advances in neurosurgery (including recent advances)

Note: The distribution of topics shown against the papers is suggestive only and may overlap or changes.

B. Clinical Examinations

200 marks

Types	No. of cases	Marks
Long cases	1	100
Short cases	2	100 (50 x 2)
Ward Round	4	100 (25 x 4)
Total		300

C. Viva-voce examination

100 marks

(Including specimen, radiology and operative techniques and details)

Aims: to elicit candidate's knowledge and investigative / therapeutic skills

All examiners will conduct viva – voce conjointly on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may be given gross specimens, histopathology slides. Radiological investigations including CT scan and Magnetic Resonance Imaging, etc., for interpretation and questions on these as well as use of instruments will be asked. Student's knowledge on use of instruments and drugs will also be evaluated during viva-voce examination.

D. Maximum Marks:

Theory	Clinical / practical	Viva-voce	Grand Total
400	300	100	800

E. Passing criterion:

To pass the examination the candidate must secure 50% of the marks in each head of theory and practicals separately.

VII. Recommended Books (latest editions):

S. No.	Title	Author	Publisher
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01	Operative neurosurgical techniques	Sweet & Schmidek	Saunders
02	Youman's Neurological Surgery	H. Richard Winn	Saunders
03	Textbooks of operative Neurosurgery	Ramamurthi, Ravi Ramamurthi	B. I. Publications
04	Text book of Neurosurgery	Wilkins & Rengachary	Churchill Livingstone
05	Spine surgery	Edward Benzel	Elsevier

The authors / editors may changes with newer editions.

VIII. Reference journals:

S. No.	Title	Publisher
01	Neurology India	Medknow Publications
02	Indian journal of Neurosurgery	Official publication of neurological surgeons society of india (NSSI) (Thieme Publications)
03	Journal of Neurosurgery	American association of neurological surgeons (USA)
04	Neurosurgery	Congress of neurologist surgeons
05	British journal of neurosurgery	Society of British Neurological Surgeons, Informa UK Ltd.
06	Acta neurochirurgica	Springer
07	Journal of clinical neurosciences	Churchill livingstone
08	Neurosurgery clinics of north America	Saunders Elsevier

ANNEXURE II

Student appraisal form for MCH in Neurosurgery											
	Element	Less than Satisfactory			Satisfactory			More than satisfactory			Comments
		1	2	3	4	5	6	7	8	9	
1	Scholastic Aptitude and Learning										
1.1	Knowledge appropriate for level of training										
1.2	Participation and contribution to learning activity e.g., Journal Club, Seminars, CME etc)										
1.3	Conduct of research and other scholarly activity assigned (e.g Posters, publications etc)										
1.4	Documentation of acquisition of competence (eg Log book)										
1.5	Performance in work based assessments										
1.6	Self Directed Learning										
2	Care of the patient										
2.1	Ability to provide patient care appropriate to level of training										
2.2	Ability to work with other members of the health care team										
2.3	Ability to communicate appropriately and empathetically with patients families and care givers										
2.4	Ability to do procedures appropriate for the level of training and assigned role										

2.5	Ability to record and document work accurately and appropriate for level of training												
2.6	Participation and contribution to health care quality improvement												
3	Professional attributes												
3.1	Responsibility and accountability												
3.2	Contribution to growth of learning of the team												
3.3	Conduct that is ethical appropriate and respectful at all times												
4	Scholarship												
4.1	Teaching and mentoring skills appropriate to level of training												
4.2	Ability to formulate research questions, initiate conduct and complete research projects												
4.3	Ability to review and use the published literature appropriately in care of the patient lab or workspace												
4.4	Ability to provide consultations to other specialties as may be required												
5	Space for additional comments												
6	Disposition												
	Has this assessment been discussed with the trainee?	Yes	No										
	If not explain												
	Name and Signature of the assessee												
	Name and Signature of the assessor												
	Date												

KLE Academy of Higher Education (Deemed University) Post Graduate training course in Cardiology

- **Superficiality Degree Course**
- **DM in Cardiology**
- **Curriculum and Syllabus**

MD/DNB in General Medicine and pediatrics graduates will have very limited exposure to Echocardiography, Cath Lab procedures, Management of arrhythmias and other subjects of higher Cardiology. DM in Cardiology course gives them an opportunity to learn all aspects of Cardiac diagnosis and management of all Cardiovascular diseases.

Programme & Objectives:

After successful completion of DM in Cardiology course the candidate should be

- a) Able to do Echocardiogram and its interpretation.
- b) Should be able to do all diagnostic and therapeutic procedures in the Cath Lab.
- c) Should be able to diagnose and manage all cardiovascular diseases.
- d) Should be able to diagnose and manage all cardiac emergencies in ICCU.
- e) Should be able to lead the whole team in that institute in the management of cardiovascular diseases.
- f) Should have acquired sound scientific knowledge for teaching and research in the subject of cardiology.
- g) Should be able to guide the public in prevention of cardiovascular diseases.

Aims & Objective:

- 1) Candidate should read, learn and do Echocardiogram in all types of cardiovascular diseases.
- 2) Should learn to do all cath procedures, coronary angiogram, all therapeutic interventions.
- 3) Should learn to do TMT, Holter monitoring and interpretation of results.
- 4) Will have to learn diagnosis and management of all cardiovascular diseases with latest technology.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the DM student should acquire the following competencies under the three domains:

A. Cognitive domain (Knowledge domain)

By the end of the course, the DM student should be able to:

- i. Demonstrate that he/she is well versed with the past and current literature on relevant aspects of basic, preventive, investigative, clinical and interventional Cardiology.
- ii. Demonstrate a thorough knowledge of epidemiology, natural history, pathological abnormalities, etiopathogenesis, clinical manifestations and principles of management of various cardiac disorders of adults and children.
- iii. Plan appropriate investigations applicable for diagnosis and management of patients in a cost-effective manner and interpret correctly the results of various routine and specialized investigations necessary for proper management of the patients with cardiac diseases.
Should be able to provide best management even in resource-limited settings as well
- iv. Recognize and manage cardiac emergencies.
- v. Acquire adequate knowledge of application of various cardiac related laboratory investigations.
- vi. Acquire knowledge of the functioning of various equipments in routine use in the Cardiology lab.
- vii. Be able to plan and conduct a research proposal in the specialty in accordance with guidelines of Ethics Committee and critically evaluate published literature in medical journal.
- viii. Be able to establish a research laboratory.
- ix. Acquire relevant knowledge of biostatistics so as to be able to critically read and judge new literature.
- x. Recognize the value of ethical principles of patient care and research.
- xi. Be able to take decisions regarding hospitalization or timely referral to other consultants of various specialties recognizing his/her limitations in these areas.
- xii. Have a basic knowledge of data science as it applies to cardiology -including artificial intelligence machine learning devices and wearables.

B. Affective domain (Attitudes including Communication and Professionalism)

The DM student should:

- Have empathy for patients and their family and should address them as worthy human beings.
- Discuss options, including advantages and disadvantages of each investigation and treatment. She/He should be able to discuss medical issues with them in layperson's language.
- Become confident communicators and should be well accomplished professionals.
- Have developed skills to debate, deliver scientific lecture, participate in panel discussions, and hold group discussions and be ready to deliver the knowledge received by him/her during the course. .
- Be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
- Always adopt ethical principles and maintain proper etiquette in dealing with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
- Develop communication skills to write reports and give professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should have acquired following skills:

Skills & Procedures:

The following list gives minimum number and variety of procedures to be carried out independently by the candidate.

Coronary Angiogram	-50
PTCA	5
Pacemaker Implantation	-2
Balloon Valvoplasty	-10
Echocardiography	-200
TEE cardiogram	-10

Classes to be attended by the PG student

a) subject Seminar	36
b) Journal clubs	36
c) Bedside Clinics	36
d) Cardiothoracic conference	36
e) General Clinics	36
f) Interesting ECG, Echo & X-Ray chest	-36
g) Mortality meeting	-36

Course Contents:

Syllabus for DM Cardiology (3 Years Course)

1) Basics of CVS

- a) History of the Heart and Heart Diseases
- b) Epidemiology of Heart Diseases
- c) Development of cardiovascular system
- d) Functional Anatomy of the Heart
- e) Normal Physiology of CVS
- f) Biology of the vessel wall
- g) Genetics related to CVS.

2) Patient Evaluation

- a) History and Clinical Examination
- b) Electrocardiogram

- c) Chest Roentgenogram
- d) Echocardiogram
- e) Stress test
- f) Cardiac Catheterisation, Coronary Angiogram, Other angiograms, Pressure measurements- Interpretation and decision making
- g) CT Angio
- h) Nuclear Cardiology
- i) Intravascular Ultrasound (IVUS), Optical Coherence Tomography (OCT), Fractional flow reserve (FFR)
- j) Magnetic Resonance imaging (MRI), Computerized Tomography(CT)

3) Preventive Cardiology

- a) Lipoprotein disorder & Cardiovascular disease
- b) Primary & Secondary prevention of coronary artery disease
- c) Cardiac Rehabilitation

4) Coronary Artery Disease

- a) Atherosclerosis
- b) Risk Factors
- c) Pathogenesis
- d) Clinical presentation, Diagnosis, Investigations and management of Acute and Chronic ischemic heart disease, Coronary Blood flow & myocardial ischemia
- e) PTCA
- f) CABG surgery
- g) Long term management
- h) Prevention of CAD

5) Hypertension

- A) Epidemiology
- B) Pathophysiology
- C) Diagnosis
- D) Treatment
- E) Prevention
- F) Secondary Hypertension

6) Valvular Heart Disease

- a) Acute Rheumatic Fever
- b) Aortic Valve Disease
- c) Mitral valve disease
- d) Other Valvular diseases
- e) Prosthetic valves
- f) Antithrombotic therapy
- g) Bacterial Endocarditis

7) Congenital Heart Disease

- a) Pathology, Pathophysiology, diagnosis, treatment and prevention of CHD.
- b) ASD, VSD, PDA, PS, TOF, DORV, TAPVC, Single atrium, Single ventricle, AS, RSOV, Coarctation of Aorta, Ebstein's anomaly, Marfan's Syndrome, Dextrocardia, PTA, TGV, CTGV and other congenital Heart diseases.

8) Cardiomyopathy

- a) Dilated
- b) Hypertrophic
- c) Restrictive
- d) Other Cardiomyopathies
- e) Myocarditis

9) Pericardial diseases

- a) Acute Pericarditis
- b) Pericardial effusion
- c) Constrictive pericarditis
- d) Other pericardial diseases

10) Heart Failure

- a) Pathophysiology
- b) Diagnosis
- c) Management
- d) Emerging therapies & strategies in the treatment of heart failure

- e) Heart transplant & Stem cell therapy

11) Brady and Tachyarrhythmia's

- a) Approach to the patient
- b) Diagnosis and Management
- c) Pacemakers
- d) Electro physiologic evaluation
- e) Catheter treatment

12) Syncope, Sudden death

- a) Diagnosis
- b) Management
- c) Cardiopulmonary Resuscitation

13 Diseases of Great vessels

- a) Diseases of aorta
- b) Carotid arteries
- c) Peripheral vascular diseases
- d) Endovascular /Peripheral vascular stenting

14) Miscellaneous Conditions affecting CVS:

- a) Connective tissue disorders
- b) Neoplastic diseases
- c) AIDS
- d) Trauma
- e) Diabetes
- f) Obesity
- g) Pregnancy
- h) Endocrinal diseases

15) Other cardiovascular diseases

- a) Pulmonary Hypertension
- b) Drugs used in Cardiology
- c) Intracardiac masses
- d) Sleep apnea & cardiovascular disease

- e) Anesthesia & non cardiac surgery in patients with heart disease
- 16) Recent advances
- a) Other day today recent advances in the field of cardiology
- 17) Statistics
- a) Statistical analysis of data

IV. TEACHING & LEARNING ACTIVITIES

A) Theoretical Teaching:

1. **Lectures:** Lectures are to be kept to a minimum. Certain selected topics can be taken as lectures may be didactic or integrated.

2. **Journal Club:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log book the relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A time table with names of the students and the moderator should announced in advance.

3. **Subject Seminar:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the subject with names of the students and the moderator should announced in advance.

4. **Case Discussion:** Recommended to be held once a week. All the PG students are expected to attend and actively participate in discussion and enter in the Log Book relevant details. The presentations would be evaluated using check lists and would carry weightage for internal assessment. A timetable for the case presentation with names of the students should announced in advance.

5. **Ward Rounds:** Ward rounds may be service or teaching rounds.

a) **Service Rounds:** Post graduate students should do service rounds every day for the care of the patients. Newly admitted patients should be worked up by the post graduate student and presented to the faculty members the following day.

b) **Teaching Rounds:** Every unit should have 'grand rounds' for teaching purpose at the bed side. A diary should be maintained for day-to-day activities by the post –graduate students. Entries of (a) and (b) should be made in the log book.

6. **Clinico-Pathological Conference:**

Recommended once a month for all post graduate students. Presentation to be done by rotation. Presentations will be assessed using checklist. If cases are not available due to lack of clinical postmortems, it could be supplemented by published CPC's.

7. Inter Departmental Meetings: Strongly recommended particularly with departments of Cardiac Surgery at least once a month. These meetings should be attended by post graduate students and relevant entries must be made in the Log Book.

Cardiac surgery: Interesting cases and important topics related to the filed should be discussed.

8. Mortality Meeting: The mortality meeting should be conducted in the department every month. The post graduate student should prepare the details regarding the cause of death after going through the case records in detail, and should present during the mortality meeting. The death records will be discussed in detail during this meeting.

9. Teaching Skills: Post graduate students must teach under graduate students (e.g., Medical, Nursing) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as by the students. Record of their participation is to be kept in Log Book. Training of post graduate students in Educational Science and Technology is recommended.

10. Continuing Medical Education Programmes (CME): Recommended that at least one national and state level CME programmes should be attended by each student during the course.

11. Conferences: Attending conference is compulsory. Post graduate students should attend at least one national and one state level conference during the course.

12. Research Activities:

During the course, Candidate should take one topic as a thesis & the same should be submitted to the University through Proper Channel , six months prior to the examination.

Candidate should have at least one publication in Peer Reviewed Journal & this paper may be a part of the thesis.

The candidate should have at least two presentations at National & International Conferences. These presentations may be in the form of Posters/Paper Presentations.

The candidate has to pass 100 marks Basic Sciences paper at the end of the first year of residency.

Classes to be attended by the PG student:

a. Subject Seminar

: 36

b. Journal Club	: 36
c. Bedside Clinics/General Clinics	: 36
d. Cardiothoracic and Cardiology meetings	: 15
e. Interesting ECG, Echo, X-Ray chest & Hemodynamic data:	36
f. Mortality meeting	:12
g. Clinico pathological conference	:12

B) Clinical /Practical Training:

The following list gives the minimum number of procedures to be carried out independently by the candidate.

The following list gives the minimum number of procedures to be carried out independently by the candidate.

Coronary angiogram	: 50
PTCA	: 05
Permanent Pacemaker Implantation	: 02
Balloon Valvoplasty	: 10
Echocardiograms	: 200
TEE	: 10

The duration of training programme in each area is determined by the Head of the Department of cardiology. In General it includes

- a) Cardiac catheterization Lab 12 months (4 months every year)
- b) Echocardiogram Room 6 months (2 months every year)
- c) Intensive Coronary care unit 6 months (2 months every year)
- d) Out patient Department 4 months
(1 month Ist year, 2 months II year, 1 month III year)
- e) Wards 4 months (2 months I year, 2 months II year)
- f) TMT and Holter room 1 month (During I year)
- g) Cardiac surgery Department 1 month (During III year)
- h) Cardiac Electrophysiology 15 days (During III year)
- i) Nuclear Cardiology 15 days (During III year)
- j) Pediatric Cardiology 1 month (During III year)

The Student will be encouraged to visit another cardiology center at his own expenses the duration of which shall not exceed two months during the course . The candidate shall take Prior permission from HOD in this regard.

V. Other Criteria to be fulfilled for the Degree Course:

1. Internal Evaluation:

During the course of three years, the department will conduct two tests. Both of them will be annual, one at the end of first year and other at the end of second year. The test may be include the written papers, clinicals and viva-voce. Records and marks obtained in such tests will be maintained by the head of department and will be sent to the University when called for.

Results of all evaluations should be entered into log book and departmental file for documentation purpose. Main purpose of periodic examination and accountability is to ensure clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.

2. Maintenance of Log Book:

Every candidate shall maintain a log book/work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentation by the candidate as well as details of clinical or laboratory procedures, if any, conducted by the candidate. All the procedures performed by the post graduate students should be entered in the Log Book. All the day to day basis should be entered in the Log Book and it should be verified and signed by the faculty member. The Log book shall be scrutinized and certified by the Head of the department and Head of the Institution and presented to the university and during clinical examinations.

VI. SCHEME OF EXAMINATION

Candidates will be allowed to appear for examination only if attendance (Minimum 80%) and internal assessment are satisfactory and research publication work is satisfactory.

The examination will consist of theory, clinical examination and viva voce examination.

A. Theory : 400marks

The theory examination shall consist of four papers each of three hours duration. Each paper shall carry 100marks and the total marks would be 400. The format of each paper will be as below.

10 Questions of 10marks each with Grand Total of 100 marks.

	No. of Questions	Marks for each question	Total Marks
Paper I	10	10	100
Paper II	10	10	100
Paper III	10	10	100
Paper IV	10	10	100
Grand Total			400

Paper- I : Basic Sciences as applied to cardiology

Paper-II : Ischemic Heart Disease and Congenital Heart Disease

Paper –III : RHD, Hypertension, Cardiomyopathy and other Cardiovascular diseases.

Paper-IV : Recent Advances in Cardiology

Note: The distribution of topics shown against the papers are suggestive only and may overlap or change.

B. Clinical Examination : 400 marks

Type of cases	No. of cases	Marks	Duration of Examination
Long case	1	150	1hour
Short case	2	150 (75 marks each)	30minutes each
Total		300marks	

C, Viva Voce Examination : 100 marks

a. Spotters: Ten

X-Ray, ECG, Cath data, Echo, Angio, TMT, Holter tracing and any other Cardiology related things (for 30minutes) **30marks**

b. Oral Examination (for 30 minutes) **70marks**

All examiners will conduct viva –voce conjointly on candidate’s comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents, Student’s knowledge on case of instruments and drugs will also be evaluated during viva voce examination.

D. Maximum Marks:

Theory	Clinical Examination	Viva Voce Examination	Grand Total
400	300	100	800

VII. Recommended Books (Latest Edition)

Sl.No.	Name of the Book & Title	Author	Publisher name, Place of Publication
1.	Recent Advances in Cardiology	Derek J. Rewland	Churchill Livingstone
2.	Progress in Cardiology	Paul N. Yu & John F. Goodwin	Lea & Febiger, U.S. A
3.	Technique and application of interventional Cardiology	Daniel L. Kulick & Shahbudin H. Rahimtoola	Mosby Year Book, U.S.A.
4.	Heart Disease	Braunwald, Zipes Libby	W.B. Saunders Company Philadelphia U.S.A
5.	Clinical methods	Hutchison	Saunders USA
6.	Clinical Examination	Macleod’s	Elsevier London
7.	Symptoms & Signs in Clinical Medicine	Colin Oglivie & Christopher C. Evan	Oxford London
8.	Clinical recognition of congenital heart disease	Joseph K. Perlof	Saunders’s USA
9.	Atlas of Transesophageal Echocardiography	Navin C Nanda	Williams & Wilkins USA
10.	The Heart	Hurst	MC, Graw Hilli Company, USA
11.	Marriott’s Electrocardiography	Galen S. Wagner	B.I. Waverly Pvt. Ltd. New Delhi
12.	Grosman’s Cardiac Catheterization, Angiography and intervention	Donald S. Baim	Lippincot Williams & Wilkins USA
13.	Text Book of Interventional Cardiology	Eric J. Topal	Harcourt Asia OTE LTD. Singapur
14.	Echocardiography	Harvey Feigenbaum	Lea & Febger USA
15.	Echocardiography	Navin C Nanda	Williams & Wilkins, USA

16.	Clinical Examination of the heart	B. Somaraju	VNS Publication
17	Echocardiography update Volume I,II,III, IV & V	P.C. Manoria	Dr. P.C. Manoria Bhopal

VIII. RECOMMENDED JOURNALS :

01.	Indian Heart Journal
02.	American Heart Journal
03	British Heart Journal
04.	Journal of Indian College of Cardiology
05.	Journal of Indian Academy of Echocardiography
06.	Journal of American College of Cardiology
07.	American Journal of Cardiology
08	Lancet
09.	Circulation
10.	European Heart Journal
11.	Journal of American Society of Echocardiography
12.	New England Journal of Medicine
13	JAMA
14.	Heart
15.	Catheterization and Cardiovascular Intervention.

GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR DM IN NEPHROLOGY

1. PREAMBLE:

While there has been improvement in nutritional status and immunization coverage over the last three decades, chronic non-communicable diseases involving various systems are now becoming an important cause of mortality and morbidity in adults. There is an increasing demand for specialized care of adults with chronic diseases. Adults with kidney diseases are often diagnosed and referred in late stages of the disease. Most of them are not treated appropriately due to lack of expertise and want of diagnostic and therapeutic infrastructure. A phenomenal progress has taken place that has revolutionized management of adults with renal diseases. For physicians to provide optimal treatment for these kidney diseases, special training and in-depth knowledge are necessary. It is imperative to provide suitable facilities for appropriate and relevant training in nephrology to promote growth of the specialty in the country. The training should emphasis on preventive aspects, early diagnosis of common diseases and their optimum management with available resources including dialysis and transplantation. The primary goal of the training programme for DM in Nephrology is to develop clinicians who have acquired the operational skills, professionalism and knowledge necessary to direct a nephrology service, including dialysis and kidney transplantation.

The program includes 36 months of training and is designed to provide the experiences necessary for the DM students to develop the knowledge and skills to function as an nephrologist and fulfill the requirements as mandated by the Medical Council of India.

Eligibility for admission: M.D/DNB in general medicine, M.D/DNB in pediatrics

Goals:

The goal of the course shall be to produce a competent specialist in the area of Nephrology:

1. who shall be competent to handle the health needs of patients in the speciality and provide secondary and tertiary level of care,
2. who shall be able to practice the speciality ethically,
3. who shall be aware of the contemporary advances and developments in the subject,
4. who shall acquire a spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology, and
5. who shall have acquired the skills for teaching medical and paramedical professionals

A. Objectives:

The objectives of the training programme will be to enable the student:

1. To develop a scientific approach, based on the understanding of the pathophysiology and epidemiology of renal disease,
2. To provide primary, secondary and tertiary care to patients with renal disease,
3. To provide the skills for management of emergencies in unstable patients with renal problems and provide renal care to critically ill in the intensive care unit,
4. To implement a follow up plan in chronic disease,
5. To be able to work in a team along with intensivists, physicians, urologists and others to provide comprehensive care with renal disease,
6. To be able to set up and manage a Nephrology unit including dialysis,
7. To develop adequate communication and counseling skills,
8. To recognize the importance of family, society and socio-cultural environment in the treatment of renal disease,
9. To review and analyses literature, seek evidence and apply to clinical practice,
10. To develop basic research skills and carry out research projects in the field of Nephrology,
11. To develop basic teaching skills and be able to train undergraduates, postgraduates, nursing and paramedical staff regarding care of renal disease.

2. SUBJECT SPECIFIC LEARNING OBJECTIVES

- **Cognitive Domain: Theoretical Knowledge**

- 1) Understand the normal renal anatomy and physiology from fetal life to adult.
- 2) Understand the normal physiology and pathophysiology of body fluids, acid-base and electrolytes including neonates and infants.
- 3) Understand the basic principles involved in pathology of renal diseases in adults and their assessment as applicable to nephrology practice.
- 4) Understand the basics of pathologic interpretation of the biopsy, including all the components: light, immunofluorescence, electron microscopy and immunohistochemical staining.
- 5) Be conversant with the etiology, pathophysiology, diagnosis and management of common renal diseases in an out-patient, inpatient and emergency settings.
- 6) Demonstrate knowledge about biomedical, clinical and cognate sciences and how to apply them in the management of kidney diseases.
- 7) Know and apply the basic and clinically supportive sciences and present evidence-based recommendations for diagnostic and therapeutic decision-making renal diseases.
- 8) Recognize the importance of inter-disciplinary approach in the management of various renal diseases and obtain relevant specialist / ancillary services' consultation where appropriate.
- 9) Acquire knowledge for the prevention of renal diseases.

• **Practical and Clinical skills**

- 1) Understand the presentation (history and clinical examination), evaluation and management of congenital and acquired renal disorders in adults.
- 2) Order relevant investigations and competently interpret the results of laboratory studies including urinalysis and the results of general and renal imaging procedures performed in kidney and urinary tract disorders.
- 3) Formulate and implement treatment plans, and monitor the effectiveness of their interventions for various renal diseases including management of acute

Kidney injury, chronic kidney disease and end-stage renal disease in a holistic manner.

- 4) Perform competently all medical and invasive procedures, i.e., (a) percutaneous renal biopsy of native and transplanted kidneys, (b) placement of temporary vascular access or peritoneal catheter for renal replacement therapy (RRT), (c) Perform hemodialysis, acute and chronic peritoneal dialysis and continuous renal replacement therapy
- 5) Develop desired skills to independently manage emergency situations related to renal disease.
- 6) Communicate effectively and demonstrate caring and respectful behavior when interacting with renal and urinary tract problems and their families.
- 7) Be conversant with counseling techniques for the family / primary care takers.
- 8) Work with faculty and colleagues to provide patient-focused care.
- 9) Perform necessary patient care documentation in an accurate and timely manner.
- 10) Develop skills as a self-directed learner, recognize continuing educational needs and use appropriate learning resources to critically analyze relevant published literature in order to practice evidence-based medicine.

• Writing Research articles

- 1) Demonstrate competence in basic concepts of research methodology and epidemiology and be able to critically analyses relevant published research literature,
- 2) Locate, appraise and assimilate evidence from scientific studies,
- 3) Develop the expertise to perform a scientific study including formulating hypothesis, research questions, designing appropriate study, analyze and interpret the results,
- 4) Ability to write an in-depth manuscript describing a completed project,
- 5) Publication or presentation of case reports or clinical series at local, regional, or national professional and scientific society meetings.

• Attitudes including communication skills

- 1) Demonstrate respect, compassion, and integrity; a responsiveness to the needs of patients and society; and a commitment to excellence.

- 2) Demonstration of skill in listening to patients and families and the ability to effectively educate and counsel patients and their families on diagnostic and treatment decisions including initiation of dialysis therapies and prognosis.
- 3) Develop the skills to interact with professional colleagues for the care of the renal patient.
- 4) Demonstrate the ability to lead the consult service through interactions with referring and primary doctor.
- 5) Effectively work with other members of the health care team, including referring physicians from other specialties, nurses, social workers and technicians, to implement a treatment plan.
- 6) Effectively teach nephrology care to medical students, junior post graduate students and nurses.
- 7) Adopt ethical principles in all aspects of nephrology practice/ research. (Professional honesty and integrity, humility, informed consent, counseling and recognize patients' rights and privileges).

- **Training in Research Methodology**

- 1) Attend research methodology course to learn framing of research question, designing and conducting study, analyzing and interpreting data and writing a paper.
- 2) Participate in on-going research activities of the department to obtain experience in various aspects of research.
- 3) Apply knowledge of study designs and statistical methods to the appraisal of clinical studies and other information on diagnostic and therapeutic effectiveness.
- 4) Familiarize with ethics in research.

3. SYLLABUS

3.1 SUBJECT SPECIFIC THEORETICAL COMPETENCIES

3.1.1 Cognitive domain (Knowledge domain)

3.1.2 Affective domain (Attitudes including Communication and Professionalism)

3.2 SUBJECT SPECIFIC PRACTICE BASED OR PRACTICAL COMPETENCIES

The curriculum outlines competences that trainees must reach by the end of the programme (combining 3.1 and 3.2)

(A) Investigation of the kidney

1. Renal Anatomy and Physiology

Knowledge	<ul style="list-style-type: none"> • To understand the embryology and development of Genito-urinary system • To understand the development of renal function and physiology for the assessment of: <ul style="list-style-type: none"> a. GFR from height and plasma creatinine b. Calcium, phosphate & bone mineral metabolism c. Urinary concentrating and diluting ability d. Tubular handling of fluid and electrolytes e. Acid-base balance • To explain the practicalities, limitations and special precautions of measurement of: <ul style="list-style-type: none"> a. Creatinine clearance b. Protein and calcium excretion c. Tubular handling d. Tests for urinary acidification
Skills	<ul style="list-style-type: none"> • To appropriately request and interpret the above investigations
Multidisciplinary aspects	<ul style="list-style-type: none"> • Laboratory Medicine Department
Resources	<ul style="list-style-type: none"> • Clinical Physiology of Acid-Base and Electrolyte Disorders – Burton David Rose • Principles of Renal Physiology – Chris Lote • Pediatric Renal Investigations – Chapman & Taylor

2. Imaging

Knowledge	<ul style="list-style-type: none">• To understand the role, limitations and interpretation of commonly used imaging modalities• To know the practicalities and safety precautions associated with each test• To understand the role of arteriography and percutaneous nephrostomy tube placement
Skills	<ul style="list-style-type: none">• To appropriately request the different radiological investigations• To be able to interpret scan images
Multidisciplinary aspects	<ul style="list-style-type: none">• Liaison with radiologists in deciding the most appropriate investigations
Resources	<ul style="list-style-type: none">• Nephro-urology radiology meetings/Posting in nuclear medicine unit• Bank of typical case images

3. Renal Biopsy and Nephropathology

Knowledge	<ul style="list-style-type: none"> • To describe the anatomy of both native and transplant kidneys • To know the indications for renal biopsy • To describe the procedure of renal biopsy and its complications • To know the type of solutions used for light (LM), immunofluorescence (IF), and electron microscopy (EM) specimens immediately post-biopsy • To have a basic knowledge of handling and processing of renal biopsy tissue and utility of various stains (hematoxylin and eosin, periodic acid Schiff, Trichrome (Masson), silver-stains, and Congo red /immuno-florescence used in the diagnosis of renal disease.
Skills	<ul style="list-style-type: none"> • To counsel families in preparation for renal biopsy, thus allowing informed consent • To perform a native and transplant biopsy safely • To recognize the histopathologic characteristics of normal kidney on LM, IF, and EM • To recognize common histological appearances and consequences for diagnosis, prognosis and treatment • Able to interpret slides, including all the components: LM, IF and EM. • Obtain adequate clinical background and information from the appropriate nephrologist submitting the specimen to allow optimal interpretation of the biopsy.
Multidisciplinary aspects	<ul style="list-style-type: none"> • Radiologist and pathologist
Resources	<ul style="list-style-type: none"> • Nephropathology meetings • Bank of typical case • Histology Training Day for processing, staining and interpreting of renal biopsy Samples

(B)Acute Kidney Injury (AKI)

Knowledge	<ul style="list-style-type: none">• To know the differential diagnosis of AKI• To know the investigations including role of renal biopsy• To describe the methods to correct fluid and biochemical abnormalities and to know the indications for dialysis• To describe the principles of dialysis and filtration• To know the treatment of reversible causes of AKI
Skills	<ul style="list-style-type: none">• To perform a reliable and accurate clinical assessment of the patient's fluid status• To be able to appropriately manage the complications of AKI – conservative and dialysis• To be able to select and practically manage the different dialysis modalities including peritoneal dialysis, hemodialysis and hemofiltration• To be able to commence correct treatment of the underlying cause• To manage the patient with multiorgan failure or systemic disease requiring acute renal replacement therapy
Multidisciplinary aspects	<ul style="list-style-type: none">• To recognize the role of nurses in the management of AKI• Liaison and share care with the intensive care unit
Resources	<ul style="list-style-type: none">• Intensive care and neonatal intensive care units

(C) Chronic Kidney Disease (CKD)

<p>Knowledge</p>	<ul style="list-style-type: none"> • To know the epidemiology of CKD • To list the causes of CKD • To know the investigations required in a patient with new presentation of CKD, including assessment of the degree of renal failure and reversibility of the condition • To understand the natural history and prognosis of common diseases causing CKD, and treatment strategies that may ameliorate the condition • To describe the pathophysiology of renal anemia, and its investigation and management, including use of erythropoietin and iron therapy
<p>Skill</p>	<ul style="list-style-type: none"> • To identify and appropriately manage the underlying cause • To manage patient with CKD including biochemical disturbance, bone disease and anemia • To appropriately counsel the family to facilities the selection of dialysis modality and prior or referral for renal transplantation • To make an accurate clinical assessment of nutritional status and to use appropriate dietary advice with the assistance of dieticians • To prescribe and monitor treatment for hyperlipidemia • To show ability to prevent, diagnose and manage renal bone disease • To diagnose and appropriately treat renal anemia
<p>Multidisciplinary aspects</p>	<ul style="list-style-type: none"> • To appreciate the role of the multi professional team including dietitian, psychologist, social work • To understand the role of the dialysis nurse and transplant coordinator • To audit biochemical and hematological results against national guidelines • To appreciate the impact of CKD on cardiovascular disease in adult life
<p>Resource</p>	<ul style="list-style-type: none"> • Chronic kidney disease clinics • Multidisciplinary team meeting

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(D)Urinary Tract Infection (UTI) and Vesicoureteric Reflux

Knowledge	<ul style="list-style-type: none"> • To know the epidemiology of UTI • To understand current theories about renal scarring • To be aware of issues in diagnosis of UTI • To describe the role of ultrasound scan, MCU, DMSA and other investigations for UTI • To know the medical and surgical options in the management of UTI • To describe the mechanisms of action of antimicrobials and their adverse effects • To understand the secondary progression of renal damage and its prevention
Skills	<ul style="list-style-type: none"> • To appropriately manage urinary tract infection in different age groups • To show ability to counsel parents about relevant investigations of UTI, and possible management of siblings of children with reflux
Multidisciplinary aspects	<ul style="list-style-type: none"> • To know the appropriate follow-up into adult life • To recognize the role of microbiologists, urologists and radiologists • To be able to contribute to the development of strategies for management of UTI at local and regional level
Resources	<ul style="list-style-type: none"> • Microbiology department • Nephro-pediatric surgery-radiology meeting

Knowledge	<ul style="list-style-type: none"> • To understand renal embryology and developmental anatomy • To describe the anatomy of the urinary tract and the sites and causes of urinary obstruction • To know the presentations of developmental variants and abnormalities, including obstruction • To describe the fluid and electrolyte disturbances occurring following the relief of obstruction • To be aware of the different reconstructive procedures performed, and their implications for future management • To be aware of other urological diagnoses, including genital anomalies • To know the importance of ambiguous genitalia and intersex in renal disease: structural as well as neoplastic
Skills	<ul style="list-style-type: none"> • To be able to provide medical support to urological services, especially following relief of obstruction
Multidisciplinary aspects	<ul style="list-style-type: none"> • Liaison with radiologists, obstetricians and surgeons in management decisions and antenatal counseling • To show ability to communicate and work together with other health professionals
Resources	<ul style="list-style-type: none"> • Department of Urology • Radiology meeting • Department/Division of Neonatology

(E)Structural Malformations

(F)Glomerular disease

Knowledge	<ul style="list-style-type: none">• To describe the etiology, pathophysiology and immunological basis of glomerulonephritis• To know the different forms of presentation• To understand the clinical course and prognosis of acute and chronic glomerulonephritis• To know the indications for immunosuppressive agents, cytotoxic drugs, plasmapheresis and dialysis
Skills	<ul style="list-style-type: none">• To appropriately investigate and manage the acute nephritic syndrome, and new presentation of chronic glomerulonephritis• To demonstrate the appropriate use of general and specific measures to treat glomerulonephritis
Resources	<ul style="list-style-type: none">• Pathology laboratory

(G)Nephrotic syndrome

Knowledge	<ul style="list-style-type: none">• To know the causes of nephrotic syndrome• To be aware of the pathophysiology of nephrotic syndrome, including latest research• To understand the investigation of nephrotic syndrome including indications for renal biopsy• To understand the complications of the nephrotic state• To know the pharmacology and side-effects of steroids, other immunosuppressive agents and other treatment modalities
Skills	<ul style="list-style-type: none">• To appropriately investigate and manage initial episode of nephrotic syndrome and relapses and the complications• To appropriately investigate and manage steroid resistant nephrotic syndrome and the complications• To manage adverse effects of immunosuppressive medications• To demonstrate the appropriate use of general and specific measures to treat secondary causes of nephrotic syndrome
Multidisciplinary aspects	<ul style="list-style-type: none">• Liaison with local pediatricians in long-term management
Resources	<ul style="list-style-type: none">• Pathology, Department of Nephrology, Pediatrics

Knowledge	<ul style="list-style-type: none"> • To understand pathology and pathogenesis of DKD • To know course of DKD • To understand complications associated with DKD • To understand regarding existence of nondiabetics kidney disorders in diabetics • To know early detection of DKD
Skill	<ul style="list-style-type: none"> • To diagnose DKD as earliest and to use measure and medications to reverse/retard the progression of DKD • To have comprehensive care in dealing with DKD patients/to tackle other complications existing with DKD • To use newer medications in controlling proteinuria/retard progression of DKD • Plan ideal modality of access and renal replacement therapy in DKD • Timely plan kidney transplant in DKD
Multidisciplinary aspects	<ul style="list-style-type: none"> • To evaluate role of endocrinologists, cardiologists, pediatrician, vascular surgeons in DKD
Resources	<ul style="list-style-type: none"> • Diabetologists, urologists

(H)DIABETIC KIDNEY DISEASE

Knowledge	<ul style="list-style-type: none"> • To understand pathology and pathogenesis of primary and secondary hypertension and hypertension in CKD • To understand pathogenesis of hypertensive emergency • To know complications of hypertension and hypertensive emergencies
Skills	<ul style="list-style-type: none"> • To manage hypertension with or without kidney disease • Handle hypertensive emergencies • Manage hypertension in CKD
Multidisciplinary aspects	<ul style="list-style-type: none"> • To understand role of endocrinologists, radiologists in management of secondary hypertension
Resources	<ul style="list-style-type: none"> • Intensivists

(I)HYPERTENSIVE KIDNEY DISEASE

Knowledge	<ul style="list-style-type: none"> • Understand physiological changes in kidney and body in pregnancy • To know pregnancy complicating pre-existing kidney disease • To understand urinary tract infection and other complications of pregnancy
Skills	<ul style="list-style-type: none"> • To monitor complications of pregnancy in pre-existing kidney disease • Plan to terminate or allow pregnancy if complications arise in kidney disease in pregnancy • To treat complications timely like pregnancy/post-partum HUS, sepsis • Plan changes in treatment of pregnancy in renal transplant patients
Multidisciplinary aspects	<ul style="list-style-type: none"> • To understand role of obstetrician, neonatologist in management of pregnancy in kidney disease
Resources	<ul style="list-style-type: none"> • Obstetricians, neonatologists

(J) PREGNANCY AND KIDNEY DISEASE

(K)KIDNEY DISEASE IN HEART FAILS

Knowledge	<ul style="list-style-type: none">• To understand pathophysiology of all cardiorenal syndromes• To understand the outcomes of cardiorenal syndromes
Skills	<ul style="list-style-type: none">• To know optimal treatment of cardiorenal syndromes• To choose ideal modes of renal replacement therapy in high-risk cardiac disease with renal failure• To know current line and newer trends of management of cardiorenal syndromes
Multidisciplinary aspects	<ul style="list-style-type: none">• To have comprehensive approach with cardiologists and cardiac surgeons in optimizing management of cardiac diseases in renal failure
Resources	<ul style="list-style-type: none">• Cardiologists and cardiovascular surgeons

(L)KIDNEY DISEASE IN HEPATIC FAILURES

Knowledge	<ul style="list-style-type: none">• To understand pathophysiology of hepatorenal syndromes• To know outcomes of hepatorenal syndromes
Skills	<ul style="list-style-type: none">• To know current management of hepatorenal syndromes• Choose ideal modality of renal replacement therapy in treatment of hepatorenal syndromes• To know management of renal failure post liver transplant
Multidisciplinary aspects	<ul style="list-style-type: none">• To have comprehensive approach with gastroenterologist, hepatologist, surgical gastroenterologist in management of hepatorenal syndrome and plan liver transplant
Resources	<ul style="list-style-type: none">• Gastroenterologist, surgical Gastroenterologist

(M)KIDNEY DISEASES IN NEUROLOGICAL DISORDERS

Knowledge	<ul style="list-style-type: none">• To understand pathophysiology of electrolyte imbalance and brain edema/ischemia• To understand pathophysiology and clinical features uremic• To know role of plasmapheresis in neurological diseases
Skills	<ul style="list-style-type: none">• To treat cerebral edema/ischemia in presence of renal failure• To choose best modality of renal replacement therapy in renal failure in acute stroke cases• To plan timely the need of plasmapheresis in neurological disorders like AIDP and myasthenia gravis
Multidisciplinary aspects	<ul style="list-style-type: none">• To have comprehensive approach in management of neurological disorders with renal failure with neurologists and neurosurgeons
Resources	<ul style="list-style-type: none">• Neurologists, Neurosurgeons

Knowledge	<ul style="list-style-type: none"> • To know benign and malignant tumors of urinary tract • To understand nature of tumors and their complications • To understand management aspects to urinary tract tumors
Skills	<ul style="list-style-type: none"> • To diagnose the urinary tract tumors timely • To plan treatment according to stage of illness and fitness of patients • To know newer aspects of treatment of urinary tract tumors
Multidisciplinary aspects	<ul style="list-style-type: none"> • To involve urologists/oncosurgeons/oncologist early in suspected urinary tract tumors
Resources	<ul style="list-style-type: none"> • Urologists, oncosurgeons, oncologists, radiologists

(N)URINARY TRACT TUMORS

(O)Systemic lupus erythematosus (SLE)

Knowledge	<ul style="list-style-type: none">• To describe the pathogenesis of SLE and underlying immunological mechanisms• To list the histological classification of lupus nephritis• To describe the clinical course of lupus nephritis• To describe the different treatment options
Skills	<ul style="list-style-type: none">• To perform a relevant clinical examination to diagnose and assess a patient with SLE• To plan and interpret investigations, including renal histology and immunology• To appropriately manage acute renal failure due to SLE, including use of plasmapheresis• To show ability to undertake long-term management of the patient with lupus nephritis

Multidisciplinary aspects	<ul style="list-style-type: none"> • To appreciate the role of other specialists, especially rheumatologists • To counsel the patient about long-term implications of SLE, including problems with renal transplantation and • impact on reproductive potential
Resources	<ul style="list-style-type: none"> • Adult nephrology, rheumatology services

(P)Other Vasculitis

Knowledge	<ul style="list-style-type: none"> • To understand the pathophysiology and immunology of vasculitis • To know the different causes of vasculitis • To know the presentation of vasculitis, patterns of multisystem involvement and spectrum of disease • To describe the investigation and monitoring of the patient with vasculitis • To list the different therapeutic options available, including adverse effects
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Skills	<ul style="list-style-type: none"> • To perform a relevant multisystem clinical examination • To be able to appropriately investigate and treat vasculitis, including use of immunosuppression, in the short and long-term
Multidisciplinary aspects	<ul style="list-style-type: none"> • To work with other specialists including rheumatologists
Resources	<ul style="list-style-type: none"> • Adult rheumatology clinics and Pediatric

(Q) Hemolytic uremic syndrome (HUS)

Knowledge	<ul style="list-style-type: none">• To understand the pathophysiology of microangiopathic hemolytic anemia• To know the epidemiology of VTEC, S. dysentery• To know the presentation and clinical course of diarrhea-positive and atypical HUS• To be aware of non-renal manifestations of HUS• To understand the long-term consequences and prognosis of D+ HUS• To understand principles of treatment, including conservative, and the role of plasma exchange and dialysis• To understand the investigation of atypical HUS• To be aware of the long-term management of atypical HUS including implications for transplantation
Skills	<ul style="list-style-type: none">• To be able to investigate, diagnose and manage the initial presentation of HUS• To appropriately initiate dialysis and plasma exchange

(R) Interstitial nephritis

Knowledge	<ul style="list-style-type: none">• To list the causes of interstitial nephritis and tubulointerstitial disease, and the relationship to systemic conditions
Skills	<ul style="list-style-type: none">• To appropriately investigate and manage the patient with interstitial nephritis, including use of corticosteroids

(S)Hypertension

<p>Knowledge</p>	<ul style="list-style-type: none"> • To define and understand how to diagnose hypertension • To know the common renal and non-renal diagnose simplicated in hypertension in different age groups • To describe the possible mechanisms causing primary(essential) and secondary hypertension • To describe the investigation of hypertension including theuse of arteriography and renal vein sampling; nuclear imaging • To describe the mechanism of action and side-effects of anti-hypertensive agents • To understand vascular interventions in renal arterystenosis
<p>Skills</p>	<ul style="list-style-type: none"> • To show ability to appropriately investigate the patients with hypertension • To be competent in the management of hypertensive emergencies • To be competent in the management of chronic hypertension, and in using the different classes of drugs • To be able perform and interpret ABPM read out and • modify prescription
<p>Multidisciplinary aspects</p>	<ul style="list-style-type: none"> • Liaison with local pediatricians; interventional radiologist
<p>Resources</p>	<ul style="list-style-type: none"> • Intensive care unit; Radiology services

(T)Nephrolithiasis

Knowledge	<ul style="list-style-type: none">• To know the etiology of renal stone formation, including underlying tubular abnormalities• To know the biochemical and radiological investigation of renal stones• To understand the acute and chronic medical (including prevention of the development of renal stones) and surgical management of renal stones (including lithotripsy)
Skills	<ul style="list-style-type: none">• To demonstrate ability to appropriately investigate the patients with renal stones• To show ability to manage the patients with renal stones
Multidisciplinary aspects	<ul style="list-style-type: none">• To involve urologists were indicated• To show understanding of the significance of the family history and genetic implications in some cases
Resources	Departments of Laboratory Medicine, Urologists, Urology and Radiology

(U)Tubular disorders

Knowledge	<ul style="list-style-type: none">• To understand the different presentations of primary and secondary tubular disorders• To know the different causes• To understand the investigation of tubulopathies
Skills	<ul style="list-style-type: none">• To be competent in the investigation and management of tubular disorders
Multidisciplinary aspects	<ul style="list-style-type: none">• To understand the role of other specialists (hepatologists,neurologists, biochemists, geneticists) in the diagnosis, management and treatment of these disorders• To be able to provide dialysis support to other specialists
Resources	<ul style="list-style-type: none">• Metabolic clinics, Endocrine clinic• Biochemistry department

(V)Cystic disease

Knowledge	<ul style="list-style-type: none">• To list the different causes of renal cystic disease in different age groups• To describe the mode of inheritance and methods of screening• To know the clinical course and associated features of autosomal recessive and autosomal dominant polycystic kidney disease
Skills	<ul style="list-style-type: none">• To appropriately examine and investigate the adults with renal cysts in different age groups• To appropriately manage the patients with polycystic kidney disease
Multidisciplinary aspects	<ul style="list-style-type: none">• To appreciate the implications of a diagnosis of autosomal dominant polycystic kidney disease on other family members• To recognize the importance of genetic counseling
Resources	<ul style="list-style-type: none">• Radiology services

(W)Genetic disorders (Inherited diseases of the kidneys)

Knowledge	<ul style="list-style-type: none">• To know the presentation and management of commonly encountered inherited renal disease including renal involvement in syndromes, familial nephritis and polycystic kidney disease• To understand basic genetic principles
Skills	<ul style="list-style-type: none">• To be able to advise parents of the risks of recurrences and the need for family screening in commonly inherited diseases
Multidisciplinary aspects	<ul style="list-style-type: none">• To understand the role of the geneticist in diagnosis and counseling, including antenatal diagnosis
Resources	<ul style="list-style-type: none">• Geneticist

(X)Fluid and electrolyte disturbances

Knowledge	<ul style="list-style-type: none">• To understand the physiology underlying fluid and electrolyte imbalance in the patients without primary renal disease• To know the principles of treatment of fluid and electrolyte imbalance• To know the endocrine diseases associated with electrolyte imbalance and their management
Skills	To be able to manage fluid and electrolyte imbalances in non-renal disease including overdose
Resources	<ul style="list-style-type: none">• Intensive care unit• Endocrine clinics

(Y)Neurogenic bladder

Knowledge	<ul style="list-style-type: none">• To know the pathophysiology of neurogenic bladder• To know the role of basic urodynamic investigations• To know the appropriate surgical management of different types of bladder dysfunction• To understand the treatments available to regularize bowel and bladder habit
Skills	<ul style="list-style-type: none">• To be able to appropriately assess the whole patients with neurogenic bladder• To show ability to investigate and manage the upper and lower urinary tract
Multidisciplinary aspects	<ul style="list-style-type: none">• To know the importance of shared care with surgeons and urologists
Resources	<ul style="list-style-type: none">• Urologists

(Z)Hematuria

Knowledge	<ul style="list-style-type: none">• To know the pathophysiology of macroscopic and microscopic hematuria• To describe the methods of investigation in microscopic hematuria, including the role of renal biopsy• To understand the various findings of phase contrast microscopy and their meaning• To know the underlying causes of hematuria• To know the long-term outcome of the underlying causes
Skills	<ul style="list-style-type: none">• To be able to perform urinalysis• To demonstrate appropriate investigation and management of the patient with hematuria, including role of imaging, urological assessment, and genetic and molecular studies
Multidisciplinary aspects	<ul style="list-style-type: none">• To explain the mode of inheritance of hereditary nephritis, and implications for other family members• To appreciate the role of the Urologists• To understand the need for long-term follow up
Resources	<ul style="list-style-type: none">• Nephropathology meeting• Pathology laboratory (microscopy of urine)

(Z1) Proteinuria

Knowledge	<ul style="list-style-type: none">• To know the pathophysiology of proteinuria• To know the physiological and pathological causes of asymptomatic proteinuria• To describe the methods of investigation of asymptomatic proteinuria• To list the indications for renal biopsy• To know the long-term prognosis of the various conditions causing proteinuria
Skills	<ul style="list-style-type: none">• To be able to differentiate between pathological and physiological proteinuria• To show ability to manage the child with proteinuria
Multidisciplinary aspects	<ul style="list-style-type: none">• To understand the requirement of long-term follow-up

(Z2) Disorders of Micturition

Knowledge	<ul style="list-style-type: none"> To know the common renal and non-renal diagnoses associated with enuresis To know the appropriate use of urodynamic studies To explain the rationale for various management strategies in enuresis using behavioral and pharmacological therapies
Skills	<ul style="list-style-type: none"> To be able to interpret urodynamic studies, and instigate appropriate management To know the practicalities involved in enuretic alarms
Multidisciplinary aspects	<ul style="list-style-type: none"> Liaison with urodynamic staff Role of the psychologist
Resources	<ul style="list-style-type: none"> Urologists

(Z3) Transplantation

Knowledge	<p><u>Pre-Transplantation</u></p> <ul style="list-style-type: none"> To understand the ethical issues surrounding organ donation/ transplant To know the principles of recipient selection, indications and contraindications To describe the theoretical and practical application of blood grouping, HLA matching and donor-recipient cross matching To know what is involved in a transplant work-up To know the advantage and disadvantage of deceased versus live related donor transplantation To know the acceptability criteria for deceased organ donation
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- To describe the advantages and disadvantages of preemptive transplantation

Transplantation

- To understand the unique needs of adults undergoing organ transplantation
- To know the basic surgical procedures involved
- To know the medication used, including side-effects and recent advances and trials
- To know the approach towards handling deceased organ transplantation

Post Transplantation

- To know the indications for and knowledge of the procedure of renal transplant biopsy
- To understand the immune mechanisms of rejection
- To know the recurrence rate of the original disease, and other complications pertaining to the original diagnosis and their management

Skill	<p><u>Pre-Transplantation</u></p> <ul style="list-style-type: none"> • To assess the suitability of patient for renal transplant • To discuss the issues of transplantation <p>Transplantation</p> <ul style="list-style-type: none"> • To be able to manage the peri-operative transplant • To assess renal transplant function • To plan and modify immunosuppressive therapy <p>Post Transplantation</p> <ul style="list-style-type: none"> • To be competent in the diagnosis and management of acute rejection episodes • To understand the role of fine needle cytology and histopathology for diagnosing rejection • To be able to advise the child, family and school • To be able to diagnosis and manage chronic rejection • To be aware of the diagnosis and management of the short and long-term complications of transplantation • To counsel patients with a failing graft and discuss future management on renal replacement therapy
Multidisciplinary aspects	<ul style="list-style-type: none"> • To understand the role of the transplant coordinator • To appreciate the role of the multidisciplinary team
Resource	<ul style="list-style-type: none"> • Transplant clinic • Tissue typing laboratory • Transplant surgeon

(Z4) COVID SCENARIO IN NEPHROLOGY CARE

Knowledge	<ul style="list-style-type: none"> • To know about covid disease • To know about covid causing kidney disease • To understand covid affecting preexisting kidney disease • To understand covid disease affecting kidney transplant patients
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ls	<ul style="list-style-type: none"> • To know treatment of covid infection • To understand regarding changes in management of covid infection in renal failure • To decide from of renal replacement in renal failure in covid infection • To know newer option of management in severe covid cases with or without renal failure like endotoxin removal/adsorbent therapy
ltidisciplinary Aspects	<ul style="list-style-type: none"> • Liaison with local physicians and generally practioners
ources	<ul style="list-style-type: none"> • Physicians, respiratory physicians, intensivists

(Z5) INTERVENTIONAL NEPHROLOGY

nowledge	<ul style="list-style-type: none"> • The candidate should have knowledge of perm caths, techniques of insertion • He should be exposed to complications post perm caths, insertion • He has to be well versed with complications of AV fistulas • To know indications of renal artery angiography
ls	<ul style="list-style-type: none"> • The candidate should perform perm Cath insertion independently • To have knowledge regarding management of perm Cath complications post insertion • Candidates have to acquire skills in performing venography in AV fistulas complications • The candidate must gain exposure in performing renal artery angiography and performing renal artery procedures like angioplasty and coil embolization in complications post kidney biopsy • The candidate should insert CAPD catheters
ltidisciplinary ects	<ul style="list-style-type: none"> • Liaison with dialysis technician and referral doctors, physicians
ources	<ul style="list-style-type: none"> • Interventional radiologists, vascular surgeon, urologist

(Z6) DIALYSIS

1. Hemodialysis

Knowledge	<ul style="list-style-type: none">• To describe the principles of hemodialysis and compare and contrast with other methods of dialysis• To describe the anatomy of the neck veins, and their assessment• To describe the methods of vascular access and arteriovenous fistulas, and their complications• To understand the principles of water treatment and maintaining water quality• To define the methods to assess adequacy of hemodialysis• To list the complications occurring during dialysis• To list the particular infections which may occur in patients on dialysis, and to define strategies to prevent blood-borne viral infections in patients on hemodialysis
Skills	<ul style="list-style-type: none">• To be able to plan the initiation of hemodialysis• To manage different forms of vascular access, and their difficulties• To assess the functional status of AV fistula and cannulate• To operate hemodialysis machine and respond to alarms; disinfection of machines and circuits• To be able to handle dialyzers and the dialyzer tubing appropriately• To adjust the prescription of hemodialysis based on adequacy and monitor change• To manage the complications of hemodialysis• To diagnose, investigate and treat infection

Multidisciplinary aspects	<ul style="list-style-type: none"> • To understand the role of the nurses in preparing the patient physically and psychologically for hemodialysis, and in the long-term management • To counsel patients about blood borne infection • To work closely with the microbiologist in developing protocols and in audit and management of infection
Resources	<ul style="list-style-type: none"> • Hemodialysis technician and nurses • Departments of Nephrology, Microbiology and Surgery

(Z7) Peritoneal Dialysis

Knowledge	<ul style="list-style-type: none">• To describe the principles of acute and peritoneal dialysis, and know the advantages and disadvantages compared to hemodialysis• To describe methods to assess adequacy of peritoneal dialysis and ultrafiltration• To describe the anatomy and outline the surgical procedure of insertion of peritoneal dialysis catheters• To know the complications of peritoneal dialysis, both infective and mechanical
Skills	<ul style="list-style-type: none">• To be able to prescribe peritoneal dialysis and monitor change and measure adequacy• To perform peritoneal equilibration test (PET)• To manage the complications of peritoneal dialysis
Multidisciplinary aspects	<ul style="list-style-type: none">• Urologists

(Z8) Pharmacology

Knowledge	<ul style="list-style-type: none">• To define the principles of pharmacokinetics and drug handling in renal impairment• To list ways in which different classes of drugs act on the nephron• To describe how drugs may affect renal function• To list the effects of hemodialysis, hemofiltration and peritoneal dialysis on drug prescribing• To describe the principles of drug interactions especially immunosuppressive agents
Skills	<ul style="list-style-type: none">• To prescribe safely to patients with renal disease
Multidisciplinary aspects	<ul style="list-style-type: none">• To educate patients regarding importance of compliance and reporting of problems with medication
Resources	<ul style="list-style-type: none">• Pharmacologists

(Z9) Psychosocial and Ethical issues

Knowledge	<ul style="list-style-type: none">• To understand the impact of chronic illness on the adolescent, parents, siblings and extended family• To understand the ethics of research in adult• To know the process of informed consent in different ages• To know the procedures for clinical trials
Skills	<ul style="list-style-type: none">• To demonstrate competence in communication skills at initial diagnosis and thereafter• Liaison with Physician and other health professionals• To show interest in ethical discussions within the department• To show ability to take informed consent
Multidisciplinary aspects	<ul style="list-style-type: none">• To understand the role of the psychologist, psychiatrist, social worker, teacher and religious leaders<ul style="list-style-type: none">• To understand the care of the dying patient
Resources	<ul style="list-style-type: none">• Multidisciplinary team meeting

(Z10) Teaching skills

Knowledge	<ul style="list-style-type: none">• To understand the principles of adult learning and different teaching techniques• To understand the role of clinical audit and research
Skills	<ul style="list-style-type: none">• To demonstrate formal and informal teaching skills at undergraduate and postgraduate level, and to other professionals within the multidisciplinary team• To demonstrate continuing self-education and self-reflection• To show support or active involvement in research• To show ability to critically evaluate literature reviews, audit and research papers• To demonstrate ability in oral presentation skills and manuscript preparation

(Z11) Nutrition

Knowledge	<ul style="list-style-type: none">• To develop basic knowledge of nutritional requirements of patients with acute kidney injury and chronic kidney disease including those on dialysis and transplantation
Skills	<ul style="list-style-type: none">• To be able to counsel and provide nutritional advice for patients with chronic kidney disease
Multidisciplinary aspects	<ul style="list-style-type: none">• Nutritionist

Competency in Procedural /Practical Skills:

The post graduate student should be able to perform independently the following procedures

- **Renal biopsy**

Satisfactory performance of percutaneous biopsy of native and transplant kidneys entail:

- knowledge of indications for the procedure,
- obtaining informed consent,
- performance of the procedure itself including minimizing patient discomfort, and
- interpretation of results of the biopsy.

- **Central venous access insertion for hemodialysis (Non tunneled and tunneled)**

Satisfactory placement of vascular access entails:

- knowledge of informed consent,
- proper Seldinger technique,
- knowledge of vascular anatomy,
- minimizing patient discomfort, as well as
- functional catheter placement and recognize/manage complications

- **Acute peritoneal dialysis catheter insertion**

Satisfactory placement of peritoneal catheter placement entails:

- knowledge of informed consent,
- proper technique,
- minimizing patient discomfort, as well as
- functional catheter placement.

In addition, they should be able to perform independently the following:

To be able to write a prescription, conduct and supervise acute and chronic intermittent hemodialysis

- Entails knowledge of proper indications for hemodialysis,
- knowledge of first dialysis precautions,
- writing of dialysis order which includes choosing dialysis filters,
- choosing dialysate composition,
- understanding and treatment of complications, and
- modifying dialysis prescription for inadequate clearance in chronic hemodialysis patients.

To be able to write a prescription, conduct and supervise acute and chronic peritoneal dialysis:

- Entails knowledge of proper indications of peritoneal dialysis,

- writing orders for peritoneal dialysis which includes dialysis prescription (volume of dialysate, frequency of exchanges, and use of different hypertonic solutions),
- understanding and treatment of complications, and
- modifying dialysis prescription in special situations (lactic acidosis, metabolic disorders) and inadequate clearance in chronic peritoneal dialysis patients

To be able to write a prescription, conduct and supervise continuous renal replacement therapy (CRRT)

- Entails knowledge of proper indications of CRRT,
- writing orders for continuous renal replacement therapy (flow rate of dialysate, choosing ultrafiltration rate,
- choosing dialysate composition including the use of bicarbonate-based solutions),
- understanding and treatment of complications, and
- modifying dialysis prescription for inadequate clearance in patients undergoing continuous renal replacement therapy

To be able to write a prescription, conduct and supervise slow low efficiency daily dialysis (SLED)

- Entails knowledge of proper indications of SLED,
- writing orders (flow rate of dialysate,
- choosing ultrafiltration rate,
- choosing dialysate composition,
- understanding and treatment of complications, and
- modifying dialysis prescription for inadequate clearance in patients undergoing SLED

To be able to write a prescription, conduct and supervise plasmapheresis

- Entails knowledge of proper indications of plasmapheresis,
- writing orders (volume of plasma replacement,
- choosing rate of plasmapheresis, monitoring,
- understanding and treatment of complications, and modifying plasmapheresis prescription based on the goal of plasmapheresis.

To be able to perform urine analysis at bedside

- To perform correctly urinalysis and interpret findings and to know the limitations of interpretation as applied to patient care.

Procedure	O	A	P	SJ
Renal biopsy				
Hemodialysis catheter access				
Acute peritoneal catheter insertion				

O- Observed; A- Assisted; P- Performed independently; SJ- Supervised junior colleague

4. TEACHING AND LEARNING METHODS

Clinical postings: Recommended schedule for three years training

The training of the post graduate student shall be a residency program with graded responsibility in the management of patients entrusted to his/her care. The participation of the students in all facets of the educational process is essential. The post graduate student shall take active part in seminars, group discussions, clinics, journal reviews, CPC and clinical meetings. The post graduate student shall also participate in training of post graduates, nursing and paramedical staff. They shall also be involved in research activities pertaining to the subject.

The post graduate student is required to work full time in the Department of Nephrology participate in the patient care and academic and research activities as described below. The trainee should attend not less than 80% (Eighty percent) of the training during the calendar year.

Orientation programme: The post graduate student would first familiarize himself/herself with the faculty of the department and other allied specialties; general working of the hospital, the Wards, admission norms, geography of the hospital, location of the various services, discharge protocol, ordering investigations and other administrative aspects that may help in them during their training period.

The clinical postings will divide between the out-patient services, sub-specialty clinics, wards, dialysis, intensive care unit and electives.

The training will consist of intensive training in Clinical Nephrology in order to develop the fundamental skills and knowledge required to evaluate, diagnose and formulate management plans for various renal diseases in out-patient and in patient setting and in emergency cases. During the postings in ward, the DM student will be directly involved in patient care and present clinical cases to the faculty and receive one-on-one instruction and feedback in history taking, physical examination and management. The senior DM students will also engage in supervising and teaching junior colleagues. The faculty will interview, examine and discuss assessment and plans with the DM students for all inpatient consultations and emergency cases. The DM student will also undertake 24 hour calls as per the schedule of the department and will report to faculty on call. The student will also learn to counsel the patients and care takers. It will be the responsibility of the DM student to maintain documentation regarding the care of the patients treated in the unit. This will include preparation of discharge summaries, scheduling of treatment protocols for chronic diseases and transplant patients, and preparing medical reports.

During the postings, the DM student will perform various procedures initially under supervision of faculty or senior trainees and later independently like percutaneous renal biopsy of both native and transplanted kidneys, placement of temporary vascular access for hemodialysis or continuous renal replacement therapy, placement of peritoneal catheter for acute peritoneal dialysis, prescribing, supervising and trouble-shooting acute and chronic hemodialysis, peritoneal dialysis, continuous renal replacement therapy, plasmapheresis and performing urinalysis.

The total period of the course is 36 months. Of this, 30 months will be spent in the nephrology unit; 6 months will be meant for rotations in related specialties.

Suggested posting

schedule

Mandatory

- | | |
|--|-------------|
| ○ Nephrology including hemodialysis service and transplant | 30 months |
| ○ Urology | 1 month |
| ○ Pediatric Nephrology | 1-2 months |
| ○ Renal Pathology | 15 -30 days |

Electives (at least three of the below - 3 months)

- PICU/NICU
- Radiology
- Nuclear medicine
- Posting to an external Pediatric Nephrology unit
- Genetics
- Transplantation immunology and diagnostics

(i) **Academic sessions:** In addition to bedside teaching during clinical rounds and in out-patient setting, formal teaching is necessary. The departments may select a mix of the following: sessions:

Journal club/Review	Once a month
Medical audit	Once a month
Seminar; lecture	Twice in a month
Case discussions	Once a week
Interdepartmental case or seminar	Once a month
Attend accredited scientific meetings (CME, symposia, and conferences)	

Additional sessions on basic sciences, biostatistics, and research methodology, teaching methodology, medical ethics and legal issues related to pediatric nephrology are suggested.

- a) **Journal Club/Review:** Once per month of 1 hour duration-. The presentation of journal club includes a brief review of the scientific context of the paper, the data, an analysis thereof, and a critique/discussion of the experimental approach/study design and results. In journal review, relevant articles from recommended journals are reviewed. Each post graduate student shall present at least 6 journal club/reviews in one academic year and attend at least 12 others.
- b) **Seminars/Topic review:** Seminar twice every month of 1 hour duration. Aim is to provide didactic seminars on topics that cover the broad field of Nephrology and includes basic sciences relevant to the topics being discussed. Each post graduate student shall present at least 6 seminars/symposia in one academic year and attend at least 12 others.
- c) **Case presentation** in the ward once a week for one hour. Post graduate students will present a clinical case for discussion before a faculty and discussion made pertaining

to its management and decision to be recorded in case files. Alternatively, a case is selected and presented by a post graduate student (with faculty input) from those encountered by the post graduate student in hospital and in outpatient clinics. Important literature review associated with the case may also be presented. The case is analyzed in order to make key teaching points. Each post graduate student shall present at least 6 clinical cases in one academic year and attend at least 12 others.

- d) **Clinical renal pathology Conference:** Once a month of 1 hour duration. The biopsies performed during the preceding month will be discussed. The post graduate student will summarize the clinical aspects of the case followed by interpretation of the renal biopsy in conjunction with faculty from pathology. Each post graduate student shall present at least 6 cases in one academic year and attend at least 10 sessions.
 - e) **Inter-departmental seminar or Grand Round:** Presentation of cases in clinical combined / grand rounds (Pediatrics, Urology Surgery, Radiology, nutrition) once in a month. Each post graduate student shall present at least 3 cases in one academic year and attend at least 8 sessions.
 - f) **Mortality and Morbidity/Audit meet:** Once a month for one hour to discuss the mortality and departmental statistics.
- (ii) **Teaching in the out-patient setting, during clinical rounds:** The faculty should engage in briefly discussing with the post graduate students various common and uncommon cases presenting in the OPD. There would be at least one consultant-led ward round daily that includes referral in other departments and ICU. This would be a service round with individual case presentation and brief discussion. In addition, at least 02 teaching rounds per week are recommended involving detailed discussion on admitted clinical cases. Besides theoretical aspects, emphasis must be laid on bedside assessment and practical management issues.
- (iii) **Others:** These include non-formal teaching during the discussion on management strategies for specific sub groups of patients with renal diseases.
- a) **Dialysis meets:** Once a fortnight for one hour to discuss the various aspects of the children undergoing maintenance hemodialysis or peritoneal dialysis.
 - b) **Transplant meets –** once a fortnight for one hour to discuss transplant workup and also discuss management issues in patient who have been transplanted.

- (iv) **Conference, CME's and Workshops:** Participating and contributing to the organization of such meets is desirable. During the 3-year period of training; he/she should attend at least one national or international and one state level meet.
- (v) **Paper Presentation/ Publication:** During the training programme, the trainees must have presented at least one paper in a national or international conference and have at least one publication in a peer reviewed journal.
- (vi) **Teaching by trainees:** The post graduate student will assist and be involved in the teaching of under graduate medical/ nursing students and those training for MD (medicine). He/she will learn the use of various teaching – teaching media (eg. audiovisual aids) in this exercise.

12. LOG BOOK

The DM student shall maintain a log book of the work carried out by them and the training programme undergone during the period of training including details of procedures assisted or done independently by the trainees. The log book shall be checked and assessed periodically by the faculty members imparting the training. Maintenance of performance record in Log book is mandatory. Certified and assessed copy should be made available at the time of practical examination for review by examiners.

Log book should be made to contain:

1. Certificate duly signed by Head of department and Head of Institute stating Dr..... has worked in department from.....to.....for a period of 3 years. This performance record book contains authentic record of work done and assessment for last 3 years.
2. Record of training: Name of the trainee; Name of the Hospital; Training period; Name of guide.
3. Posting.
4. Working schedule.
5. Teaching programme.
6. Presentational academic sessions (Journal club/Review, Seminars, Case presentation/conference, Audit, Teaching activity): Date, Topic/Article name, Presenter/Attendee, Assessment.

7. Procedures: Date, Name of patient, Type, Complications observed. Mentioned if supervised / performed independently or supervised colleague during the procedure.
8. Participation in Research Activity: name of project, Duration.
9. Conference / Workshop attended: Date/Conference name/Place
10. Paper presentation / Publications.

ASSESSMENT

FORMATIVE ASSESSMENT, during the training programme

Formative assessment (periodic, multiple) is an internal assessment by the teaching faculty of the department. The faculty should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

Each trainee should attend regular appraisal meetings and reviews of their academic performances, competence progression and workplace-based assessments by the faculty of the department. It is frequent, covers small content areas and provides immediate feedback to the teacher and the taught.

Assessment

- | | |
|--|-------------------------|
| • Personal attributes | 3-6 months |
| • Clinical skills and performance | 3-6 months |
| • Academic activities | 3-6 months |
| • Theory assessment | End of 12 and 24 months |
| • Practical assessment | -do- |

Personal attributes include a broad assessment of general attitude, interest in work, initiative, responsibility and reliability, organizational ability, communication skills, professional attitude and team work.

Assessment of academic activities includes Journal based / recent advances learning, participation in departmental and interdepartmental learning activity, external and outreach activities and attending /presenting abstracts in CMEs and conferences.

Clinical skills and performance, academic performance and personal attributes shall be graded on a scale of 1 to 9 listed in DM student appraisal form (Annexure I). The academic presentations shall be graded at the time of presentation of the faculty in-charge. Evaluation on clinical skills including competency in procedures and personal attributes shall be done by the Unit in-charge at the end of every quarter.

SUMMATIVE ASSESSMENT, namely, assessment at the end of training

The summative examination should be carried out as per the Rules given in POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000. The Post graduates examination shall be in two parts and will be as per the details given in Post Graduate Regulations, 2000.

Summative evaluation (terminal, single) is a combined assessment by the internal and external examiners designated by the NMC/Medical University of the State at the end of the course.

The DM examination shall be in two parts: Theory and Clinical / Practical and Oral/viva voce Examination.

VI. SCHEME OF EXAMINATION:

Candidates will be allowed to appear for examination only if attendance (minimum 80%) and internal assessment are satisfactory and research / publication work is satisfactory.

A. Theory: 400 Marks

The theory examination shall consist of four question papers, each of three hours duration. Each paper shall carry maximum of 100 marks and the total maximum marks would be 400. The format for the theory paper shall be as follows:

Type of questions	No. of questions	Marks for each question	Total marks
Short essay	10	10	100
Grand total			100

There shall be the following four theory papers:

Paper 1: Basic Medical Sciences in Nephrology

Paper 2: Clinical Nephrology

Paper 3: Dialysis and Transplantation

Paper 4: Recent advances in Nephrology.

B. Practical Examination: 300 marks.

1. Clinical examination:

DM student shall appear for practical exam on given date with

- a) Logbook duly signed by HOD.
- b) Project report duly signed by HOD.

Type of cases	Marks	Duration
One Long case-	100 marks	1 hour
Two Short cases	- 50 marks each	30 min each
2. Spotters	- 50 marks	
3. Ward rounds	- 50 marks	

C. Viva Voce examination: (including Histopath slides and Radiology) - 100 marks

Aims: To elicit candidate's knowledge and investigative / therapeutic skills.

All examiners will conduct viva voce conjointly on candidates' comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition, candidates may be given histopathology slides, investigation like CT/MRI scans etc

D. Maximum marks:

c) Theory	-	400
d) Practical's	-	300
e) Viva voce	-	100
Grand total	-	800

E. Passing criterion

To pass the examination the candidate must secure at least 50% of marks in each head of theory and practicals separately or as per the existing MCI regulations for postgraduate medical education.

VII. RECOMMENDED BOOKS

Essential Books (Latest Editions)

Sl.No.	Title	Author	Publisher
1	Oxford Text book of Clinical Nephrology	Davison, 3 rd edition, 2006	Oxford publication
2	Diseases of the kidney and urinary tract	Robert W.Schrier Seventh Edition, 2001	LWW publication
3	The Kidney	Brenner and Rector Seventh edition, 2005	W.B. Saunders
4	Comprehensive Clinical Nephrology	Johnson and Feehally, 2018	Mosby
5	Acid-Base and Electrolytes disorders	Rose D.Burton 5 nd Edn, 2001	W.B. Saunders
6	Transplant Kidney transplantation	Peter Morris-----7 th Edn, 2013	Elsevier
7	Hand book of kidney Transplantation	Danovitch 5 th Edn, 2010	Lippincott Williams & Wilkins
8	Dialysis: Hand book of dialysis	Daugirdas 5 th edition, 2014	Lippincott Williams & Wilkins
9	Renal replacement therapy	Drecker 2 nd Edn, 2017	Biomed Central

The authors / editors may change with newer editions.

VIII. RECOMMENDED JOURNALS:

Sl.No.	Journal	Publisher
1	Kidney International	Elsevier
2	American Journal of Kidney diseases	Elsevier
3	Journal of American Society of Nephrology	Lippincott Williams & Wilkins
4	Nephrology Dialysis and Transplantation	Elsevier
5	Seminars in dialysis	Wiley
6	Clinical Transplantation	Wiley
7	Transplant proceedings	Elsevier
8	New England Journal of Medicine	Massachusetts Medical Society
9	Journal of Indian Society of Nephrology	Medknow publications
10	Journal of Association of Physicians of India.	Jaypee press

Annexure I

DM Student Appraisal Form

Pre / Para /Clinical Disciplines

Name of the Department/Unit

:Name of the PG Student

:

Period of Training : FROM.....TO.....

Sr. No.	PARTICULARS	Not Satisfactory			Satisfactory			More Than Satisfactory			Remarks
		1	2	3	4	5	6	7	8	9	
1.	Journal based / recent advances learning										
2.	Patient based /Laboratory or Skill based learning										
3.	Self-directed learning and teaching										
4.	Departmental and interdepartmental learning activity										
5.	External and Outreach Activities / CMEs										
6.	Research work										
7.	Log Book Maintenance										

Publications

Yes/ No

Remarks* _____

***REMARKS: Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested.**

Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE SIGNATURE OF CONSULTANT SIGNATURE OF HOD

COMPETENCY BASED POSTGRADUATE TRAINING
PROGRAMME FOR
DM IN CARDIAC ANAESTHESIA

PREAMBLE

DM Cardiac Anaesthesia course is designed to train post graduates of anesthesiology (MD / DNB) in principles and practice of cardiac anesthesia and intensive cardiovascular and thoracic care. The training offered to the extent that they function as independent faculty/consultant in Cardiovascular and thoracic anesthesia, intensive cardiovascular and thoracic care unit. There has been significant progress in the field of Cardiac Anesthesiology over the decades, especially with the introduction of perioperative Trans-esophageal echocardiography for assessment of cardiac function in operating room and in surgical ICU. Clinical research in core field of cardiac anesthesiology, cardiovascular sciences, cardiac perfusion and extracorporeal circulation has greatly changed the clinical practice and outcomes of cardiac surgeries. With more advanced monitoring and management strategies being available, the clinical management of cardiovascular disorders has changed for the better over the decades. Such knowledge should also be disseminated to the post graduate students and clinicians to get updated and expertise in patient care and improving the outcomes following non-complex as well as complex cardiac, cardiovascular as well as thoracic surgeries. In order to achieve the above goals and to provide basic and advanced clinical skills, thorough knowledge in core subject of cardiac anesthesiology and perioperative Trans-esophageal echocardiography, cardiac anaesthesia has now established itself as a specialty for the past 10-15 years. The evolution of cardiac anaesthesia as a super specialty has definitely opened a new platform for acquiring subject specific skills and knowledge which has resulted in improved patient care and outcome following cardiovascular and thoracic surgical procedures. It has been the general experience that institutions with dedicated cardiac anaesthesia services have provided better care and optimal outcomes for patients with cardiovascular diseases.

SUBJECT SPECIFIC AIMS AND OBJECTIVES

The goals of 3-year course in DM Cardiac Anaesthesia are, the trainee who is already a qualified MD/DNB in Anaesthesia and completes the course would be able to: -

1. Practice independently, the art and science of Cardiothoracic and Vascular Anaesthesia and perioperative care effectively and ethically, supported by scientific knowledge and skills in the field of cardiac anaesthesia and perioperative Trans-esophageal echocardiography.
2. Undertake responsibilities in cardiothoracic and vascular surgical operation rooms, postoperative intensive care units, procedures in cardiac Cath lab suits and other areas where patients require perioperative or peri-procedural care.
3. Continue to demonstrate keen interests in continuous professional development and the recent advances in the field of cardiac Anaesthesia, cardiac perfusion and extracorporeal circulation.
4. Function as a dedicated, motivated teacher who is keen to train or share his knowledge and clinical skills with colleagues or juniors or any allied health sciences learners.
5. Have acquired spirit of scientific inquiry and will be oriented to the principles of research methodology and cardiovascular research.

SUBJECT SPECIFIC COMPETENCIES

The objectives formulated to reach the goals set for the DM cardiac anaesthesia are based and categorized on flowing domains as: -

1. Knowledge acquisition (Cognitive domain)
2. Skills acquisition (psychomotor domain)
3. Attitude, communication abilities, human values and good clinical and ethical practice
4. Professionalism (Affective domain)

A candidate registered for the DM cardiac anaesthesia program should achieve these objectives by the end of 3 years of training program. Thus, at the completion of training the candidate must be able to:

1. Knowledge acquisition (Cognitive domain): -

- ❖ Demonstrate understanding of the basic sciences related to cardiovascular system and anaesthesia.

- ❖ Reveal comprehension of the anaesthetic management of non-complex and complex cardiovascular and thoracic surgical procedures in patients belonging to all age groups, with a thorough knowledge of the etiology, pathophysiology and medical as well as surgical management of the diseases.
- ❖ Describe theory, of the underlying etiology, mechanism and management of critical conditions requiring cardio-pulmonary-cerebral resuscitation (CPCR) in coherence with the latest practicing guidelines.
- ❖ Demonstrate understanding of principles, pathophysiology, components, conduct, and complications of cardiopulmonary bypass, extracorporeal circulation, cardiac assist devices and cardiac and/or lung transplantation.
- ❖ Show understanding of the principles, pathophysiology and complications of major vascular surgeries.
- ❖ Assimilate and practice principles of critical care in postoperative cardiac, thoracic and vascular surgical intensive care units.
- ❖ Recognize the disease conditions beyond the area of his/ her competence and follow appropriate referral mechanisms prior to subjecting the patients to anaesthesia for effective perioperative care.
- ❖ Teach and guide his team colleagues, students, and paramedical staff.
- ❖ Reveal understanding of medico legal aspects of cardiothoracic and vascular anaesthesia.
- ❖ Demonstrate knowledge of administrative aspects of cardiothoracic and vascular operation suite complex.

- ❖ Undertake audit, use information technology media, and conduct research, both clinical and biomedical, with publishing the work and presenting at various scientific events.

2. Skills acquisition (psychomotor domain): -

- ❖ Evaluate patients scheduled for cardiac, thoracic and vascular surgery in the preoperative period by taking relevant history, examining the patient, ordering relevant investigations, and interpreting them to obtain additional information about surgical condition and or the associate medical condition, which necessitates modifications of the proposed anaesthetic management.
- ❖ Administer appropriate anaesthesia to the cardiac, thoracic and vascular surgical procedures independently.
- ❖ Perform invasive procedures necessary for optimal patient care during the perioperative period.
- ❖ Provide basic and advanced cardiac life support in coherence with the latest BLS/ACLS Guidelines.
- ❖ Demonstrate intensive care skills necessary for management of patients in postoperative cardiac, thoracic and vascular surgical intensive care unit.
- ❖ Shoulder responsibility of patient monitoring in perioperative period.
- ❖ Perform the perioperative Trans esophageal echocardiography and able to come to conclusive diagnosis and direct or alter the plan of medical or surgical management for the improved outcome.
- ❖ To initiate and maintain mechanical cardiovascular support and extracorporeal circulatory support (ECMO).

3. Attitude, communication abilities, human values, ethical and good clinical practice: -

- ❖ Adapt ethical principles, professional honesty and integrity in all aspects of cardiothoracic and vascular anaesthesia practice.
- ❖ Develop communication abilities in explaining the various options available in the anesthetic management, critical care and pain management and to obtain true informed consent from patient.
- ❖ Provide leadership in the operating suite and get best out of the teamwork in a congenial working atmosphere.
- ❖ Apply high moral and ethical standards while carrying out human and animal research.
- ❖ Be humble and accept the limitations in his knowledge and skill and to ask for help from colleagues when needed
- ❖ Respect patient's rights and privileges including right to information and right to seek a second opinion.

4. Professionalism (Affective Domain): -

The students enrolled for the course of DM cardiac anaesthesia are required to practice professionalism in the areas of academic, clinical and research activities. Under appropriate supervision, they will have primary responsibility for managing cardiac anaesthesia care in the operating room, remote locations, intensive cardiovascular units, running the pre-anaesthesia checkup clinics and pre heart/heart-lung transplant work up clinics. They would be dealing with patients of various ages and ethnicities. Intellectual integrity is emphasized in all settings, including in the clinics, operating room, ICU, conference room, in the conduction of research and publications.

COMPETENCE EXPECTED AT END OF TRAINING

A well-defined and formulated clinical training program will be adapted by department of cardiac anaesthesia. It has been designed to provide the candidate a comprehensive clinical and academic training in different aspects of Cardiovascular and thoracic anaesthesia.

By the end of the course, the student should have acquired knowledge (cognitive domain), clinical skills (psychomotor domain), Attitude, communication abilities, human values and good clinical and ethical practice and lastly professionalism (affective domain) as per details given below:

A. Cognitive domain (Knowledge acquisition):-

The post graduate student should acquire knowledge in the following areas by the end of the training program:-

1. General principles and practice relevant to cardiac anaesthesia
2. Basic and applied cardiac, thoracic and vascular anatomy
3. Basic and applied cardiovascular physiology
4. Basic and applied respiratory physiology
5. Renal, hepatic and neurophysiology
6. Physiology of Coagulation system.
7. Pathophysiology of cardiovascular disorders
8. Pathophysiology of respiratory disorders
9. Pathophysiology of neurovascular diseases
10. Pathophysiology of Reno-vascular diseases
11. Pathophysiology of coagulation disorders
12. Pharmacology pertinent to anaesthetic agents, cardiovascular drugs, antibiotics, coagulants and anticoagulants etc.
13. Adult cardiac, thoracic and vascular diseases
14. Congenital heart diseases
15. Pathophysiology of cardio-pulmonary bypass and extracorporeal circulation
16. Trans thoracic and Trans-esophageal Echocardiography
17. Heart and Lung transplantation
18. Nutrition in the cardiovascular and thoracic unit
19. Cardiovascular imaging
20. Recent advances in cardiac anaesthesia

The detailed topics are given under the heading “syllabus”.

B. Psychomotor domain (Skill acquisition):-

All students pursuing DM Cardiac Anaesthesia must follow the following structured teaching/clinical training, as given below:

Running pre-anesthetic evaluation clinic and able to stratify the risk. Exposure to anesthetic management of whole range of cardiac, thoracic and vascular surgical procedures. Also, the student should get exposure to post-operative intensive care management. Student should also get exposure to anaesthetic management of procedures performed in cardiac catheterization laboratory including hybrid procedures. Student should also gain skills in perioperative Trans-esophageal and transthoracic echocardiography.

❖ In The Pre-anesthetic evaluation clinic the student will acquire following skills :-

- Pre-anesthetic evaluation of patients for elective cardiovascular and thoracic surgical procedures and assessment of risk and risk stratification.
- Necessary preoperative lab investigations and imaging need to be ordered and evaluated.

❖ In the Operating Room, Student will acquire following skills :-

1. Endotracheal intubation with routine technique as well as using advanced gadgets
2. Arterial line insertion
3. Central venous cannulation
4. Pulmonary artery cannulation
5. Hemodynamic and cardiac output monitoring and management of cardiovascular instability
6. Intraoperative trans esophageal echocardiography
7. Fluids, electrolyte and acid-base balance management
8. Monitoring conduct of cardiopulmonary bypass
9. Monitoring anticoagulation and management of bleeding , reversal of anticoagulation
10. Blood and blood component therapy

- ❖ In the Intensive Cardiovascular surgical unit, the student will acquire following skills :-
 1. Intensive hemodynamic and cardiac output monitoring
 2. Mechanical ventilation and weaning from ventilation.
 3. Noninvasive ventilation and different modalities of oxygen therapy
 4. Diagnosing shock, differential diagnosis of shock and its management
 5. Managing the low cardiac output state with pharmacological and mechanical cardiovascular supports
 6. Focus assessed transthoracic echocardiography for diagnosis of shock
 7. Initiating and maintenance of extracorporeal circulatory support
 8. Postoperative sedation and pain management.
- ❖ In Cardiac Catheterization laboratory, student will acquire following skills :-
 - Monitored anaesthesia care and sedation for adult and pediatric cath-lab procedures.
 - Anaesthesia for TAVR, Vascular stenting and hybrid procedures.

C. Attitude, communication abilities, human values, Good clinical and ethical practice and Professionalism (Affective domain):- The student should be able to

1. Function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the surgeons or other colleagues to provide the best possible diagnosis, treatment plan or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

SYLLABUS

COURSE CONTENTS

I. Basic Sciences:-

1. Applied Anatomy:-

- ***Cardiac Anatomy:*** - Embryology of heart and great vessels and feto-maternal circulation, pulmonary and peripheral vascular anatomy, coronary artery anatomy, surface and applied anatomy related to cardiovascular regional anaesthesia.
- ***Pulmonary and thoracic anatomy:*** - Embryology of bronchial and pulmonary tree and vessels. Anatomy of Broncho pulmonary segments. Surface and applied anatomy related to thoracic regional anaesthesia.

2. Applied Physiology:-

- ***Cardiac Physiology:*** - Cellular physiology, Cardiac action potential, Cardiac cycle and pressure volume curves, cardiac conduction system and electrophysiology. Cardiovascular hemodynamics and physiology of coronary circulation.
- ***Pulmonary Physiology:*** - Pulmonary circulation, pulmonary gas exchange, oxygen cascade, physiology of one lung ventilation, pulmonary function tests, cardiopulmonary exercise testing.
- Autonomic nervous system.
- Physiology of blood circulation, hemostasis and coagulation system.
- Renal, Hepatic and neurophysiology.
- Physiology of Endocrine system and metabolism.

3. Cardiac Pathophysiology :-

- Pathophysiology of Atherosclerosis, Ischemic heart diseases, Valvular heart diseases, vascular diseases and congenital heart diseases. Cardiomyopathies, Cardiac arrhythmias, end stage heart failure and pericardial diseases.
- Pathophysiology of Pulmonary vascular diseases.
- Pathophysiology of cardiopulmonary bypass (CPB) and extracorporeal circulation.

4. *Applied Pharmacology :-*

- Pharmacological principles: - Pharmacokinetics & Pharmacodynamics, drug distribution, routes of administration and elimination, pharmacological effects and adverse drug reaction.
- Anesthetic intravenous induction agents and inhalational agents.
- Cardiovascular pharmacology: - Cardiac glycosides, inotropes, vasopressors, vasodilators, inodilators, antiarrhythmics, antihypertensives, antianginal drugs and newer heart failure drugs.
- Antiplatelets, anticoagulants, procoagulants, antifibrinolytics and thrombolytic agents.
- Bronchial and pulmonary pharmacology: - Bronchodilators, pulmonary antihypertensives and vasodilators.
- Steroidal and non-steroidal anti-inflammatory agents and analgesics.
- Pharmacology of cardiopulmonary bypass: - Cardioplegic solutions.
- Antibiotics used in cardiac surgery and ICU.

5. *Applied Physics:-*

- Basic concepts of physics related to cardiovascular hemodynamics and calculations,
- Physics related to invasive and non-invasive monitoring systems in cardiovascular medicine.
- Physics related to mechanical ventilation, gaseous exchange and anaesthesia machine.
- Basic physics of 2D and 3D ultrasound.

6. *Basic concepts in medical statistics :-*

- Principle of research methodology, study designs, statistical analysis and application of statistical tests.
- Practice of evidence based medical research.

II. Clinical Practice of Adult Cardiovascular and thoracic Anaesthesia

1. Anaesthesia for Adult cardiac surgical procedures :-

- Risk assessment and stratification of patients coming for adult cardiac surgeries.
- Cardiac Catheterization Laboratory :- Diagnostic and therapeutic procedures in adults
- ECG and Cardiac electrophysiology: - diagnosis and treatment
- Hemodynamic monitoring of heart and vascular system
- Anaesthesia for coronary artery bypass surgery (OPCAB and On Pump CABG)
- Anaesthesia for valvular heart diseases
- Anaesthesia for minimally invasive cardiac surgeries
- Anaesthesia for congenital heart diseases in adults
- Anaesthesia for surgeries for cardiac tumors, cardiomyopathies and pericardial diseases and pulmonary thromboembolisms, cardiac surgeries during pregnancy
- Anaesthesia for re-do cardiac surgeries

2. Anaesthesia for thoracic surgeries

- Anaesthesia for lung surgeries and VATS.

3. Anaesthesia for vascular surgeries :-

- Anaesthesia for aortic surgeries
- Anaesthesia for peripheral vascular surgeries

III. Clinical Practice of Pediatric Cardiac Anaesthesia, Perioperative trans-esophageal echocardiography and Extracorporeal Circulation

1. Clinical Practice of Pediatric Cardiac Anaesthesia:-

- Anaesthesia for Left to right Shunts (Anaesthesia for ASD, VSD, PDA closures etc.)

- Anaesthesia for right to left shunts (Anaesthesia for B-T shunts, BD Glenn surgeries, intracardiac repairs, hemi-fontan, fontan surgery, Rastilli's repair etc.)
- Anaesthesia for complex pediatric congenital heart diseases (TGA, Ebsteins anomaly, TAPVC, PAPVC, AVCD, Truncus arteriosus, aortopulmonary windows, hypoplastic aortic arch and coactation of aorta, Hypoplastic left heart syndromes)
- Pediatric Cardiac catheterization laboratory: - Diagnostic and therapeutic procedures (pediatric cardiac catheterization, BAS, ASD,VSD,PDA device closure)

2. Perioperative Trans-esophageal echocardiography :-

- Physics of Perioperative Trans esophageal Echocardiography
- Trans esophageal Image acquisition, knobology and optimization of image quality
- Imaging artifacts and pitfalls in trans-esophageal echocardiography
- Basic comprehensive Trans esophageal echocardiography views
- Evaluation of Left Ventricular Global and Regional Function
- Evaluation of Mitral valve
- Evaluation of Tricuspid Valve
- Evaluation of Aortic Valve
- Evaluation of Pulmonary Valve
- Evaluation of Right Ventricle
- Evaluation of Congenital Heart Diseases
- Evaluation of Aorta
- Evaluation of Intracardiac Masses

- Doppler and Spectral echocardiography
- Evaluation of pericardial diseases.

3. Extracorporeal Circulation :-

- Extracorporeal cardiac perfusion technology, principles, equipment assembly, reservoirs oxygenators.
- Temperature regulation, hypothermia, techniques and protocols
- Myocardial Protection strategies and techniques, cardioplegia and organ preservative solutions
- Priming solutions, hemodilution, hemofiltration devices and systems
- Transfusion medicine, anticoagulation and monitoring of coagulation on cardiopulmonary bypass
- Pathophysiology of cardiopulmonary bypass, SIRS, MODS other Side-effects of extracorporeal circulation.
- Subsystem care on CPB - Cerebral, Renal, Hepatic protection and monitoring
- Total circulatory arrest, left heart bypass
- Anaesthesia management during CPB and extracorporeal circulation
- Pharmacokinetics and pharmacodynamics of drugs during CPB.
- Discontinuation and weaning from CPB and extracorporeal support.
- Acid-Base balance management

IV. Intensive care in Cardiovascular and Thoracic unit and Recent Advances:-

1. Intensive care in Cardiovascular and Thoracic unit:-

- Fast-tracking & Enhanced recovery after cardiovascular and thoracic surgery

- Management of Postoperative bleeding
- Diagnosis and management of myocardial infarction after myocardial revascularization/
Postoperative MI
- Diagnosis and management of shock, low cardiac output syndrome and vasoplegia
- Management of Postoperative Left or Right ventricular dysfunction
- Management of post-operative pulmonary hypertension and hypertensive crisis
- Stroke or seizures after cardiac surgery
- Postoperative atrial fibrillation after cardiovascular surgery and other arrhythmias
- Pain management after cardiothoracic and vascular surgery
- Management of sepsis
- Antibiotic stewardship
- Acute Kidney Injury & Dialysis in cardiac ICU
- Nutrition in ICU
- Management of Mechanical ventilation
- Prediction of difficulty in weaning of ventilation after cardiovascular surgery :
Evaluation and management
- Focus assessed transthoracic echo (FATE) for diagnosis of hemodynamic instability in
ICU
- Bedside lung ultrasound (BLUE) for ICU
- Indications, contraindications, complications and insertion technique of intra-aortic
balloon counter pulsations pump.

2. Recent Advances:-

- Anaesthesia for heart, lung and heart-lung transplant
- Anaesthesia for cardiac assist devices, LVAD,RVAD, impella insertion
- Extracorporeal membrane oxygenation (ECMO)
- 3 D Trans esophageal echocardiography (TEE), Strain echocardiography and speckle tracking
- Anaesthesia for TAVI, Mitraclip insertion and hybrid Cath lab procedures.
- Current advances in hemodynamic monitoring methods.
- Most recent and updated AHA/ACC/ECS/IACTA/ASE guidelines relevant to cardiac anaesthesia, cardiac surgery, thoracic and vascular surgeries, echocardiography, transfusion medicine, diagnosis and management of cardiovascular diseases.

CURRICULUM

&

SUBJECT SPECIFIC TEACHING - LEARNING METHODS

1. **Journal Club:** The DM trainee will present a journal article relevant to cardiovascular and thoracic anaesthesiology. Article should cite background/context, study methods and statistical analysis, interpret results and discussion, summarize, present limitations and critically analyse the study methods and outcomes.
2. **Subject Seminar:** The DM trainee will present a subject topic allocated after doing a comprehensive preparation, relevant literature search and present the topic in detail covering all the relevant aspects, clinical applications and engage audience and answers questions.
3. **Clinical Case Presentation:** The DM trainee will present a clinical case after performing thorough history and physical examination. Trainee will elicit physical and non-physical aspects in history, elicit all physical signs, formulate diagnosis/differential diagnosis and able to plan a comprehensive Anaesthetic and critical care plan for the patient.
4. **Faculty Lectures:** DM Trainee must attend didactic lectures on basics of cardiovascular and thoracic anaesthesiology, perioperative trans-oesophageal echocardiography, relevant topics of cardiovascular and thoracic critical care, biostatistics and research methodology, teaching methodology, from both internal and external faculties of specialties related to the subject.
5. **Mortality meet:** DM trainee should present mortalities for the respective month at the end of the month. Presentation should involve detailed analysis of the events and probable cause of the death.
6. **Additional teaching/training:** DM trainee is expected to attend regular CMEs, Conferences, and Workshops. In addition, they are expected to teach and train anaesthesia post graduates students posted in department of cardiac anaesthesia. The trainee is also expected to utilize the e-learning resources of the department and the university. The trainee must register and complete 16 weeks online course in medical research methodology called “Basic Course in Biomedical Research” of Indian Council of Medical Research, Swayam-NPTEL (<https://onlinecourses.nptel.ac.in>).
7. **Research:** DM trainee has to take up and complete a thesis work in stipulated time. He/she is supposed to present his work in state, national or regional level conference. The work has also to be published or at least sent for publication in an indexed journal before the completion of course. He/she should submit proofs of the same before commencement of his/her final examination.

8. **Intensive Cardiovascular and thoracic surgical ICU Grand Rounds:** The DM trainee will attend the grand rounds once weekly, which involves case discussions from cardiac anaesthesia and cardiac surgery.

TEACHING PROGRAM SCHEDULE

Journal Club	Alternate week on every Wednesday (1 st and 3 rd), 7:30 am - 8 :30 am
Subject Seminar	Alternate week on every Wednesday (2 nd and 4 th), (7:30 am - 8 :30 am)
Clinical Case Presentation	Weekly once on every Saturday , 3:00 pm – 5:00 pm
Faculty lecture	Every 2 nd Thursday of the month
Mortality Meeting	Last Thursday of the month

LOG BOOK

The DM trainee shall maintain a Log book of the conduct of cardiovascular and thoracic anaesthesia, invasive and non-invasive procedures performed by him / her during the training period right from the point of entry. He/she should maintain a log of journal club, subject seminars, case presentations, mortality meetings attended and presented by him/her and faculty lectures attended. Authenticity of the log book entries shall be regularly assessed by the faculty and certified by the concerned postgraduate teacher / Head of the department. This shall be made available to the Board of Examiners for their perusal at the time of his / her appearing at the final exit Examination. The logbook should record cases anaesthetized (both in the operation theatre and also in the cardiac catheterization/ interventional laboratory. Log book entries must be qualitative and not merely quantitative.

Index of the Format of the log book will be:-

INDEX

Sl. No.	Title	Sl. No.	Title
1.	Title Page	15.	Subject Seminar / Symposium attended
2.	Index	16.	Subject Seminar / Symposium presented
3.	Certificate	17.	Check list for Seminar Symposium presentation
4.	Personal details	18.	Clinical case presentation
5.	Instruction to PG	19.	Evaluation form for clinical case presentation

6.	Postings	20.	Post graduate Teaching Lecture
7.	Details of Leave	21.	JNMC Scientific Society Clinical Meetings attended, presented cases
8.	Research Projects	22.	Mortality Meeting – Cases presented
9.	Check list for Synopsis presentation	23.	CME / Workshops / Conference attended
10.	Check list for dissertation presentation	24.	Scientific Papers / posters presented in the conference
11.	Continuous evaluation of dissertation work	25.	Check list for evaluating Clinical work in Cardiac OT/Adult ITU/ Pediatric ITU and Cathlab
12.	Journal club attended	26.	Academic Performance of PG during the Course (Annexure 1)
13.	Journal club [article presented]	27.	Diagnostic, operative invasive and noninvasive Procedures performed (Annexure 2)
14.	Check list for Journal article presentation	28.	Assessment format for case presentation (Annexure 3)

TRAINING TIMELINE DURING THREE YEARS OF RESIDENCY

The program of training will be divided as follows:-

Clinical Training		Duration
1	Adult Cardiovascular and Thoracic Anaesthesia	24 Months
2	Pediatric Cardiac Anaesthesia	6 Months
3	Adult Cardiac Surgical ICU	3 Months
4	Pediatric Cardiac Surgical ICU	2 Months
5	Cardiac Cathlab	1 Month
Total Duration Of Clinical Posting		36 Months

Year of training	Sr. No	Clinical posting	Duration
1st Year	1	Adult Cardiovascular and Thoracic Anesthesia	8 Months
	2	Pediatric Cardiac Anesthesia	2 Months
	3	Adult Cardiac Surgical ICU	1 Month

	4	Pre-anesthesia evaluation clinic	1 month
2 nd year	1	Adult Cardiovascular and Thoracic Anesthesia	6 months
	2	Pediatric Cardiac Anesthesia	2 months
	3	Adult Cardiac Surgical ICU	1 month
	4	Pediatric cardiac surgical ICU	1 month
	5	Cardiac Cathlab	1 month
	6	Pre anesthesia evaluation clinic	1 month
3 rd Year	1	Adult Cardiovascular and Thoracic Anesthesia	8 months
	2	Pediatric Cardiac Anesthesia	2 months
	3	Adult Cardiac Surgical ICU	1 month
	4	Pediatric cardiac surgical ICU	1 month

ASSESSMENT

FORMATIVE ASSESSMENT:-

Quarterly assessment during the DM training should be based on:-

1. Journal based / recent advances learning
2. Patient based /clinical or Skill based learning
3. Self-directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs /Workshops

The student to be assessed as per categories listed in postgraduate student Appraisal form (Annexure I).

Yearly examination will consist of: -

1. Theory paper of 100 marks (duration of 3 hours) at the end of 1st year based on “paper I” i.e. Basic Sciences.
2. Theory paper of 100 marks (duration of 3 hours) at the end of 2nd year based on “paper II” and “paper III” i.e. clinical practice of cardiac anesthesia.
3. Preliminary examination of 4 theory papers each carrying 100 marks (duration 3 hours each) based on entire syllabus will be conducted before final university examination.

SUMMATIVE ASSESSMENT:-

The summative examination would be carried out as per the Rules given in “*Postgraduate Medical Education Regulations, 2000*”.

The summative assessment examination shall include two heads:

A. Theory examination.

B. Practical, Clinical examination and Viva-voce.

Theory examination and Practical/Clinical, Viva-voce shall be separate heads of passing.

Theory examination shall comprise of four papers. Passing percentage shall be cumulatively 50% with minimum of 40% marks in each theory paper.

Practical /Clinical examination consisting of at least one long case, two short cases, ICU rounds and viva-Voce. Passing percentage shall be 50%.

Passing shall be separate for each head and failing shall be common, meaning thereby that Clearance at theory and failure at practical / clinical shall amount to failure at Summative Examination and vice versa.

1. Theory Examination: - There shall be 4 theory papers of 100 marks each and allotted time of 3 hours each.

Paper I: *Basic Sciences related to cardiac Anaesthesia*

Paper II: *Clinical Practice of Adult Cardiovascular and thoracic Anaesthesia*

Paper III: *Clinical Practice of Pediatric Cardiac Anaesthesia, Perioperative trans-esophageal Echocardiography and Extracorporeal Circulation*

Paper IV: *IV.Intensive care in Cardiovascular and Thoracic unit and Recent Advances*

Each paper will be consisting of 10 questions with 10 marks each totaling to 100 marks

Total marks of theory examinations: - 400 marks.

2. Clinical/Practical and Oral Examination:-

A) Clinical Presentation: - *One long case (duration 1 hour) (100 marks)*

Two short cases (duration 30 minutes each) (75 x2 = 150 marks)

B) Oral Examination: - *Viva –Voce (duration 30 min) (100 marks)*

C) ICU rounds: - *Duration 15 minutes (50 marks)*

Total marks of clinical/practical examination: - 400 marks.

Post graduate Student Appraisal Form

(Annexure 1)

Name of the Department: - Cardiac Anesthesia

Name of the student:-

Period of training: - From: - To

Sr. No	Particulars of training	Not Satisfactory	Satisfactory	More than Satisfactory	Remarks
	Scoring	1 2 3	4 5 6	7 8 9	
1	Journal based / recent advances learning				
2	Patient based /clinical or Skill based learning				
3	Self-directed learning and teaching				
4	Departmental and interdepartmental learning activity				

5	External and Outreach Activities/CMEs /Workshops				
6	Thesis/Research work				
7	Maintenance of Log book				

Publications: - Submitted: - (Yes/ No). Published: - (Yes/No).
 Remarks :-

 ...

 Remarks *:- Any significant positive or negative attributes of a postgraduate student to be Mentioned. For score less than 4 in any category, remediation must be suggested. Individual Feedback to postgraduate student is strongly recommended.

Signature of the Assesse

Signature of the Head of the Department

Invasive / Non-Invasive Procedures Performed Annually
(Annexure 2)

Sl. No	Name of Procedures	Minimum No. of Procedures expected to be performed Annually	No. of Procedures Performed
1.	Invasive Arterial Line Cannulation	100	
2.	Central Venous Line Cannulation	100	
3.	Pulmonary Artery Catheterization	25	
4.	Continuous Cardiac Output Monitoring	5	
5.	Ultrasound guided Vascular Cannulation	50	
6.	IABP Insertions	5	
7.	Trans Esophageal Echocardiography	100	
8.	Transthoracic Echocardiography	50	
9.	Epicardial Echocardiography	10	
10.	Bedside Lung Ultrasound	10	
10.	Placement of DLT & Bronchial Blockers	2 - 5	
11.	Ultrasound guided Regional Nerve Blocks	5	
12.	Epidural and Caudal nerve Block	5	
13.	Paravertebral Nerve Blocks	5	
14.	Endotracheal intubations using video laryngoscopy	20	
15.	Fiber optic bronchoscopy	5	
16.	Percutaneous tracheostomy	5	
17.	Extracorporeal circulatory support (ECMO) institution (Assisted)	5	

Signature of the Assesse

Signature of the Head of the Department

ASSESSMENT FORM FOR CLINICAL CASE PRESENTATION FOR DM IN
CARDIAC ANAESTHESIA
(ANEEXURE 3)

Name of the Candidate:-

Date :-

Name of the Assessor:-

Patient Details:-

Sr. No	Competencies Assessed	Not Satisfactory	Satisfactory	More than Satisfactory	Remarks
	Scoring	1 2 3	4 5 6	7 8 9	
1	Preanaesthetic evaluation :- Eliciting History				
2	Preanaesthetic evaluation :- Physical Examination				
3	Preanaesthetic evaluation :- Obtaining and analyzing laboratory and diagnostic imaging data				
4	Preanaesthetic evaluation :- Ability to diagnose and understand the severity of the disease and risk stratification				
5	Consent and Counselling skills				
6	Conduct of the Anesthesia with specific anesthetic considerations				
7	Ability to expect and detect case related complications or untoward event and its management in perioperative period				
8	Ability to deal with post-operative sedation, analgesia and extubation.				
9	Overall clinical competencies				

Comments of the assessor:-

Remarks *:- Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual Feedback to postgraduate student is strongly recommended.

Signature of Student

Signature of the Assessor

Signature of the HOD

RECOMMENDED TEXT BOOKS FOR REFERENCES AND READING

Sl. No	Name of the Text Book	Name of Author
1	Kaplan's Cardiac Anesthesia – 7 th Edition	Dr. Joel Kaplan
2	Practical Approach to Cardiac Anesthesia 5 th Edition	Dr. Hensley Martin
3	Comprehensive of Cardiac Anaesthesia Perioperative Trans-esophageal Echocardiography 2 nd Edition	Dr. R. Savage
4	A Practical Approach to trans esophageal Echocardiography 4 th Edition	Dr. Scott T. Reeves, Albert C. Perrino

5	TEE in Congenital Heart Disease	Dr. Sutherland, George R
6	Brunwalds Heart Diseases : A textbook of Cardiovascular Medicine 11 th edition	Dr. Braun Wald
7	Moss and Adam's Heart Disease 10 th Edition	Moss & Adams (Volume - 1)
8	Moss and Adams Heart Disease 10 th Edition	Moss & Adams (Volume - 2)
9	Millers textbook of Anaesthesia 9 th Edition	Dr. Ronald Miller (Volume – 1)
10	Millers textbook of Anaesthesia 9 th Edition	Ronald Miller (Volume – 2)
11	Feigenbaum's Echocardiography 8 th Edition	Feigenbaum
12	The ICU book 4 th Edition	Dr.Paul Marino
13	Drugs of the Heart 8 th Edition	Liarel Opie
14	Pediatric Cardiac Anaesthesia 4 th Edition	Carol L. Lake, Peter D. Booker
15	Problem-Based trans-esophageal Echocardiography 1 st Edition	Dr.Deepak Tempe
16	Extracorporeal Life Support the ESLO Red book 5 th Edition	ELSO text book.
17	Manual of Perioperative Care in Adult Cardiac Surgery 6 th Edition	Robert M. Bojar
18	Text book of Cardiac Anesthesia 4 th Edition	Dr. Deepak Tempe
19	Cardiopulmonary Bypass 4 th edition	Glenn Gravellee
20	A practical manual of Pediatric Cardiac Intensive Care 1 st Edition	Avneet Jayant

RECOMMENDED JOURNALS:

1. Journal of Cardiothoracic & Vascular Anaesthesia
2. Annals of Cardiac Anaesthesia
3. British Journal of Anaesthesia.

Curriculum DM Gastroenterology Index

1. Goals
2. Objectives
3. Syllabus
4. Subject specific competencies
5. Teaching programme
6. Schedule of Posting
7. Research Project
8. Job responsibilities
9. Assessment
10. Suggested books and journals

Curriculum

DM Gastroenterology

The infrastructure and faculty of the department of gastroenterology will be as per NMC guidelines

1. Goals

The goal of DM course is to produce a competent Gastroenterologist who:

- ❖ Recognizes the health needs of adults and carries out professional obligations in keeping with principles of National Health Policy and professional ethics;
- ❖ Has acquired the competencies pertaining to gastroenterology that are required to be practiced in the community and at all levels of health care system;
- ❖ Has acquired skills in effectively communicating with the patients, family and the community;
- ❖ Is aware of the contemporary advances and developments in medical sciences. Acquires a spirit of scientific enquiry and is oriented to principles of research methodology; and
- ❖ Has acquired skills in educating medical and paramedical professionals.

2. Objectives

At the end of the DM course in Gastroenterology, the student should be able to:

- ❖ Recognize the key importance of medical problems in the context of the health priority of the country;
- ❖ Practice the specialty of gastroenterology in keeping with the principles of professional ethics;
- ❖ Identify social, economic, environmental, biological and emotional determinants of adult gastroenterology diseases and know the therapeutic, rehabilitative, preventive and promotion measures to provide holistic care to all patients;
- ❖ Take detailed history, perform full physical examination and make a clinical diagnosis;
- ❖ Perform and interpret relevant investigations (Imaging and Laboratory);
- ❖ Perform and interpret important diagnostic procedures;
- ❖ Diagnose gastroenterological illnesses in adults based on the analysis of history, physical examination and investigative work up;
- ❖ Plan and deliver comprehensive treatment for illness in adults using principles of rational drug therapy;
- ❖ Plan and advise measures for the prevention of gastroenterological diseases;
- ❖ Plan rehabilitation of adults suffering from chronic illness, and those with special needs;
- ❖ Manage gastroenterological emergencies efficiently;
- ❖ Demonstrate skills in documentation of case details, and of morbidity and mortality data relevant to the assigned situation;
- ❖ Demonstrate empathy and humane approach towards patients and their families and respect their sensibilities;
Demonstrate communication skills of a high order in explaining management and prognosis, providing counselling and giving health education messages to patients, families and communities.
- ❖ Develop skills as a self-directed learner, recognize continuing educational needs; use appropriate learning resources, and critically analyze relevant published literature in order to practice evidence-based medicine;
- ❖ Demonstrate competence in basic concepts of research methodology and epidemiology;

Facilitate learning of medical/nursing students, practicing physicians, para-medical health workers and other providers as a teacher-trainer;

- ❖ Play the assigned role in the implementation of national health programs, effectively and responsibly;
- ❖ Organize and supervise the desired managerial and leadership skills;
- ❖ Function as a productive member of a team engaged in health care, research and education.

3. SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the student should be able to acquire the following competencies under the three domains:

- ❖ **Cognitive domain (Knowledge domain):** By the end of the course the DM candidate
 - should be encompassing skills in broad aspects of evaluation, diagnosis and management of primary and secondary diseases of the gastrointestinal system
 - should develop ability in advancing the field by participating in research
 - should be competent enough to impart training and education.
- ❖ **Affective domain (Attitudes including Communication and Professionalism):** The DM candidate
 - should become confident communicators and should be well accomplished professionals. •
 - should be ready to deliver the knowledge received by them during the course.
 - should have developed skills to debate, deliver scientific lecture, participate in panel discussions, and hold group discussions.
 - should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
 - always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
 - develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.
- ❖ **Psychomotor Domain (subject specific practice based or practical competencies):** The DM candidate
 - should be able to take independent management decisions
 - should carry out the endoscopic procedures, liver biopsy procedures, paracentesis, hemodynamic studies and handle emergencies with utmost confidence.
 - interpretation of laboratory tests • analyses and evaluation of findings of various procedures

The student should be able to perform independently the following procedures:

UGI and lower GI Endoscopy, both diagnostic and therapeutic

- Endoscopic sclerotherapy
- Endoscopic variceal band ligation
- Other haemostatic procedures
- Endoscopic biopsies
- Endoscopic stricture dilatation
- Endoscopic argon plasma coagulation
- Endoscopic stent placement

The student should become familiar with the following procedures:

1. Side viewing Endoscopy (ERCP), biliary stenting, NBD drainage, papillotomy and stone extraction

2. Endosonography
3. Doppler studies and Ultrasound of liver and biliary tract
4. Invasive hemodynamics
5. Liver biopsies • Percutaneous and transjugular liver biopsy procedure
6. Intensive care management of liver patients • Subclavian and transjugular catheterization • Ventilatory care
7. Pre - and post - liver transplantation along with long-term follow-up

4. Syllabus

4.1 Theory

The syllabus should include the cardinal manifestations, definition, epidemiology, Etiopathogenesis, genetics, clinical presentation, complications, differential diagnosis, investigations, treatment and prevention and prognosis of all gastroenterological diseases. In addition the candidate should be well versed with all the common and important paediatric gastroenterological diseases. It should also cover the recent advances that have occurred in the field of gastroenterology.

❖ **Biology of the gastrointestinal tract and liver**

- Gastrointestinal Hormones and Neurotransmitters.
Cellular Communication, Neural Regulation of the Gastrointestinal Tract, Peptide Hormones of the Gastrointestinal Tract, Other Chemical Messengers of the Gastrointestinal tract, Signal Transduction, Regulation of Gastrointestinal Growth by Hormones and Transmitters, Regulation of Gastrointestinal Hormones by Intraluminal Releasing Factors, Gastrointestinal Peptide That regulate Satiety and Hunger, Enteroinular Axis.
- Mucosal Immunology and Mechanisms of Gastrointestinal Inflammation
Mucosal Immune Responses, Inflammatory Responses.
- Cellular Growth and Neoplasia
Mechanisms of Normal Cell Homeostasis, Tumour Development: Multistep Formation and Clonal Expansion, Neoplasia Associated Genes, Oncogenic Signalling Pathways, Environmental Mutagenesis, Biological Features of Tumour Metastasis, Summary of Molecular Mechanism of Gastrointestinal Cancers, Molecular Medicine: Current and Future Approaches in Gastrointestinal Oncology.

❖ **Approach to patients with symptoms and signs**

- Acute Abdominal Pain
Anatomic Basis of Pain, Stimulants of Pain, Types of Pain, an Approach to the Patient with Acute Abdominal Pain, Pharmacologic Management of the Acute Abdomen
- Chronic Abdominal Pain
Definition and Classification of Functional Abdominal Pain Syndrome, Epidemiology And Impact on Health care Systems, Pathophysiology, Clinical features, Diagnosis And Differential Diagnosis Treatment
- Symptoms of Oesophageal Disease
Dysphagia, Odynophagia, Globus Sensation, Hiccups, Chest Pain of Oesophageal Origin, Heartburn and Regurgitation, Extra-oesophageal Symptoms of Gastro-oesophageal Reflux Disease
- Dyspepsia
Definition, Epidemiology, Cause of Organic dyspepsia, Functional (Non-ulcer) Dyspepsia, Approach to Investigated Dyspepsia, Treatment of Functional

Dyspepsia

- Nausea and Vomiting

Pathophysiology, Clinical Characteristics of Vomiting, Causes, Diagnostic Evaluation, Complications, Treatment

- Diarrhea

Definition, Pathophysiology, Clinical Classification, Differential Diagnosis, Evaluation of the Patient with Diarrhea and Selected Diarrheal Syndromes and treatment.

- Intestinal Gas Volume and its Composition, Sources of intestinal Gas, Propulsion of Gas through the Intestinal Tract, Clinical Gas Problems.
- Faecal Incontinence.

Prevalence, Mechanisms of Continence and Faecal Incontinence, Differential Diagnosis Faecal Incontinence, Evaluation of the Patient with focal Incontinence, Treatment, Management of Specific Situations.

- Constipation: Definition and Presenting Symptoms, Epidemiology, Risk Factors, Classification of Constipation, Colonic Anatomy and function, Pathophysiology of Constipation, Disorders of the Anorectum and Pelvic Floor, Constipation with Systemic Disorders, Constipation with Nervous System Disease, Constipation Secondary to Structural Disorders of the Colon, Rectum, Anus, and Pelvic Floor, Medications Associated with Constipation, Psychological Disorders as Causes of or Aggravating Factor in Constipation, Clinical Assessment, Diagnostic Tests, Medical Treatment.

- Gastrointestinal Bleeding: Clinical Manifestations, Acute Upper Gastrointestinal Bleeding, Acute Lower Gastrointestinal Bleeding, Occult and Obscure Bleeding.

- Jaundice: Determinants of Serum Bilirubin Concentration, Differential Diagnosis of Jaundice, Diagnostic Approach to the Patient with Jaundice, Therapeutic Options.

❖ Nutrition

- Nutritional Assessment and Management of the Malnourished Patient
Basic Nutritional Concepts, Micronutrients, Starvation, Malnutrition, When Aggressive Nutritional Support is indicated for the Hospitalized Patient? Refeeding Syndrome, Management of Severe Malabsorption: A Nutritional Perspective.

- Nutrition in Gastrointestinal Disease

Nutritional Assessment, Nutrients, Nutrition in Specific Disease States, Nutrition Therapy.

- Eating Disorders

Epidemiology, Etiology and Course, Diagnosis and Evaluation, Gastrointestinal Abnormalities Associated with Eating Disorders, Management of Eating Disorders in The Adult, Medical Management of Gastrointestinal Symptoms of Patient with Eating Disorders

- Obesity

Definition and prevalence Etiology, Gastrointestinal Complications, Non-Gastrointestinal Complications, Treatment

- Food Allergies

Background, Definitions, and Prevalence, Pathogenesis, Clinical Features, Diagnosis, Therapy and Natural History.

❖ Oesophagus

- Anatomy, Histology, Embryology, and Developmental Anomalies of the Oesophagus.

• Oesophageal Motor and Sensory Function and Motor Disorders of the Oesophagus¹⁷
Motor and Sensory Innervation, Coordinated Oesophageal Motor Activity, Pathogenesis and Categorization of Motor Disorders, Diagnosis, Disorder of the UES

And Cervical Oesophageal Region, Achalasia, Other Hypermotility Disorders of the Distal Oesophagus and LES (Spastic Disorders), Oesophageal Hypomotility Disorders

- Gastroesophageal Reflux Diseases and Its Complications

Epidemiology, Health Care Impact, Pathogenesis, Clinical Features, Differential Diagnosis, Associated Conditions, Diagnosis, Clinical Course, Complications, Treatment of uncomplicated disease, Treatment of complications

- Oesophageal Disorders Caused by Medications, Trauma, and infection
Medication-Induced Oesophageal Injury, Oesophageal Injury from Nasogastric and Other Non-endoscopic Tubes, Oesophageal Injury from Penetrating or Blunt Trauma, Oesophageal Infections in the Immunocompetent Host

- Tumours of the Oesophagus

Malignant Epithelial Tumours, Other Malignant Epithelial Tumours, Benign Epithelial Tumours, Malignant Non-epithelial Tumours, Benign Non-epithelial Tumours

❖ **Stomach and duodenum**

- Anatomy, Histology, Embryology, and Developmental Anomalies of the Stomach and Anatomy of Duodenum, Congenital Anomalies of the Stomach and Duodenum

- Gastric Motor and Sensory Function and Motor Disorders of the Stomach
Gastric Motor and Sensory Physiology, Clinical Assessment of Gastric Motor and Sensory Function and Dysfunction, Gastric Motor Disorders, Treatment

- Gastric Secretion

Physiology, Quantitative aspect of acid Secretion in Humans, Mucus/Bicarbonate Secretion, Secretion of Other Electrolytes (K⁺, Na⁺, Cl⁻), Pepsinogens and other Gastric Aspartic proteases, Human Gastric lipase, Intrinsic factor, Gastric Secretion in Disease, Gastric Anti-secretory drugs

- Helicobacter pylori

Epidemiology, Virulence Factors, Acute and Chronic Infection, Diagnosis, Treatment, Immunization (Prevention)

- Gastric and Gastropathies

Classification, Chronic Nonspecific Gastritis, Infection Gastritis, Granulomatous Gastritis, Distinctive Gastritis, Miscellaneous forms of Gastritis, Reactive Gastropathies (Acute Erosive Gastritis), Hyperplastic Gastropathies, Differential Diagnosis of Gastritis and Gastropathy, Treatment and Prevention of Gastritis and Gastropathy

- Peptic Ulcer Disease

Pathophysiology of Peptic Ulceration, Epidemiology, Clinical Features of Uncomplicated Peptic Ulcer Disease, Diagnostic Tests, Complication of Peptic Ulcer Disease, Cameron Ulcers (Linear Gastric Erosions in Hiatal Hernias)

- Treatment of Peptic Ulcer Disease

History, Anti-secretory and Acid-Neutralizing Agents, Ulcers Associated with Helicobacter pylori infection, Peptic Ulcer Associated with Non-steroidal Anti-inflammatory, Drugs, Refractory Peptic Ulcers, Stress-Related Mucosal Injury, Treatment of Complications of Peptic Ulcer Disease.

- Tumours of the Stomach.

Adenocarcinoma, Gastric Lymphoma, Gastric Carcinoid Tumours, Gastrointestinal Stromal Tumours, Miscellaneous Tumours.

❖ **Pancreas**

- Anatomy, Histology, Embryology, Signalling and Growth Factors, and Developmental Anomalies of the Pancreas.

- Pancreatic Secretion.

Functional Anatomy, Composition of Exocrine Secretions, Functions of the major Digestive Enzymes, Digestive Enzyme synthesis and Transport, Cellular regulation

of Enzyme Secretion, Organ Physiology, Pancreatic secretory Function tests.

- Hereditary, Familial, and Genetic Disorders of the Pancreas and Pancreatic Disorders in Childhood.

Definitions and Terminology, Models of Pancreatitis as a Complex Disorder, Major Gene Mutations Causing Pancreatic Disease, Modifier Genes in Pancreatic Disease, Pancreatic Disorders in Childhood, Genetic Disorders Affecting Pancreas in Childhood, Rare Syndromes, Familial Metabolic Syndromes Associated with Recurrent Acute and Chronic Pancreatitis.

- Acute Pancreatitis.

Epidemiology, Definitions, Natural History, Pathology, Pathogenesis, Pathophysiology, Predisposing Conditions, Clinical Features, Laboratory, Diagnosis, Radiologic Diagnosis, Differential Diagnosis, Predictors of Severity, Treatment, Complications.

- Chronic Pancreatitis.

Definition, Epidemiology, Pathology, Pathophysiology, Etiology, Clinical Features, Physical Examination, Diagnosis, Treatment and Complications.

- Pancreatic Cancer, Cystic Pancreatic Neoplasms, and Other Non-endocrine Pancreatic Tumours.

Pancreatic cancer, Cystic tumours of the Pancreas, Other Non-endocrine, Pancreatic Tumours.

❖ **Biliary tract**

- Anatomy, Histology, Embryology, Developmental Anomalies, and Paediatric Disorders of the Biliary Tract.

- Development of the Liver and Biliary Tract, Anatomy of the Biliary Tract and Gallbladder, Congenital Anomalies of the Gallbladder, Overview of Disorders of the Biliary Tract in Children, Paediatric Disorders of the Bile Ducts, Paediatric Disorders of The Gallbladder Biliary Tract Motor Function and Dysfunction.

Anatomy and Physiology, Gallbladder Dyskinesia, Sphincter of Oddi Dysfunction, Sphincter of Oddi Dysfunction in Pancreatitis, Failure of Response to Biliary Sphincterotomy in Sphincter of Oddi Dysfunction.

- Bile Secretion and the Enterohepatic Circulation.

Bile Acid Synthesis and Metabolism, The Enterohepatic Circulation, Hepatic Bile Acid Transport and Bile Secretion, Intestinal and Renal Bile Acid Transport, Disorders of the Enterohepatic Circulation, Bile Acid Therapy, Sequestrants, and Transport Inhibitors.

- Gallstone Disease.

Epidemiology, Composition, Risk Factors, Pathogenesis, and Natural History of Gallstones, Clinical features, Uncommon Complications,

- Treatment of Gallstone Disease

Medical Treatment, Surgical Treatment, Choice of Treatment, Indications for Treatment, Treatment of Choledocholithiasis, Bile duct Stricture, Post-cholecystectomy Syndrome, Gallstones, Cholecystectomy, and Cancer

- Acalculous Cholecystitis, Cholesterolosis, Adenomyomatosis, and Polyps of the Gallbladder Acalculous Biliary Pain, Acute Acalculous Cholecystitis, Cholesterolosis of the Gallbladder, Adenomyomatosis of the Gallbladder, Polyps of the Gallbladder

- Sclerosing Cholangitis and Recurrent pyogenic Cholangitis

Primary Sclerosing Cholangitis, Recurrent Pyogenic Cholangitis

- Tumours of the Gallbladder, Bile Ducts, and Ampulla

Gallbladder Tumours, Tumours of the extra hepatic Biliary Tree, Tumours of the Ampulla of Vater

- Endoscopic and Radiologic Treatment of Biliary Disease

General Principles, Procedural Techniques, Treatment of Specific Conditions

❖ **Liver**

- Anatomy, histology, Embryology, and Developmental Anomalies of the liver
Surface Anatomy, Segmental Anatomy, Large Vessels of the liver, Lymph Vessels, Nerve Supply, Biliary System, Microanatomy

- Liver Physiology and Energy Metabolism

Liver Cell types and Organization, Integration of the Functions of the Different Cell Types, Regeneration and Apoptosis of Liver Cells, Protein Synthesis and Degradation in the Liver Cells, Hepatic Nutrient Metabolism

- Liver Chemistry and Function tests

Biochemical Markers of Hepatic Injury, Patterns and Severity of Hepatic Injury, Predictors of Hepatic Injury, Additional Tests

- Hemochromatosis

Causes of Iron Overload, Pathophysiology, Clinical Features, Diagnosis, Treatment and Prognosis, Family Screening

- Wilson's Disease

The Copper Pathway, The Basic Molecular defect, Clinical Features, Pathology, Diagnosis, Treatment, Prognosis

- Other Inherited Metabolic Disorders of the Liver

- Clinical Features of Metabolic Liver Disease, α 1 Alpha Antitrypsin deficiency, Glycogen Storage Diseases, Congenital Disorders of Glycosylation, Porphyria's, Tyrosinemias, Urea Cycle Defects, Bile Acid Synthesis and Transport defects, Cystic Fibrosis.

Mitochondrial Liver Diseases

- Hepatitis A

Virology, Epidemiology, Pathogenesis, Clinical Features, Diagnosis, Prevention and Treatment

- Hepatitis B and D

Virology, Epidemiology, Pathogenesis, Clinical Features, Diagnosis, Prevention and Treatment

- Hepatitis C

Virology, Epidemiology, Pathogenesis, Clinical Feature, Diagnosis, Histopathologic Finding and Role of Liver Biopsy, Natural History, Prevention, Treatment.

- Hepatitis E

Virology, Epidemiology, Pathogenesis, Clinical Features, Diagnosis, Treatment and Prevention

- Hepatitis caused by Other Viruses

Hepatitis G and GB Agent Infection, TT Virus Infection, Sanban, Yonban, and SEN Viruses and TTV-Like Mini-Virus Infections, Systemic Viral Infections That Involve the Liver.

- Bacterial, Parasitic, and Fungal Infections of the Liver, Including Liver Abscess
Bacterial Infections Involving or Affecting the Liver, Parasitic Infections, Fungal Infections, Liver Abscess

- Vascular Diseases of the Liver

Budd-Chiari Syndrome, Sinusoidal Obstruction Syndrome (Veno-occlusive Disease), Portal Vein Thrombosis, Ischemic hepatitis, Congestive hepatopathy, Peliosis hepatitis, Hepatic Artery Aneurysm, Atherosclerosis

- Alcoholic liver Disease

Epidemiology, Spectrum of Disease, Diagnosis of Alcohol Abuse, Diagnosis of Alcoholic Liver Disease, Clinical Challenges, Confounders that may influence Progression of Alcoholic Liver Disease, Pathogenesis, Prognosis and its Treatment.

- Non-alcoholic Fatty Liver Disease

Non-alcoholic Fatty Liver and Steatohepatitis, Focal Fatty Liver, Liver Disease Caused by Drugs, Definitions and Importance, Epidemiology, Pathophysiology, Clinic pathologic Features of Drug- induced liver Disease, Practical and Management, Dose- Dependent and drug Hepatotoxicity, Acute hepatitis, Drug induced Granulomatous Hepatitis, Drug- Induced Chronic hepatitis, Drug-Induced Acute Cholestasis, Drug-Induced Chronic Cholestasis, Drug-Induced Steatohepatitis, Hepatic Fibrosis, and Cirrhosis, Drug-Induced Vascular Toxicity

- Liver Disease Caused by Aesthetics, Toxins, and Herbal Preparations
Aesthetic Agents, Chemicals, Metals, Adulterated cooking Oils and Contaminated Foods, Drugs of Abuse, Botanical and Environmental Hepatotoxins, Vitamins and Herbal Preparations
- Autoimmune Hepatitis
Diagnosis Criteria, Pathogenesis, Classification, Variant Forms, Autoimmune, Hepatitis and Chronic hepatitis C, Epidemiology, Prognostic Indices, Clinical features, Treatment, Liver Transplantation, Future Directions
- Primary Biliary Cirrhosis
Epidemiology, Pathogenesis, Clinical Features, Diagnosis, Natural History, Treatment, Complication of Chronic Cholestasis, Liver Transplantation, Autoimmune Cholangitis (AMA-Negative Primary Biliary Cirrhosis).
- Portal Hypertension and Gastrointestinal Bleeding
Normal Portal Circulation, Hemodynamic Principles of portal Hypertension, Measurement of Portal Hypertension, Detection of varices, Cause of portal Hypertension, Clinical Assessment of patients with portal hypertension-related bleeding, Treatment of portal hypertension-related Bleeding, Management of Specific lesions
- Ascites and Spontaneous Bacterial peritonitis
Pathogenesis of Ascites, Clinical Features, Diagnosis, Differential Diagnosis, Complications, Treatment of Ascites, Prognosis
- Hepatic Encephalopathy, Hepato-pulmonary Syndrome, Hepato-renal Syndrome, and Other Complications of Liver Disease
Hepatic Encephalopathy, Hepato-pulmonary Syndrome, Hepato-renal Syndrome, Endocrine Dysfunction, Coagulation Disorders
- Acute Liver Failure
Definition, Etiology, Clinical Features, Predictors of Outcome, Treatment, Liver Transplantation, Investigational Approaches
- Hepatic Tumors and Cysts
Hepatic Tumors, Tumor-Like Hepatic Lesions, Hepatic Cysts, Approach to the Patient with a Hepatic Mass Lesion
- Liver Transplantation
Indications, Listing Criteria and Policies of the United Network for Organ Sharing, Absolute and Relative Contraindications, Transplantation Evaluation and Listing, Disease-Specific Indications, Surgical Aspects of Liver Transplantation, Immunosuppression, Postoperative Course, Long-Term management

❖ **Small and large intestine**

- Anatomy, Histology, Embryology, and Development Anomalies of the Small and Large Intestine
- Small Intestinal Motor and Sensory Function and Dysfunction
Anatomy, Structural Elements and Their Role in Small intestinal motor and Sensory Function, Integrative Control of Motility, Mechanisms underlying Abnormal Motor and Sensory Function, Evaluation of Small Intestinal Motility, Clinical Measurement of Small Intestinal Motility, Normal Small Intestinal Motility, Clinical Consequences of Disordered Small Intestinal Motor Function, Approach to Patients with Possible Small

Intestinal Motor Dysfunction

- Colonic Motor and Sensory function and Dysfunction

Anatomy and Basic Control Mechanisms, Innervation of the Colon, Relationships among cellular Events, Pressure and Flow, Regulation of Colonic Filling, Transport, and defecation, Anorectal motility, Modulators of Colonic Motility, Disorders of Colonic Motility

- Intestinal Water and Electrolyte Transport

Features of the Intestinal Mucosa Essential for Water and Electrolyte Transport, Mucosal Components Involved in the Regulation and Modulation of intestinal Water and Electrolyte transport, Neuro-humoral regulation of Intestinal Secretion and Absorption, Mucosal water and Electrolyte transport Processes, Changes in water and electrolyte transport in disease.

- Digestion and Absorption of Nutrients and vitamins

Digestion and Absorption of Nutrients: An Overview, Fat, Carbohydrate, Protein, Vitamins, Minerals, Trace Elements, Adaptation to Changes in need or Load, The Neonatal Intestine, Diet-Gene Interactions, Bariatric Surgery: Effect on Digestion and Absorption

- Etiology and Pathophysiology

Etiology and Pathophysiology, Clinical Features and Evaluation, Anatomic Investigations, Non-invasive Evaluation of Gastrointestinal Absorptive and Digestive Function, Malabsorption in Specific Disease States, General Approach to the Management of Malabsorption

- Enteric Bacterial Flora and Bacterial Overgrowth

Composition and Molecular Analysis of the Enteric Flora, Host-Flora Interaction, Metabolic Activity of the Flora, Small Intestinal Bacterial Overgrowth

- Short Bowel Syndrome

Etiology, Incidence and Prevalence, Pathophysiology, Medical Management, Complications, Surgical Management, Pharmacologic Enhancement of Bowel Adaptation, Survival and Quality of Life

- Celiac Sprue and Refractory Sprue

Definitions, History, Epidemiology, Pathology, Clinical Feature, Diagnostic Studies, Differential Diagnosis, Disease Associated with Celiac Sprue, Treatment, Complications, Refractory Sprue, Prognosis, Future Therapies

- Tropical Malabsorption and Tropical Diarrhea

Specific Causes of Tropical Malabsorption, Nonspecific Tropical Malabsorption

- Whipple's Disease

History, Epidemiology, Microbiology, Genomics, Pathogenesis and Immunology, Clinical Features, Pathology, Diagnosis, Differential Diagnosis, Treatment and Prognosis, Future Prospects

- Infectious Enteritis and Proctocolitis and Bacterial Food Poisoning

Susceptibility to Intestinal Infection, Classification of Bacterial Diarrhea, Diagnosis of Infectious Diarrheal Disease, Toxigenic Pathogens, Invasive Pathogens, Viral Pathogens, Special Situations, Dysentery versus Ulcerative Colitis, Treatment of Tuberculosis of Gastrointestinal Tract, Bacterial Food Poisoning, Fish Poisoning

• Antibiotic-Associated Diarrhea, Pseudomembranous Enterocolitis, Clostridium difficile-Associated Diarrhea and Colitis, Antibiotic-Associated Diarrhea, Pseudomembranous Enterocolitis, Clostridium difficile-Associated Diarrhea and Colitis

- Intestinal Protozoa

Entamoeba Histolytica, Other Intestinal Amebae, Giardia Lamblia, Dientamoeba fragilis, Blastocystis hominis, Cryptosporidium Species, Cyclospora cayetanensis,

Isospora belli, Microsporidia, Trypanosoma cruzi(American Trypanosomiasis or Chagas Disease)

- Intestinal Worms

Nematodes, Cestodes, Trematodes

- Crohn's Disease

History, Epidemiology, Etiology and Pathogenesis, Pathology, Clinical Features, Differential Diagnosis, Establishing the Diagnosis and Evaluation of Disease, Treatment, Crohn's Disease in the life Cycle, Prognosis

- Ulcerative Colitis

Epidemiology, Etiology and Pathogenesis, Pathology, Clinical Features, Natural History and Prognosis, Diagnosis, Assessment of Disease Activity, Medical Therapy, Surgical Therapy, Management of Specific Complications, Extra-intestinal Manifestations

- Ileostomy, Colostomy, and Pouches

Pathophysiologic Consequences of Proctocolectomy, Clinical Consequences of Proctocolectomy, Complications and Management of the Conventional Brooke Ileostomy, Continent Ileostomy, Ileal Pouch-Anal Anastomosis, Abdominal Colectomy and ileorectal Anastomosis, Colostomy in the Management of Inflammatory Bowel Disease, Summary of Risk-Benefit Analysis

- Intestinal Ischemia

Anatomy of the Splanchnic circulation, Pathophysiology and Pathology, Acute Mesenteric Ischemia, Mesenteric Venous Thrombosis, Focal Segmental Ischemia of the Small Intestine, Colon Ischemia, Chronic Mesenteric Ischemia, Vasculitis and Angiopathy of the Splanchnic Circulation

- Ulcers of the Small and Large Intestine

Isolated Ulcers, Diffuse Ulcerations

- Appendicitis

Historical Notes, Epidemiology, Anatomy and Embryology, Pathology, Pathogenesis, Diagnosis, Complications, Treatment, Treatment Outcomes,

❖ **Miscellaneous Topics**

- Diverticular Disease of the Colon

Epidemiology, Pathologic Anatomy, Etiology and Pathogenesis, Uncomplicated Diverticulosis, Diverticular Haemorrhage

- Irritable Bowel Syndrome

Definitions, Clinical Features, Epidemiology, Pathophysiology, Diagnosis, Management, Prognosis

- Intestinal obstruction and ileus

Small Intestinal Obstruction, Colonic Obstruction ileus

- Acute and Chronic Pseudo-obstruction

Epidemiology, Neural Control of Small Intestinal and Colonic Motility, Chronic Intestinal Pseudo-obstruction, Acute Colonic Pseudo-obstruction, Colonic Pseudoobstruction and Megacolon, Chronic Colonic Pseudo-obstruction

- Small Intestinal Neoplasms

Epidemiology, Pathology, Etiology and Risk Factors, Diagnosis, Treatment

- Colonic Polyps and Polyposis Syndromes

Colonic Polyps, Gastrointestinal Polyposis Syndromes

- Malignant Neoplasms of the Large Intestine

Epidemiology of Colorectal Cancer, Etiology and Clues about Causation, of Colorectal Cancer, Familial Colon Cancer, Predisposing Factors for Colorectal Cancer, Pathology, Natural History, and Staging, Prognosis, Clinical Manifestation, Diagnosis and Screening, Treatment, Other malignant Colonic Tumors

- Other Disease of Colon and Rectum
Lymphocytic and Collagenous Colitis, Diversion Colitis, Nonspecific Colonic Ulcers, Dieulafoy's-Type Colonic Ulceration, Cathartic Colon, Pseudo-melanosis Coli, Chemical Colitis, Pneumatosis Coli, Malakoplakia, Colitis Cystica Profunda, Neutropenic Enterocolitis, Endometriosis

- Disease of the Anorectum
Anatomy, Examination of the Anus and rectum, Haemorrhoids, Anal Fissure, Abscesses and Fistulas, Special Fistulas, Anal Warts, Pruritus Ani, Anal Stenosis, Unexplained Anal pain, Hidradenitis Suppurativa, Pilonidal Disease, Rectal Foreign Body

❖ **Psychosocial factors**

- A Biopsychosocial Understanding of Gastrointestinal Illness and Disease
Case Study: A Typical Patient in a Gastroenterology Practice, The Biomedical Model, The Biopsychosocial Model

- Palliative Medicine in Patient with Advanced Gastrointestinal and hepatic Disease
- Definitions, Common Themes in Palliative Medicine
- Complementary and Alternative Medicine Therapies in gastrointestinal and Hepatic Disease
Definition and Epidemiology, Types of Therapies, Demography, Rationale for use, Gastrointestinal Disorders Addressed by CAM Therapies

❖ **Topics involving multiple organs**

- Oral Disease and Oral-Cutaneous Manifestations of Gastrointestinal and Liver Disease

Disorders of Mouth and Tongue, Mucocutaneous Candidiasis, Mucocutaneous Features of HIV Infection, Mucocutaneous Ulcerative Disease, Vesiculobullous Diseases, Lichen Planus, Cutaneous Manifestations of Intestinal Disease, Vascular and Connective Tissue Disorders, Cutaneous Manifestations of Gastrointestinal Malignancies, Cutaneous Manifestations of Liver Disease, Parasitic Diseases of the Intestine and Skin, Dermatitis Herpetiformis and Celiac Sprue, Vitamin Deficiencies

- Diverticula of the Pharynx, oesophagus, Stomach, and Small Intestine
Zenker's Diverticulum, oesophageal Diverticula, oesophageal intramural Pseudodiverticula, Gastric Diverticula, Duodenal Diverticula, Jejunal Diverticula

- Abdominal Hernias and Gastric Volvulus
Diaphragmatic Hernias, Gastric Volvulus, Inguinal and Femoral Hernias(Groin Hernias), Other Ventral Hernias, Pelvic and Perineal Hernias, Lumbar Hernias, Internal Hernias

- Foreign Bodies and Bezoars
Foreign Bodies, Bezoars

- Caustic Injury to the Upper Gastrointestinal Tract
Caustic Agents, Button (Disk) Battery Ingestion

- Abdominal Abscesses and Gastrointestinal Fistulas
Abdominal Abscesses, Gastrointestinal Fistulas

- Eosinophilic Disorders of the Gastrointestinal Tract
Eosinophil: Role in Health and Disease, Clinical Entities, Evaluation, Differential Diagnosis and Management

- Protein-Losing Gastroenteropathy
Definition and Normal Physiology, Pathophysiology, Clinical Manifestations, Disease Associated with Protein-Losing Gastroenteropathy, Diagnosis, Treatment and Prognosis

- Gastrointestinal Lymphomas: Background, General Principles of lymphoma

Management, Gastric Lymphomas, Small Intestinal Lymphomas, Others Sites, Immunodeficiency-Related Lymphomas

- Gastrointestinal Stromal Tumors

Incidence, Location, Clinical Presentation, Pathology and Molecular Pathobiology, Diagnosis, Treatment and Special Considerations

- Gastrointestinal Carcinoid Tumors and the Carcinoid Syndrome

Clinical Presentation, Pathology, Classification, Carcinoid Syndrome, Metastatic Carcinoid Tumors

- Endocrine Tumors of the Pancreas and Gastrointestinal Tract

General Aspects, Multiple Endocrine Neoplasia, Other Inherited Syndromes, Insulinomas, Gastrinomas, Glucagonomas, VIPomas, Somatostatinomas, GRFomas, PPomas/Nonfunctioning Pancreatic Endocrine Tumors(PETs), Other PETs, Tumor Localization and Management of Metastatic PETs

• Gastrointestinal Consequences of Infection with Human Immunodeficiency Virus
Diarrhea, Odynophagia and Dysphagia, Abdominal Pain, Anorectal Disease, Gastrointestinal Bleeding, Hepatomegaly and Abnormal Liver Tests

• Gastrointestinal and Hepatic Complications of Solid Organ and Hematopoietic Cell Transplantation

Complications of Solid Organ Transplantation, Complications of Hematopoietic Cell Transplantation

- Gastrointestinal and Hepatic Manifestations of Systemic Disease

Rheumatologic and Collagen Vascular Diseases, Oncologic and Hematologic Disease, Endocrine Diseases, Disorders of Lipid Metabolism, Renal Disease, Neurologic Diseases, Pulmonary Disease and Problem in Patients Who Require Critical Care, Cardiovascular Diseases, Infiltrative Diseases, Nodular Disorders of the Liver

- Vascular Lesions of the Gastrointestinal Tract

Vascular Lesions, Abdominal Aortic Aneurysm, Mycotic Aneurysms, Paraprostatic Enteric and Aortoenteric Fistula, Superior Mesenteric Artery Syndrome, Celiac Axis Compression Syndrome

- Surgical Peritonitis and Other Diseases of the Peritoneum, Mesentery, Omentum, and Diaphragm

• Anatomy and Physiology, Surgical Peritonitis, Peritonitis of Other Causes, Peritoneal Tumors, Diseases of the Mesentery and Omentum, Diseases of the Diaphragm, Laparoscopy in the Evaluation of Peritoneal Disease

- Gastrointestinal and Hepatic Disorders in the Pregnant Patient

Gastrointestinal and Hepatic Function in Normal Pregnancy, Gastrointestinal Disorders and Pregnancy, Hepatic Disorders Unique to Pregnancy, Common Liver Diseases and Pregnancy

- Radiation Injury to the Gastrointestinal Tract

Radiation Physics, Biological Effects of Radiation, Mechanisms of Radiation-Induced Damage to the Gastrointestinal Mucosa, Radiation-Induced Esophagitis, Radiation-Induced Gastritis, Radiation –Induced Enteritis, Management and Prevention of Radiation-Induced Gastrointestinal Tract Injury

- Complications of Gastrointestinal Endoscopy

Complications of Sedation, Infectious Complications, Bleeding Complications, Other General Complications, Timing and Severity of Complication, Medico-legal Complications, Complications of Upper Endoscopy, Complications of Colonoscopy and Sigmoidoscopy, Complications of ERCP and Complications of Endoscopic Ultrasonography

- ❖ **Recent advances**

- Recent advances in Gastroenterology
- Recent advances in Hepatology
- Recent advances in Endoscopy

4.2. Practical

- ❖ **History, examination and writing of records:**
 - History taking should include the back ground information, presenting complaints and history of present illness, history of previous illness, family history, social and occupational history and treatment history.
 - Detailed physical examination should include general examination and systemic examination (Chest, Cardio-vascular system, Abdomen, Central nervous system, locomotor system and joints), with detailed examination of the abdomen.
 - Skills in writing up notes, maintaining problem oriented records, progress notes, and presentation of cases during ward rounds, planning investigations and making a treatment plan should be taught.
- ❖ **Bedside procedures & Investigations:**
 - Therapeutic skills: Venepuncture and establishment of vascular access, Administration of fluids, blood, blood components and parenteral nutrition, Nasogastric feeding, Urethral catheterization, Administration of oxygen, Cardiopulmonary resuscitation, Endotracheal intubation.
- ❖ **Upper GI Endoscopy, Colonoscopy and ERCP procedures, Endoscopic Ultrasound, Motility Studies, Double Balloon Enteroscopy.**

4.3. Clinical Teaching

Residents should have the practical knowledge and clinical skills to evaluate and manage various medical and gastrointestinal disorders. Clinical work should be closely guided and supervised by Consultants. If a particular clinical teaching material is not available in the institution, then the resident should be posted in another institution for acquiring that practical knowledge and skill.

❖ Gastroenterology Teaching Clinical

- OPD: A Resident should evaluate all cases for a preliminary diagnosis and discuss with the consultant.
- WARD: A Resident should gain competency in diagnostic workup and day today management of routine and advanced Gastroenterology cases.

• Investigations

The Resident should have acquired the theoretical/practical knowledge about following investigations:

- ❖ Interpretation of plain X-ray of the abdomen, barium studies
- ❖ ultrasound abdomen
- ❖ CT scan of the abdomen.
- ❖ Indication for upper GI Endoscopy, Sigmoidoscopy, Colonoscopy, Endoscopic Sclerotherapy and Banding, Enteroscopy
- ❖ Indications for liver biopsy.
- ❖ ERCP and MRCP- indications and interpretations.
- ❖ Capsule Endoscopy- indications and interpretations.
- ❖ GI Motility studies- indications and interpretations.

- ❖ Fibroscan- indications and interpretations.
- ❖ Endoscopic Ultrasound- indications and interpretations.

Procedures

The Resident should have acquired practical knowledge of/and should be able to carry out the following:

- ❖ Per rectal examination and proctoscopy.
- ❖ Nasogastric intubation.
- ❖ Ascitic tap.
- ❖ Liver biopsy.
- ❖ FNAC of abdominal masses (under ultrasound guidance).
- ❖ Needle aspiration from liver abscess (under ultrasound guidance).
- ❖ Upper GI Endoscopy
- ❖ Sigmoidoscopy
- ❖ Colonoscopy
- ❖ PEG
- ❖ Side viewing Endoscopy/ ERCP
- ❖ Manometry
- ❖ Hydrogen BreathTest
- ❖ Capsule Endoscopy

MINIMUM PROCEDURES TO BE CARRIED OUT BY A GASTROENTEROLOGY RESIDENT

ENDOSCOPY TRAINING

The residents should have knowledge of instruments and its applications

- ❖ Endoscopes
- ❖ Accessories
- ❖ Operation and Maintenance of Endoscopy suite

Procedure	Number of Procedures
Oesophagus- gastro-Duodenoscopy (EGD)	200
Oesophageal intubation	
Pyloric intubation	
Variceal ligation	
Sclerotherapy	
Colonoscopy Navigation through sigmoid colon	50
Intubation of splenic flexure	
Intubation of the hepatic flexure	
Intubation of cecum	
Retro- flexion in the rectum	
Pile banding	
Polypectomy	

Sigmoidoscopy Retro- flexion in the rectum	100
Endoscopic retrograde Cholangiopancreatography (ERCP) Duodenal Intubation Visualization of Papilla	20
Liver Biopsy Safety & adequate understanding of the procedure	10

5. Teaching Program

5.1 General Principles

Once a candidate has enrolled for the DM Gastroenterology course he/she shall be a full time post graduate student (24 x 7) during course period. He/she will not engage in private medical practice/ Nursing home practice. And shall abide by the rules of the university strictly.

Acquisition of practical competencies being the keystone of postgraduate Medical education, postgraduate training is skills oriented.

Learning in postgraduate program is essentially self-directed and primarily emanating From clinical and academic work. The formal sessions are merely meant to supplement this core effort.

5.2 Teaching Sessions

- The teaching methodology consists of bedside discussions, ward rounds, case presentations, clinical grand rounds, statistical meetings, journal clubs, lectures and seminars.
- Along with these activities, trainees should take part in inter-departmental meetings i.e. Clinico-pathological and Clinico-radiological meetings that are organized regularly.
- Trainees are expected to be fully conversant with the use of computers and be able to use databases like the Medline, Pubmed etc.
- They should be familiar with concept of evidence based medicine and the use of guidelines available for managing various diseases.
- Each unit should have regular teaching rounds for residents posted in that unit. The rounds should include bedside case discussions, file rounds (documentation of case history and

examination, progress notes, round discussions, investigations and management plan), interesting and difficult case unit discussions.

- Teaching Skills- Post Graduate students must teach undergraduate students (eg- Medical, Nursing) by taking demonstrations, bedside clinics, tutorials, lectures etc. Assessment is made using a checklist by medical faculty as well as by the students. Record of the participation is to be kept in the Log book.
- Continuing Medical Education Programs (CME) - It is recommended that at least one national level CME be attended by each student during the course.

5.3 Teaching Schedule

Following is the suggested weekly teaching programme in the Department of Gastroenterology:

Sr. No.	Description	Frequency
1.	Case Presentation	Once a week
2.	Seminar	Once a week
3.	Journal Club	Once a week
4.	Grand Round presentations	Once a month
5.	Statistical & Mortality Meet	Once a month
6.	Clinico-Pathological meet	Once a month
7.	Clinico-Radiological meet	Once a month
8.	Clinico-Surgical meet	Once a month
9.	Faculty lecture teaching	Once a month

5.4 Conferences and Papers

- Conferences- Attending conferences are compulsory. Post Graduate students should attend at least one national and one state level conference during the course.
- A post graduate student is required to present two papers/posters in national/state conference during the course period

6. Schedule of Posting

The residents should be posted in the gastroenterology ward, emergency (casualty) and Gastroenterology intensive care unit during the three year course. They should also Under go rotation in allied specialties. The following should be the training program in the department:

1. Gastroenterology OPD	}	33 months (1 to 4)	18
2. Gastroenterology Ward			
3. Endoscopy Lab			
4. Gastroenterology ICU			

5. Gastro-intestinal Surgery -	1 month
6. Pathology/ Microbiology	15 days
7. Radiology -	15 days
8. Optional postings-	1 Month

The student will be encouraged to visit another gastroenterology centre on his/her own expense, the duration of which shall not exceed two months during the course. The candidate shall take prior permission from HOD in this regard.

First Academic Year

1. Workup of patients in OPD under supervision: The DM student should become competent in rendering appropriate outpatient care from evaluation through long-term follow-up or discharge from clinic as indicated for each disease process. The DM student should provide care to patients with a broad range of gastrointestinal, hepatobiliary diseases and pancreatic disorders. The DM student should be able to organize outpatient evaluation, diagnostic procedures and treatment, including hospital admissions as necessary. The DM student should perform history and examination, review of outside data and present cases to the attending faculty.
2. Supervised general and intensive care of admitted patients: The DM student should become competent in rendering appropriate inpatient care from evaluation to discharge of a broad range of hepatobiliary disease. The DM student should become competent in the performance of diagnostic and therapeutic invasive procedures. The DM student should learn to evaluate and ameliorate the psychosocial impact of disease, utilize available ancillary services and deliver cost efficient care.
3. Overall The DM student will participate, with supervision from attending faculty, in all aspects of the care of patients with gastrointestinal & hepatobiliary diseases. This care includes initial evaluation, formulation of differential diagnosis and evaluation, participation in diagnostic procedures, interpretation of laboratory, radiologic, pathologic and other testing, treatment and discharge planning.
4. Assist in all endoscopic procedures and start performing diagnostic endoscopic procedures in first year of residency under supervision.

Goals: The DM student should become increasingly proficient in the performance of various gastrointestinal procedures: patient assessment for a specific procedure, sedation, understands procedural techniques and post-procedure monitoring and management. The student should develop skills to become proficient in diagnostic procedures such as upper gastrointestinal endoscopy, percutaneous liver biopsy and bedside procedures. The DM student should observe therapeutic procedures like endoscopic sclerotherapy, banding and glue injections.

Objectives: The DM student will review charts of scheduled outpatient procedures daily, should participate in the consent process, conscious sedation, the procedure, post-procedure management, communication with patients and families and generation of reports. The student should also attend emergency calls.

Second Academic Year

1. Care of admitted and out-patients. As already laid out for the first year DM student
2. Perform elective diagnostic and therapeutic endoscopies
3. Academic presentation: Seminar, journal club, journal scans and clinical case presentation, monthly patient data statistics, radiology and histopathology case presentations in respective sessions.

Third Academic Year

1. Care of admitted and out-patients
2. Liver transplantation related patient care

3. Should perform emergency, and elective diagnostic and therapeutic endoscopies
4. Academic work as before
5. ERCP
6. Postings in Pathology, Radiology, HPB surgery Departments and different laboratories
7. Analysis and submission of research project

❖ **Maintenance of Log Book:**

Every candidate shall maintain a Log Book /Work dairy and record

- Participation in training programmes (Seminars, Journal Reviews etc.)
- Clinical presentations
- Clinical and Laboratory procedures
- Endoscopic procedures performed
- All daily activities, including ward rounds and routine and emergency procedures.

The log book shall be duly verified and signed by a faculty member, and certified by the head of department, head of the institute and presented in the University practical/clinical examination.

7. Research Project:

- ❖ Every candidate shall carry out work on an assigned research project (Thesis) under the guidance of a recognized postgraduate teacher. The project shall be written and submitted in the form of a Thesis.
- ❖ The student will (i) identify a relevant research problem, (ii) conduct a critical review of literature, (iii) formulate a hypothesis, (iv) determine the most suitable study design, (v) state the objectives of the study, (vi) prepare a study protocol, (viii) undertake a study according to the protocol, (viii) analyze and interpret research data, and draw conclusions.
- ❖ Every candidate shall submit a project plan to the university within 9 months of joining the course.
- ❖ The thesis should be submitted to the university at least 6 months before the final Theory and Clinical/ Practical examination.
- ❖ The candidate shall publish at least one research paper in an indexed peer reviewed journal during the course period, which may be a part of his/her thesis.

8. Job Responsibilities

Outdoor Patient (OPD) Responsibilities

- ❖ The working of the residents in the OPD should be fully supervised.

- ❖ They should evaluate each patient and write the observations on the OPD card with date and signature.
- ❖ Investigations should be ordered as and when necessary using prescribed forms.
- ❖ Residents should discuss all the cases with the consultant and formulate a management plan.
- ❖ Patient requiring admission according to resident's assessment should be shown to the consultant on duty.
- ❖ Patient requiring immediate medical attention should be sent to the casualty services with details of the clinical problem clearly written on the card.
- ❖ Patient should be clearly explained as to the nature of the illness, the treatment advice and the investigations to be done.
- ❖ Resident should specify the date and time when the patient has to return for follow up.
- ❖ **In-Patient Responsibilities**
 - Each resident should be responsible and accountable for all the patients admitted under his care. The following are the general guidelines for the functioning of the residents in the ward;
 - Detailed work up of the case and case sheet maintenance;
 - He/ She should record a proper history and document the various symptoms. Perform a proper patient examination using standard methodology. He should Develop skills to ensure patient comfort/consent for examination. Based on the above evaluation he/she should be able to formulate a differential diagnosis and prepare a management plan.
 - Should develop skills for recording of medical notes, investigations and be able to properly document the consultant round notes.
 - To organize his/her investigations and ensure collection of reports.
 - Bedside procedures for therapeutic or diagnostic purpose.
 - Presentation of a precise and comprehensive overview of the patient in clinical rounds to facilitate discussion with senior residents and consultants.
 - To evaluate the patient twice daily (and more frequently if necessary) and Maintain a progress report in the case file.
 - To establish rapport with the patient for communication regarding the nature of illness and further plan management.
 - To write instructions about patient's treatment clearly in the instruction book Along with time, date and the bed number with legible signature of the resident.
 - All treatment alterations should be done by the residents with the advice of the concerned consultants and senior residents of the unit.
- ❖ **Admission day**

Following guidelines should be observed by the resident during admission day.

 - Resident should work up the patient in detail and be ready with the preliminary necessary investigations reports for the evening discussion with the consultant on duty.
 - After the evening round the resident should make changes in the treatment and plan out the investigations for the next day in advance.
- ❖ **Doctor on Duty**
 - Duty days for each Resident should be allotted according to the duty roster.
 - The resident on duty for the day should know about all sick patients in the wards and relevant problems of all other patients, so that he could face an emergency situation effectively.
 - In the morning, detailed over (written and verbal) should be given to the next Resident on duty. This practice should be rigidly observed.
 - If a patient is critically ill, discussion about management should be done with the consultant at any time.

- The doctor on duty should be available in the ward throughout the duty hours.
- ❖ **Care of Sick Patients**
- Care of sick patients in the ward should have precedence over all other routine work for the doctor on duty.
- Patients in critical condition should be meticulously monitored and records Maintained.
- If patient merits ICU care then it must be discussed with the senior residents and consultants for transfer to ICU.
-
- ❖ **Resuscitation skills**
- At the time of joining the residency programme, the resuscitation skills should be demonstrated to the residents and practical training provided at various work stations.
- Residents should be fully competent in providing basic and advanced cardiac life support.
- They should be fully aware of all advanced cardiac support algorithms and be Aware of the use of common resuscitative drugs and equipment like defibrillators and external cardiac pacemakers.
- The resident should be able to lead a cardiac arrest management team.
- ❖ **Discharge of the Patient**
- Patient should be informed about his/her discharge one day in advance and Discharge cards should be prepared 1 day prior to the planned discharge.
- The discharge card should include the salient points in history and examination, complete diagnosis, important management decisions, hospital course and procedures done during hospital stay and the final advice to the patient.
- Consultants and DM Residents should check the particulars of the discharge Card and counter sign it.
- Patient should be briefed regarding the date, time and location of OPD for the Follow up visit.
- ❖ **In Case of Death**
- In case it is anticipated that a particular patient is in a serious condition, relatives should be informed about the critical condition of the patient beforehand.
- Residents should be expected to develop appropriate skills for breaking bad News and bereavements.
- Follow up death summary should be written in the file and face sheet notes must be filled up and the sister in charge should be requested to send the body to the mortuary with respect and dignity from where the patient's relatives can be handed over the body.
- In case of a medico legal case, death certificate has to be prepared in triplicate and the body handed over to the mortuary and the local police authorities should Be informed.
- Autopsy should be attempted for all patients who have died in the hospital Especially if the patient died of an undiagnosed illness.

- ❖ **Bedside Procedures**
- The following guidelines should be observed strictly:
- Be aware of the indications and contraindications for the procedure and record it in the case sheet. Rule out contraindications like low platelet count, prolonged prothrombin time, etc.
- Plan the procedure during routine working hours, unless it is an emergency. Explain the procedure with its complications to the patient and his/her relative And obtain written informed consent on a proper form. Perform the procedure Under strict aseptic precautions using standard techniques. Emergency tray

Should be ready during the procedure.

- Make a brief note on the case sheet with the date, time, nature of the procedure and immediate complications, if any.
- Monitor the patient and watch for complications(s).

❖ **Medico-Legal Responsibilities of the Residents**

- All the residents are given education regarding medico-legal responsibilities at the time of admission in a short workshop.
- They must be aware of the formalities and steps involved in making the correct death certificates, mortuary slips, medico-legal entries, requisition for autopsy etc.
- They should be fully aware of the ethical angle of their responsibilities and should learn how to take legally valid consent for different hospital procedures & therapies.
- They should ensure confidentiality at every stage.

9. Assessment

All the Post Graduate students are assessed daily and periodically for their academic activities.

9.1. Internal Assessment

The performance of the resident during the training period shall be monitored throughout the course and duly recorded in the log books.

The department will conduct three tests during the course of three years;

- Two of the tests will be annual, at the end of 1st and 2nd years. (Theory Examination)
- The third will be a preliminary examination which may be held three months before the final examination. (Theory & Practical Examination)
- Records and marks obtained in such tests shall be maintained by the Head of Department and sent to the University when called for.

9.2. Scheme of Examination:

Candidates will be allowed to appear for examination only if he/she has a minimal¹⁹ of 80% Attendance.

1. Theory: 400 Marks

The theory examination shall consist of four question papers each of three hours duration. Each paper shall carry maximum of 100 marks and the total maximum marks would be 400. The format for the theory paper shall be as follows:

Type of Question	No. of Question	Marks for each Question	Total Marks
Short Essay	10	10	100
Grand Total			100

Paper Title	Marks
Paper -I Basic Gastroenterology Sciences	100
Paper-II Clinical Gastroenterology	100
Paper-III Clinical and Investigative Gastroenterology	100
Paper-IV Recent advances in Gastroenterology	100
Total	400

2. Practical Examination: 300 Marks

Types of Cases	No. of Cases	Marks	Duration
Long Case	01	100	1 hour
Short Cases	02	100(50x 2)	30 min. each
Spotters		50	
Ward Rounds		50	

3. Viva- Voce Examination

100 Marks

Aims: To elicit candidate's knowledge and investigative/Therapeutic skills.

Examiners will conduct vivo-voce on candidate's comprehension, analytical approach, expression and interpretation of data. It includes all components of course contents. In addition candidates may be given gross specimens, histopathology slides, endoscopy accessories, endoscopy video clippings, Manometry tracings, breath test recordings, radiological investigations including CT scan and Magnetic Resonance Imaging, etc., for interpretation and questions on these will be asked. The student's knowledge on use of instruments and drugs will also be evaluated during vivo-voce examination.

4. Maximum Marks:

Theory	Clinical Examination	Viva Including Spotters	Grand Total
400	300	100	800

5. Passing Criterion

To pass the examination the candidate must secure at least 50% of marks in each head of theory and practical separately or as per the existing Medical Council of India regulations for the post graduate medical education.

10. Suggested Books and Journals

10.1 Textbooks

1. Gastrointestinal and Liver Disease- Sleisenger & Fordtran
2. Diseases of the Liver - Eugene R. Schiff
3. Diseases of the Liver & Biliary System- Sheila Sherlock
4. Yamada textbook of Gastroenterology-YAMADA
5. Sivak's textbook of GI Endoscopy- SIVAG
6. Gastro-intestinal Endoscopy- P. Cotton
7. Liver Diseases in Children-Suchy
8. Surgery of Liver and Biliary tract- Blumgart

10.2 Journals

1. Gastroenterology
2. Hepatology
3. GUT
4. Journal of Hepatology
5. American Journal of Gastroenterology
6. Gastrointestinal Endoscopy
7. Seminars in Liver disease.
8. Indian Journal of Gastroenterology
9. New England Journal of Medicine
10. Lancet
11. Tropical Gastroenterology

10.3 Clinics

1. Gastroenterology Clinics of North America
2. Clinics in Liver disease
3. Gastrointestinal Endoscopy Clinics of North America.

**Guidelines
For
Competency Based Training Program in
M.Ch- Surgical Oncology**

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INTRODUCTION

Surgical Oncology covers the treatment of solid tumours of the oro-esophago-gastrointestinal tract, of parenchymal and endocrine organs, skin, mesenchymal, neurogenic, bone and soft tissues.

Surgical Oncology also includes prevention, genetic counseling, specific diagnostic and staging procedures, rehabilitation and follow-up care. Surgical Oncology is focused on multimodality therapy.

The Surgical Oncologist differs from his colleagues in general surgery in several respects. With rapid advances in surgery, radiation, medical oncology, and new disciplines such as immunotherapy and hyperthermia, the Surgical Oncologist is in a critical position to help integrate these approaches to the management of an individual patient.

It is likewise critical that the Surgical Oncologists have special training that makes it possible for him or her to understand these divergent fields and appreciate their potential roles in treatment. The Surgical Oncologist should take the responsibility for training new residents and educating the general surgical staff of their hospitals and medical institutions to better define the concepts and indications of advances in cancer diagnosis and management.

3

PROGRAMME GOAL

At the end of the course the candidate should have acquired knowledge, skills, aptitude and attitude to be able to function as an independent clinician/ consultant and a teacher

PROGRAMME AIMS

The trainee should achieve such knowledge during the training period that he/she after qualification, independently or as a responsible surgical member of an interdisciplinary oncology team is able to:

- Recognize symptoms and signs of cancer
- Make a diagnostic programme for suspected tumours or metastasis and manage as per guidelines.
- Staging and classification of manifest tumours
- Perform prognostic assessment
- Define the role of surgery in a given classified disease reflecting the patient's general condition, including or excluding multimodality approaches in a pretreatment discussion within a multidisciplinary team
- Perform an adequate preoperative work-up
- Perform cancer surgery within his/her specialty with high skill and quality
- Manage postoperative care
- Decide on and perform adequate follow-up
- Implement national guidelines into local practice

- Perform palliative surgical treatment, supportive and terminal care
- Diagnose, score and treat side-effects and complications of surgical treatment
- Assess the impact of surgical interventions on quality of life
- Communicate accurately and adequately to cancer patients and their relatives
- Manage common psychologic reactions to crisis and final stage of life
- Practice medicine in accordance with medical ethics and patient's rights

The surgical oncologist should be specially trained to perform unique and complicated surgical procedures, such as resection of soft tissue sarcomas and total pelvic exenteration, not normally performed by the community-based general surgeon. It is expected that general surgeons will perform most of the standard cancer resections, with more complex and less frequently performed procedures being handled by specialists in surgical oncology.

The surgical oncologist should be involved with clinical and basic science research activities in oncology and should help to organize clinical protocols for the study of cancer patients

Management of each patient's care should be coordinated with medical oncologists, radiation therapists, and other disciplines in the practice of medicine as needed, in order to establish the highest possible standards of care for treatment of cancer

Finally, surgical oncologists must lead fellow surgeons who remain the primary treatment source for most patients with malignant disease. Such leadership includes establishment of protocols for research, convincing colleagues that patients should be entered into clinical trials and other studies, helping to explain the results of such trials, and being critical of ineffective or poorly conceived studies. Thus, the surgical oncologist will both direct and stimulate better investigation and treatment, and also provide a critical viewpoint as new and innovative management approaches come to the clinical arena

CANCER PREVENTION

Surgical oncologists—because of their knowledge of neoplastic disease and because of their recognition of social, occupational, nutritional, and sexual practices that contribute to neoplasia—have a special obligation among physicians to educate the general public, including other professionals with a less intense interest in cancer prevention. Smoking is the principal correctable cancer-inducing activity. Surgical oncologists should counsel patients and families about good nutrition and healthy sexual practices. This is entirely appropriate for conditions known to be associated with a genetic predisposition, but not for all types of cancer.

CLINICAL RESEARCH

No cancer is so well treated that an improvement in outcome or therapeutic approach cannot readily be imagined. Thus, research is imperative. Furthermore, therapies that allow preservation of the involved organ are much to be desired, and investigations that have led, in many patients, to breast preservation, limb salvage, bladder conservation, and avoidance of abdomino-perineal resection are major dividends in the treatment of cancers in these organs. Although in these instances it would appear self-evident, measuring the quality of life is now quantitatively valid and has added a major opportunity to each value judgment. Every established paradigm of medical oncologic management arose from some investigative effort. In many instances, these were one-armed studies that were so successful they became adopted.

Every oncologist's office should be a research station. Every oncologist during his or her training be exposed to, and almost always be a participant in, clinical research. Virtually no regimen or treatment for any tumor is entirely satisfactory. There is much reason to anticipate that progress would be more rapid if clinical research were accepted as an integral part of the practice of medical oncology so that more oncologists and patients would participate than at present. The technology exists in medical informatics for community oncologists to ally themselves with their alma mater or other academic centers to participate in diagnostic, preventive, and therapeutic research trials using the computer, email, and fax as expedient tools. This has the virtue of maintaining greater currency with ongoing investigation. Clinical investigation should serve as the bridge to fundamental science and the excitement in the new molecular biologic understanding of the cancer cell. A set-aside for research, however, constitutes the same imperative commitment as a set-aside for education and updating.

Objectives:

The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time a candidate completes the course. The Objectives may be considered under the subheadings:

- Knowledge
- Skills
- Human values, Ethical practice and Communication abilities

a) Knowledge

- Describe etiology, patho-physiology, principles of diagnosis and management of malignancies including emergencies, in adults and children.

- Demonstrate understanding of basic sciences relevant to this specialty
- Identify socio-economic, environmental and emotional determinants in a given case, and take them into account for planning therapeutic measures.
- Describe indications and methods for blood transfusion and pheresis.
- Recognize conditions that may be outside the area of his specialty/competence and to interact with other disciplines.
- Update oneself by self-study and by attending courses, conferences and seminars relevant to the specialty.
- Teach and guide his team, colleagues and other students.
- Undertake audit.
- Use information technology tools and carry out research, both basic and clinical, with the aim of presenting or publishing his/her work in various scientific forum or journals.

a) Skills

- Take a proper clinical history, examine the patient, perform essential diagnostic procedures and order relevant tests and interpret them to come to a reasonable diagnosis & staging of disease.
- Perform common procedures relevant to the specialty.
- Undertake complete monitoring of the patient.

b) Attitude and Communication Abilities

- Adopt ethical principles in all aspects of his/her practice. Professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- Develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient & breaking of bad news.
- Provide leadership and get the best out of his team in a congenial working atmosphere.
- Apply high moral and ethical standards while carrying out human or animal research.
- Be humble and accept the limitations in his knowledge and skill and to ask for help from colleagues when needed.
- Respect patient's rights and privileges including patient's right to information and right to seek a second opinion

c) Clinical skills and attitudes by

- Demonstration of examination skills in normal subjects & patients by trainer

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- Presenting history, demonstrating clinical findings & use of investigations on ward rounds or tutorial sessions
- Presenting cases for group discussion – grand rounds, PG meetings etc. personal study including the effective use of medical literature, tumor Board of paper or electronically based problem cases
- Observation of consultant trainers managing clinical problems in day-to-day practice
- Observation of consultant trainer communicating with patients and members of team in day-to-day practice
- Clinical teaching: In OPD, ward rounds, emergency, ICU and operation theater
- Bedside clinical training for patient care management and for bedside manners

ELIGIBILITY CRITERIA FOR ADMISSIONS TO THE PROGRAMME

(A) M.Ch Surgical Oncology Course:

1. Any medical graduate with MS/DNB in General Surgery qualification, who has qualified the **Entrance Examination** conducted by NBE and fulfill the eligibility criteria for admission to KLE Academy of Higher Education and Research's **Super Specialty** courses at is eligible to participate in the Centralized counseling for allocation of M.Ch Surgical Oncology seats purely on merit cum choice basis.
2. Admission to 3 years M.Ch Surgical Oncology course post MBBS, MS/DNB General Surgery is only through **Entrance Examination** conducted by NBE and Centralized Merit Based Counseling conducted by the NBE as per prescribed guidelines.

Duration of Course: 3 years

Every candidate admitted to the training program shall pursue a regular course of study (on whole time basis) in the K.A.H.E.R's Jawaharlal Nehru Medical College under the guidance of recognized post graduate teacher for assigned period of the course

TEACHING AND TRAINING ACTIVITIES

The fundamental components of the teaching programme should include:

1. Case presentations & discussion- once a week
2. Seminar – Once a week
3. Journal club- Once a week
4. Grand round presentation (by rotation departments and subspecialties)- once a week
5. Faculty lecture teaching- once a month
6. Clinical Audit-Once a Month
7. A poster and have one oral Paper presentation at least once during their training period in a recognized conference.

The rounds should include bedside sessions, file rounds & documentation of case history and examination, progress notes, round discussions, investigations and management plan & interesting and difficult case discussions.

The training program would focus on knowledge, skills and attitudes (behavior), all essential components of education. It is being divided into theoretical, clinical and practical in all aspects of the delivery of the rehabilitative care, including methodology of research and teaching.

Theoretical: The theoretical knowledge would be imparted to the candidates through discussions, journal clubs, symposia and seminars. The students are exposed to recent advances through discussions in journal clubs. These are considered necessary in view of an inadequate exposure to the subject in the undergraduate curriculum.

Seminar: Trainees would be required to present a minimum of 20 topics based on the curriculum in a period of three years to the combined class of teachers and students. A free discussion would be encouraged in these seminars. The topics of the Seminar would be given to the trainees with the dates for presentation.

Tumor Board: Trainer would present the cases in tumor board & involve activity by discussing the management with evidence.

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Clinical: The trainee would be attached to a faculty member to be able to pick up methods of history taking, examination, prescription writing and management in rehabilitation practice.

Bedside: The trainee would work up cases, learn management of cases by discussion with faculty of the department.

Journal Clubs: This would be a weekly academic exercise. A list of suggested Journals is given towards the end of this document. The candidate would summarize and discuss the scientific article critically. A faculty member will suggest the article and moderate the discussion, with participation by other faculty members and resident doctors. The contributions made by the article in furtherance of the scientific knowledge and limitations, if any, will be highlighted.

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Research: The student would carry out the research project and write a thesis/ dissertation in accordance with K.A.H.E.R guidelines. He/ she would also be given exposure to partake in the

research projects going on in the departments to learn their planning, methodology and execution so as to learn various aspects of research.

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SYLLABUS

A trainee in Surgical Oncology has to become familiar with the basic principles of:

- Surgery
- Radiotherapy
- Chemotherapy
- Endocrine therapy
- Immunotherapy
- Evaluation of the choices of treatments
- Adverse effects with these treatments
- Interactions of these treatment modalities with those of surgery

Part I

Basic Sciences

A broad knowledge is needed to plan optimal treatment for an individual cancer patient throughout the disease course. The trainee in Surgical Oncology must therefore have a knowledge of fundamental biology of cancer including etiology and epidemiology, natural history of malignant diseases, cancer biology as well as tumor immunology.

1. Etiology and epidemiology of malignant diseases

- Genetic Predisposition to Cancer
- Chemical Carcinogenesis
- Hormones and the Etiology of Cancer
- Ionizing Radiation
- Ultraviolet Radiation Carcinogenesis
- Physical Carcinogens
- Trauma and Inflammation
- Tumor Viruses
- Herpes viruses
- Papilloma viruses and Cervical Neoplasia
- Hepatitis Viruses
- Parasites
- Environmental factors in carcinogenesis

2. Prognosis and natural history of malignant diseases

- Mechanisms and patterns in local, regional and distant dissemination of malignant diseases
- Differences in natural history between hereditary and sporadic forms of cancer

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- Diseases predisposing to malignancy e.g. Inflammatory bowel disease or primary sclerosing cholangitis
- Prognostic and predictive factors

- Genetics of hereditary malignant diseases

3. Cancer biology

- Cell kinetics, proliferation, apoptosis and the balance between cell death and cell proliferation
- Angiogenesis and lymphangiogenesis
- Genome maintenance mechanisms to prevent cancer
- Intercellular and intermolecular adhesion mechanisms and signaling pathways
- Potential effects of surgery and surgery-related events on cancer biology (e.g. Angiogenesis)

4. Tumor immunology

- Cellular and humoral components of the immune system
- Regulatory mechanisms of the immune system
- Tumor antigeneity
- Immune-mediated antitumour cytotoxicity
- Effect of cytokines on the tumor
- Effects of the tumor on anti-tumor immune mechanisms
- Potential adverse effects of surgery and surgery-related events (like blood transfusions) on the immunological responses

5. Cancer Screening and Early Detection

- Cancer screening and early detection

6. Basic principles of cancer treatment

A trainee in Surgical Oncology has to become familiar with the basic principles of

- Surgery
- Radiotherapy
- Chemotherapy
- Endocrine therapy
- Immunotherapy
- Evaluation of the choices of treatments
- Adverse effects with these treatments
- Interactions of these treatment modalities with those of surgery

Part II

1. Cancer Epidemiology

- Cancer Epidemiology

2. Cancer Prevention

- Prevention of tobacco-related cancers

- Nutrition in the etiology and prevention of cancer
- Chemo-prevention of cancer
- Cytokinetics
- Drug resistance and its clinical circumvention
- Principles of dose, schedule, and combination
- Chemotherapy
- Regional Chemotherapy
- Animal models in developmental therapeutics
- In vitro and in vivo predictive tests
- Pharmacology
- Toxicology by organ system

3. Chemotherapeutic Agents

- Folate Antagonists
- Pyrimidine and Purine Antimetabolites
- Alkylating Agents and Platinum Antitumor Compounds
- Anthracyclines and DNA Intercalators
- Epipodophyllotoxins / DNA Topoisomerases
- Microtubule – targeting anticancer drugs derived from plants and microbes
- Vinca Alkaloids, Taxanes, and Epothilones, Asparaginase
- Recent Advances/concepts

4. Principles of Endocrine Therapy

- Steroid Hormone Binding and Hormone Receptors
- Hypothalamic and Other Peptide Hormones
- Corticosteroids
- Estrogens and Anti-estrogens
- Clinical use of Aromatase Inhibitors in Breast Carcinoma
- Progestins
- Androgen Deprivation Strategies in the treatment of Advanced Prostate Cancer

5. Principles of Cancer Pathology

- Principles of cancer pathology

6. Principles of Imaging

- Imaging neoplasms of the head and neck and central nervous system
- Imaging neoplasms of the thorax
- Imaging neoplasms of the abdomen and pelvis
- Cross-sectional imaging of musculoskeletal neoplasms

- Imaging the breast
- Ultrasound in cancer medicine
- Radionuclide imaging in cancer medicine
- Perspectives in imaging
- Interventional radiology for the cancer patient

7. Principles of Surgical Oncology

- Principles of Surgical Oncology
- Vascular access in cancer patients

8. Principles of Radiation Oncology

- Physical and biologic basis of Radiation Oncology
- Principles of Hyperthermia
- Photodynamic Therapy for cancer

9. Principles of Medical Oncology

- Principles of Medical Oncology

10. Principles of Biotherapeutics

- Immunostimulants
- Active specific immunotherapy with vaccines
- Interferons
- Cytokines: biology and applications in cancer medicine
- Hematopoietic Growth Factors.
- Monoclonal Serotherapy
- Cancer Gene Therapy
- Hepatitis Viruses
- Parasites

11. Neoplasms of the Thorax

- Cancer of the Lung
- Malignant Mesothelioma
- Thymomas and Thymic Tumors

12. Neoplasms of the Female Reproductive Organs

- Neoplasms of the vulva and vagina
- Neoplasms of the cervix
- Endometrial cancer
- Neoplasms of the fallopian tube

- Ovarian cancer
- Gestational Trophoblastic Disease

13. Neoplasms of the Breast

- Neoplasms of the breast

14. Neoplasms of the Skin

- Neoplasms of the skin

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15. Malignant Melanoma

- Malignant melanoma

16. Neoplasms of the Bone and soft Tissue

- Bone Tumors & Sarcoma of non- osseous tissues

17. Neoplasms of the Hematopoietic System

- Myelodysplastic Syndrome
- Acute Myeloid Leukemia in adults
- Chronic Myeloid Leukemia
- Acute Lymphocytic Leukemia
- Chronic Lymphocytic Leukemia
- Tumors of the heart and great vessels
- Primary germ cell tumors of the Thorax
- Metastatic tumors in the Thorax
- Hairy – Cell Leukemia
- Hodgkin’s Disease
- Non – Hodgkin’s Lymphomas
- Mycosis Fungoides and the Sezary Syndrome
- Plasma cell tumors
- Mast cell Leukemia and other mast cell neoplasms
- Polycythemia vera and essential thrombocythemia

18. Neoplasms of the Alimentary Canal

- Neoplasms of the Esophagus
- Neoplasms of the Stomach
- Primary Neoplasms of the Liver
- Treatment of Liver Metastases
- The Gallbladder
- Diagnosis and Management of Biliary Tract Cancer

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- Neoplasms of the Ampulla of Vater
- Neoplasms of the Exocrine Pancreas
- Neoplasms of the small intestine, vermiform appendix, and peritoneum, colon and rectum & anal canal

19. Neoplasms of the Genitourinary Tract

- Renal Cell Carcinoma
- Neoplasms of the Renal Pelvis and Ureter
- Bladder Cancer
- Neoplasms of the Prostate
- Neoplasms of the Penis
- Neoplasms of the Testis
- Neoplasms in Acquired Immunodeficiency Syndrome

20. Neoplasms of Unknown Primary Site

- Neoplasms of unknown primary site

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21. Neoplasms in Children

- Principles and practice of pediatric oncology

- Incidence, origins, epidemiology
- Principles of pediatric radiation oncology
- Late effects of treatment of cancer in children and adolescents
- Childhood Acute Lymphoblastic Leukemia
- Pediatric Acute Myeloid Leukemia
- Hodgkin's disease in children and adolescents
- Non – Hodgkin's Lymphoma in children
- Langerhan's Cell Histiocytosis
- Hepatic tumors
- Renal tumors of childhood
- Germ cell tumors
- Neuroblastoma
- Soft tissue sarcoma of childhood

22. Complications of Cancer and its Treatment

- Management of cancer pain
- Anorexia and Cachexia
- Antiemetic Therapy
- Neurologic complications
- Dermatologic complications of cancer chemotherapy

- Skeletal complications
- Hematologic complications of cancer
- Blood bank support
- Coagulopathic complications of cancer
- Urologic complications
- Cardiac complications
- Respiratory complications
- Liver function and hepatotoxicity in cancer
- Gastrointestinal complications
- Oral complications
- Gonadal complications
- Endocrine complications
- Secondary cancers : incidence, risk factors, and management

23. Infections in Patients with Cancer

- Infections in patients with cancer

24. Oncologic Emergencies

- Oncologic Emergencies

Other areas in which knowledge is to be acquired:

- Biostatistics, Research Methodology and Clinical Epidemiology
- Ethics
- Medico legal aspects relevant to the discipline
- Health Policy issues as may be applicable to the discipline

Rotation and Posting in Other Departments

Name of Service/dept	Duration
Radiation Oncology	15 days
Medical Oncology	15 days
Surgical Pathology	1 week
Radiology	1 week
Endoscopy	1 week
Observership at premier institute*	1 month

Competencies to Be Acquired by the Candidates

The trainee in Surgical Oncology must achieve knowledge and skills in performing complex cancer operations in her/his specialty. The final aim with surgical training is to develop skills in performing RO (radical) resections, adequate diagnostic procedures, lymph node dissections and meaningful palliative procedures. The numbers of operations are not fixed but should be guidance to what is needed to accomplish relevant skills.

The trainee should have experience in the following procedures:

Breast Unit:

- Modified radical mastectomy
- Radical Mastectomy
- Breast conservation surgery
- wide local excision + axillary clearance
- Lumpectomy - Breast reconstruction

Gastrointestinal unit

- Total radical gastrectomy + reconstruction
- Partial Radical gastrectomy + reconstruction – lower & upper
- Duodenal local excision + reconstruction
- Whipples pancreatic duodenectomy
- Total pancreatico duodenectomy
- Distal pancreatectomy
- Splenectomy
- Segmental small bowel resection with reconstruction
- Right & left hemicolectomy
- Total colectomy
- Extended colectomy
- APR with TME
- Anterior resection
- Hartmann's procedure
- Pelvic exenteration – anterior / posterior / total
- Wide local excision of rectal / anal tumors
- Colostomy
- Ileostomy
- Mesentric tumors excision
- Retro peritoneal tumor excision
- Right & left hepatectomy
- Extended right & left hepatectomy
- Segmentectomy
- Non Anatomical resection
- Excision of extra biliary tumors with reconstruction

Genitourinary Unit

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- Radical Nephrectomy
- Radical cystectomy with reconstruction
- Partial cystectomy
- Radical Prostatectomy
- Pelvic lymphadenectomy
- Ureteric Tumor excision with reconstruction
- RPLND - Radical/High Orchiectomy
- Hemi scrotectomy - Penectomy – Partial/Total
- Inguinal/Ilio-Inguinal lymphadenectomy

Thoracic Oncology Unit

- Pneumonectomy (R) & (L)
- Lobectomy
- Segmental resection
- Non-Anatomical resection
- Hilar lymphadenectomy
- Mediastinal Tumors resection
- Transhiatal Esophagectomy

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- RAO
- Ivor-lewis transthoracic Esophagectomy
- Mckeowns three stage Esophagectomy
- Total Esophagectomy with three field lymphadenectomy

Bone & Soft tissue Oncology

- Amputations/Disarticulation
- Forequarter
- Shoulder Disarticulation
- Above and below elbow Disarticulation
- Above and below elbow Amputation
- Ray Amputation
- Hemipelvectomy
- Hind quarter Amputation
- Extended Hemipelvectomy
- Above/Below Knee Amputation
- Hip disarticulation
- Symes Amputation
- Transmetatarsal Amputation
- Limb conserving procedures
- Wide excision with reconstruction with or without Lymphadenectomy of soft tissue and skin tumors
- Compartmental excision with reconstruction

Head and Neck Oncology

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Head and Neck Oncology

- Tracheostomy
- Neck Dissections
- Radical Neck dissection
- Modified neck dissections
- Selective neck dissections
- Hemi mandibulectomy
- Marginal mandibulectomy
- Alveolectomy
- Total Glossectomy
- Hemi glossectomy
- Composite resections
- Partial Maxillectomy
- Total Maxillectomy
- Orbital tumors
- Enucleation
- Exenteration
- Skull Base surgeries
- Wide field laryngectomy
- Conservative laryngectomy
- Laryngopharyngo Oesophagectomy
- Trchio Esophagal Prosthesis (TEP)
- Superficial parotidectomy
- Radical parotidectomy
- Excision of submandibular gland tumors
- Hemi thyroidectomy
- Total thyroidectomy
- Wide excision & reconstruction of scalp tumor & other skin tumor of Head and Neck

Gynaec Oncology

- Cone excision
- Radical hysterectomy for ca cervix
- Staging laporatomy for ca ovary
- Anterior / Total exenteration

Laparoscopic procedures

- Diagnostic & therapeutic Laparoscopic procedures
- Staging laparoscopy for GI cancer
- Laparoscopic resection of malignant tumours

OTHERS

- Melanoma and sarcoma:
- Excision of melanoma
- Regional node dissection

- Surgery of abdominal sarcomas
- Surgery of trunk and limb sarcomas

The surgical oncologist should be involved with clinical and basic science research activities in oncology and should help to organize clinical protocols for the study of cancer patients. 21 Management of each patient's care should be coordinated with medical oncologists, radiation therapists, and other disciplines in the practice of medicine as needed, in order to establish the

highest possible standards of care for treatment of cancer. Finally, surgical oncologists must lead fellow surgeons who remain the primary treatment source for most patients with malignant disease. Such leadership includes establishment of protocols for research, convincing colleagues that patients should be entered into clinical trials and other studies, helping to explain the results of such trials, and being critical of ineffective or poorly conceived studies. Thus the surgical oncologist will both direct and stimulate better investigation and treatment, and also provide a critical viewpoint as new and innovative management approaches come to the clinical arena.

THESIS PROTOCOL & THESIS

The candidates are required to submit a thesis at the end of three years of training as per the rules and regulations of K.A.H.E.R.

Guidelines for Submission of Thesis Protocol & Thesis by candidates

Research shall form an integral part of the education programme of all candidates registered for M.Ch degrees of K.A.H.E.R.. The Basic aim of requiring the candidates to write a thesis protocol & thesis/dissertation is to familiarize him/her with research methodology. The members of the faculty guiding the thesis/dissertation work for the candidate shall ensure that the subject matter selected for the thesis/dissertation is **feasible, economical and original.**

Guidelines for Thesis Protocol

The protocol for a research proposal (including thesis) is a study plan, designed to describe the background, research question, aim and objectives, and detailed methodology of the study. In other words, the protocol is the ‘operating manual’ to refer to while conducting a particular study.

The candidate should refer to the K.A.H.E.R.Guidelines for preparation and submission of Thesis Protocol before the writing phase commences. The minimum writing requirements are that the language should be clear, concise, precise and consistent without excessive adjectives or adverbs and long sentences. There should not be any redundancy in the presentation.

The development or preparation of the Thesis Protocol by the candidate will help her/him in understanding the ongoing activities in the proposed area of research. Further it helps in creating practical exposure to research and hence it bridges the connectivity between clinical practice and biomedical research. Such research exposure will be helpful in improving problem solving capacity, getting updated with ongoing research and implementing these findings in clinical practice.

Research Ethics: Ethical conduct during the conduct and publication of research is an essential requirement for all candidates and guides, with the primary responsibility of ensuring such conduct being on the thesis guide. Issues like Plagiarism, not maintaining the confidentiality of data, or any other distortion of the research process will be viewed seriously. The readers may refer to standard documents for the purpose.

The K.A.H.E.R. reserves the right to check the submitted protocol for plagiarism, and will reject those having substantial duplication with published literature.

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PROTOCOL REQUIREMENTS

1. All of the following will have to be entered in the online template. The thesis protocol should be restricted to the following word limits.
 - Title : 120 characters (with spacing) page
 - Synopsis [structured] : 250-300
 - Introduction : 300-500
 - Review of literature : 800-1000
 - Aim and Objectives : Up to 200
 - Material and Methods : 1200-1600
 - 10-25 References [ICMJE style]
2. It is mandatory to have ethics committee approval before initiation of the research work. The researcher should submit an appropriate application to the ethics committee in the prescribed format of the ethics committee concerned.

Guidelines for Thesis

1. The proposed study must be approved by the institutional ethics committee and the protocol of thesis should have been approved by K.A.H.E.R.

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2. The thesis should be restricted to the size of 80 pages (maximum). This includes the text, figures, references, annexures, and certificates etc. It should be printed on both sides of the paper; and every page has to be numbered. Do not leave any page blank. To achieve this, following points may be kept in view:
- The thesis should be typed in 1.5 space using Times New Roman/Arial/Garamond size 12 font, 1” margins should be left on all four sides. Major sections viz., Introduction, Review of Literature, Aim & Objectives, Material and Methods, Results, Discussion, References, and Appendices should start from a new page. Study proforma (Case record form), informed consent form, and patient information sheet may be printed in single space.
 - Only contemporary and relevant literature may be reviewed. Restrict the introduction to 2 pages, Review of literature to 10-12 pages, and Discussion to 8-10 pages.
 - The techniques may not be described in detail unless any modification/innovations of the standard techniques are used and reference(s) may be given.
 - Illustrative material may be restricted. It should be printed on paper only. There is no need to paste photographs separately.

3. Since most of the difficulties faced by the residents relate to the work in clinical subject or clinically-oriented laboratory subjects, the following steps are suggested:

a. The number of cases should be such that adequate material, judged from the hospital attendance/records, will be available and the candidate will be able to collect case material within the period of data collection, i.e., around 6-12 months so that he/she is in a position to complete the work within the stipulated time.

b. The aim and objectives of the study should be well defined.

c. As far as possible, only clinical/laboratory data of investigations of patients or such other material easily accessible in the existing facilities should be used for the study.

d. Technical assistance, wherever necessary, may be provided by the department concerned. The resident of one specialty taking up some problem related to some other specialty should have some basic knowledge about the subject and he/she should be able to perform the investigations independently, wherever some specialized laboratory investigations are required a co-guide may be co-opted from the concerned investigative department, the quantum of laboratory work to be carried out by the candidate should be decided by the guide & co-guide by mutual consultation.

4. The clinical residents are not ordinarily expected to undertake experimental work or clinical work involving new techniques, not hitherto perfected OR the use of chemicals or radioisotopes not readily available. They should; however, be free to enlarge the scope of their studies or undertake experimental work on their own initiative but all such studies should be feasible within the existing facilities.

5. The M.Ch residents should be able to freely use the surgical pathology/autopsy data if it is restricted to diagnosis only, if however, detailed historic data are required the resident will have to study the cases himself with the help of the guide/co-guide. The same will apply in case of clinical data.

6. Statistical methods used for analysis should be described specifically for each objective, and name of the statistical program used mentioned.

General Layout of a M. Ch Thesis:

- **Title-** A good title should be brief, clear, and focus on the central theme of the topic; it should avoid abbreviations. The Title should effectively summarize the proposed research and should contain the PICO elements.

- **Introduction-** It should be focused on the research question and should be directly relevant to the objectives of your study.
- **Review of Literature -** The Review should include a description of the most relevant and recent studies published on the subject.
- **Aim and Objectives -** The ‘Aim’ refers to what would be broadly achieved by this study or how this study would address a bigger question / issue. The ‘Objectives’ of the research stem from the research question formulated and should at least include participants, intervention, evaluation, design.
- **Material and Methods-** This section should include the following 10 elements: Study setting (area), Study duration; Study design (descriptive, case-control, cohort, diagnostic accuracy, experimental (randomized/nonrandomized)); Study sample (inclusion/exclusion criteria, method of selection), Intervention, if any, Data collection, Outcome measures (primary and secondary), Sample size, Data management and Statistical analysis, and Ethical issues (Ethical clearance, Informed consent, trial registration).
- **Results-** Results should be organized in readily identifiable sections having correct analysis of data and presented in appropriate charts, tables, graphs and diagram etc.
- **Discussion**–It should start by summarizing the results for primary and secondary objectives in text form (without giving data). This should be followed by a comparison of your results on the outcome variables (both primary and secondary) with those of earlier research studies.
- **Summary and Conclusion-** This should be a précis of the findings of the thesis, arranged in four paragraphs: (a) background and objectives; (b) methods; (c) results; and (d) conclusions. The conclusions should strictly pertain to the findings of the thesis and not outside its domain.
- **References-** Relevant References should be cited in the text of the protocol (in superscripts).
- **Appendices -**The tools used for data collection such as questionnaire, interview schedules, observation checklists, informed consent form (ICF), and participant information sheet (PIS) should be attached as appendices. Do not attach the master chart

Thesis Protocol Submission to K.A.H.E.R.

1. M.Ch candidates are required to submit their thesis protocol within 90 days of their joining M.Ch training.
2. Enclosures to be submitted along with protocol submission form:
 - a) Form for Thesis Protocol Submission properly filled.
 - b) Thesis Protocol duly signed.
 - c) Approval letter of institutional Ethical committee. (Mandatory, non-receivable of any one is liable for rejection)

Thesis Submission to KAHER Deemed to be University

1. As per K.A.H.E.R. norms, writing a thesis is essential for all M. Ch candidates towards partial fulfillment of eligibility for award of M. Ch degree.
2. M. Ch candidates are required to submit the thesis before the cut-off date
3. Candidates who fail to submit their thesis by the prescribed cutoff date shall NOT be allowed to appear in M.Ch final examination.
4. Thesis should be bound and the front cover page should be printed in the standard format. A bound thesis should be accompanied with:
 - a. A Synopsis of thesis.
 - b. Form for submission of thesis, duly completed
5. A declaration of thesis work being bonafide in nature and done by the candidate himself/herself at the institute of M. Ch training need to be submitted bound with thesis. It must be signed by the candidate himself/herself, the thesis guide and head of the institution, failing which thesis shall not be considered.

LOG BOOK

A candidate shall maintain a log book of operations (assisted / performed) during the training period, certified by the concerned post graduate teacher / Head of the department / senior consultant.

This log book shall be made available to the board of examiners for their perusal at the time of the final examination.

The log book should show evidence that the before mentioned subjects were covered (with dates and the name of teacher(s)) The candidate will maintain the record of all academic activities undertaken by him/her in log book .

1. Personal profile of the candidate
2. Educational qualification/Professional data
3. Record of case histories
4. Procedures learnt
5. Record of case Demonstration/Presentations
6. Every candidate, at the time of practical examination, will be required to produce performance record (log book) containing details of the work done by him/her during the entire period of training as per requirements of the log book. It should be duly certified by the supervisor as work done by the candidate and countersigned by the administrative Head of the Institution.
7. In the absence of production of log book, the result will not be declared.

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EXAMINATION

INTERNAL ASSESSMENT

Internal assessment includes various formal and informal assessment procedures by which evaluation of student's learning, comprehension, and academic progress is done by the teachers/faculty to improve student attainment. The goal of the Internal Examination is to collect information which can be used to improve the student learning process.

Internal assessment is essentially positive in intent, directed towards promoting learning; it is therefore part of teaching.

Yearly internal assessment will be conducted at the end of 1st and 2nd year and final internal assessment 2 months before final examination.

Each examination will consist of theory examination of 100 marks.

The performance of the resident during the training period should be monitored throughout the course

and duly recorded in the log books as evidence of the ability and daily work of the student

1. Personal attributes:

- **Behavior and Emotional Stability:** Dependable, disciplined, dedicated, stable in emergency situations, shows positive approach.
- **Motivation and Initiative:** Takes on responsibility, innovative, enterprising, does not shirk duties or leave any work pending.
- **Honesty and Integrity:** Truthful, admits mistakes, does not cook up information, has ethical conduct, exhibits good moral values, loyal to the institution.

• **Interpersonal Skills and Leadership Quality:** Has compassionate attitude towards patients and attendants, gets on well with colleagues and paramedical staff, is respectful to seniors, has good communication skills.

2. Clinical Work:

- **Availability:** Punctual, available continuously on duty, responds promptly on calls and takes proper permission for leave.
- **Diligence:** Dedicated, hardworking, does not shirk duties, leaves no work pending, does not sit idle, competent in clinical case work up and management.
- **Academic ability:** Intelligent, shows sound knowledge and skills, participates adequately in academic activities, and performs well in oral presentation and departmental tests.
- **Clinical Performance:** Proficient in clinical presentations and case discussion during rounds and OPD work up. Preparing Documents of the case history/examination and progress notes in the file (daily notes, round discussion, investigations and management) Skill of performing bed side procedures and handling emergencies.

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3. Academic Activity: Performance during presentation at Journal club/ Seminar/ Case discussion/Stat meeting and other academic sessions. Proficiency in skills as mentioned in job responsibilities.

FINAL EXAMINATION

Candidates will be allowed to appear for examination only if attendance(minimum 80%) and internal assessment are satisfactory and research and publication work is satisfactory

The examination shall consist of the following parts:

- 1) Theory
- 2) Clinical Examination and viva-voce

A) Theory Examination-400 Marks

The theory examination shall consist of four papers of hundred marks each and of three hours duration. Each paper will have 10 questions of 10 marks each

Paper I: Basic sciences as applied to Surgical Oncology

Paper II: Principles and practice of Surgical Oncology

Paper III: Specialities in Surgical Oncology

Paper IV: Operative Surgical Oncology and Recent Advances in Surgical Oncology

Note- The distribution of topics may overlap or change

B) Practical/Clinical Examination:

Type of case	No. of cases	Marks
Long case	1	100
Short cases	2	100 (50x2)
Ward Rounds	2	100 (50x2)

C) Viva Voce: 100 marks

All examiners will conduct viva-voce jointly on candidates' comprehension, analytical approach, expression and interpretation of data. It will include all components of course content.

Student knowledge on the use of instruments and drugs will also be evaluated

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D) Distribution of Marks

Theory- 400

Practical- 300

Viva Voce- 100

Grand Total – 800

E) Passing Criterion

To pass the examination, the candidate must secure 50% of the marks in theory and practical examination separately.

F) Declaration of M. Ch Final Results

1. M.Ch final is a qualifying examination.
2. Results of M.Ch final examinations (theory & practical) are declared as PASS/FAIL.
3. M.Ch degree is awarded to a M.Ch trainee in the convocation of KAHER.

Principles of Oncology

- Molecular Diagnosis of Cancer, Cotter.F.E
- Molecular Biology for Oncologist, Yarnold.J.R. et al
- Cancer Chemotherapy Handbook, Baquiran Delia
- The Lymphomas, Canellos.G.P.et al
- Chemotherapy Source Book, Perry.M.C
- Leukemia, Henderson. E.S.et al
- Cancer Medicine, Holland. J .F.et al
- Atlas of Clinical Haematology, Begemann
- Text book of Malignant Haematology, Degos.L et al
- Clinical Oncology, Abeloff et Al
- Important Advances in Oncology, Devita,V.T
- Cancer Principle And Practice Of Oncology, Devita,V.T. et al
- Decision Making in Oncology Evidence Based Management, Djulbegovic .B and Sullivan.
- AJCC Cancer Staging Manual (Americal Joint Committee on Cancer)
- Cancer Treatment, Halnane.E
- Cancer Treatment , Haske.L
- Oncology for Palliative Medicine, Hoskin Peter And Wendy
- Regional Therapy of Advanced Cancer, Rubin.J.T
- The non Hodgkin's Lymphoma, Magrath.I.
- Comprehensive Text book of Oncology, Vol 1-2,Mossa, A.R
- Oxford textbook of Oncology Peckham. M et al
- Atlas of Diagnostic oncology, Skarin.A.T
- Basic Science of Oncology,TannockK,E.I
- Glenn's Thoracic and Cardiovascular Surgery, Baue.A.E et al

Anesthesiology

- Pharmacology and Physiology in Anesthetic Practice, Stoelting .R.K
- Anesthesiology: Problem – Oriented Patient Management, Yao .F.S.F.

Head & Neck Oncology

- Essentials of Head & Neck Oncology, Close.I.G.
- Head & Neck cancer: A Multidisciplinary approach, Harrison L.B.
- Complication in Head & Neck Surgery, Ossoff.R.H
- An Atlas of Head & Neck, Lore.J.M.
- Management of Head & Neck Cancer: Multidisciplinary Approach, Million .C.R.
- Color Atlas of Head & Neck Surgery Face, Skull & Neck , Shah.J.P
- Color Atlas of Operative Technology in Head and Neck Surgery, Parotid.

- Soft Tissue and Reconstructive Surgery. Shah.J.P
- Surgery of Cancer of the Larynx and Related Structures, Silver E.E.
- Multimodality Therapy for Head and Neck Cancer, Snoks.G.B
- Comprehensive Management of Head and Neck tumors, Thawley.S.E et.al
- Basal & Squamous Cell Skin Cancer of the Head and Neck , Weber.R.G.et.al

GI Oncology

- AJCC Cancer Staging Manual (Americal Joint Committee on Cancer)
- Cancer of the Colon, Rectum and Anus, Cohen, A.M
- Atlas of Surgical Oncology, Daly.J.M And Cady.B

- Comprehensive Text Book of Thoracic Oncology, Aisner J, et al
- Minimal Access Surgery in Oncology, Geraghty, J.G. et al
- Bailey & Love's Short Practice of Surgery, Manral, C.V. Russel R.C.G
- Surgical Emergencies, Monson .J. et al
- Gastric Cancer, Nishi.M
- Atlas of Esophageal Surgery, Skinner D.B.
- Gastric Cancer, Sugimori. T & Sasaki.M.
- Colorectal Cancer, Williams.N.S
- Prevention and Early Detection of Colorectal Cancer, Young.G.P. et.al
- Maingot's Abdominal Operations, Zinner M.J.

Uro Oncology

- Campbell's Urology, Walsh. et.al
- Cancer of the Prostate, Das.S & Crawford ,E.D
- Prostate Cancer, Ernstoff,M.S.et al
- Minimal Access Surgery in Oncology, Geraghty,J.G.et al
- Clinical Management of Bladder Cancer, Hall,R,R 1999
- Testicular Cancer: Investigation and Management, Horwich. A
- Superficial Bladder Cancer, Pagano.F. et al
- Carcinoma of the Kidney, Testis and Rare Urologic Malignancies, Petrovic H .Z. et al
- Urological Oncology Waxmanj, J. Williams

Bone and soft tissue sarcoma

- Soft Tissue Tumours, Harms D & Beattie, E.J
- Cancer Surgery, Harvey,J.C and Beattie,E.J
- Bone Tumor: Diagnosis, Treatment and Prognosis, Huvos. Andrew G
- Reconstruction and Plastic Surgery: Grab's Encyclopedia of flaps.
- Soft Tissue, Weiss.S.W. & Brooks J.S.J.

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Breast

- Breast Cancer, Roses.D.F
- Breast Cancer, Singlets .D.E
- Surgery of the Breast: Principles and Art, Spear.S.L. et al.
- Breast: Comprehensive Management of Benign and Malignant Disorders, Bland

Gynecologic oncology

- Practical Gynaecologic Oncology, Berekj & Hacker .W.F
- Gynecological oncology : Guide to Clinical Management, Blake Peter et.al
- Gynaecologic Oncology: Fundamental Principles & Clinical Practice, Coplegon. M
- Principles and Practice of Gynecologic Oncology, Hosking W.J et al.
- Ovarian Cancer : Controversies in Management, Gershenson .D.M & Mcguire.W.P
- Essentials of Gynaecologic Cancer, Lakiton.F et al
- Epithelial Cancer of the Ovary, Lawton. Frank. G. et.al
- Hand Book of Colposcopy, Luesely. D. et.al

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- Cancer and Pre-Cancer Of The Cervix, Luesley.D.M & Barrass.R
- Gynaecologic Cancer Surgery, Morrow.C.P et.al
- Synopsis of Gynecologic Oncology , Morroki.C.P & Curtun.J.P
- Multimodality Therapy in Gynecologic Oncology, Sevin .B.U. et al
- Ovarian Cancer, Sharp.F. et.al
- Cancer of the Cervix, Shingleton H.M & Orr.J.W

Pediatric oncology

- Color Atlas of Pediatric Hematology .Hann. I.M
- Manual of Pediatric Hematology and Oncology .Lanzkowsky Philip.
- Principles & Practice of Pediatric Oncology. Pizzo.P.A & Popla CK
- Pediatric Surgical Oncology, Andrassu, R.J
- Surgery of Childhood Tumours, Carachi. R. et al

Optional Reading

- The most cited articles on each of the 7 disease sites are listed on the website of SSO and the students may use this as an additional resource with the lead publications in each disease site within Surgical Oncology <http://www.surgonc.org/disease-sites>

Journals

- Annals of Surgical Oncology
- American Journal of Pediatrics
- Acta Oncologica
- Hematology / Oncology
- British Journal of Cancer
- Cancer
- CA.A.Cancer Journal For Clinicians
- Cancer Detection & Prevention
- Cancer Genetics and Cytogenetics
- Cancer Journal (Scientific American) (NP)
- Cancer Survey (NP)
- Cancer Treatment Review
- Clinical Oncology
- Current Problem In Cancer
- Current Opinion In Oncology
- European Journal of Surgical Oncology
- European Journal of Surgical Oncology
- Genes, Chromosomes And Cancer
- Gynecologic Oncology
- Hematological Oncology
- Hematology Oncology Clinics of North America
- Indian Journal of Cancer (Indian)
- International Journal of Cancer (UICC)
- International Journal of Gynecological Cancer
- International Journal of Radiation Oncology
- Journal of Cancer Education (NP)
- Journal of Clinical Oncology
- Journal of National Cancer Institute (Gift)
- Journal of Psycho Social Oncology

- Journal of Surgical Oncology
- Medical & Pediatric Oncology
- Nutrition and Cancer
- Oncology (NP)
- Psycho-Oncology
- Radiotherapy & Oncology
- Seminars In Oncology
- Seminars In Oncology Nursing
- Seminars In Radiation Oncology
- Seminars In Surgical Oncology
- Surgical Oncology Clinics of North America

**COMPETENCY BASED
POSTGRADUATE TRAINING
PROGRAMME FOR
MD IN PHYSIOLOGY**

Preamble

The purpose of postgraduate medical education in Physiology is to produce experts with necessary knowledge, skills and attitude to function as competent physiologists who actively contribute towards growth of the subject through research and intellectual contribution, participate in the training of budding health professionals, participate meaningfully in patient care and lifestyle disorders, stay abreast with the advancements in the field and serve the community at large. Physiology being the basis of entire practice of Medicine, a postgraduate in Physiology needs to acquire all necessary competencies that would enable him or her to function efficiently in domains of preclinical, para- clinical and clinical sciences.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes. The Expert group of the National Medical Commission has endeavored to render uniformity without compromise to purpose and content of this document. The revision within the document are mainly aimed to introduce competencies that ensure application of Physiology beyond preclinical boundaries and thereby improve health outcomes, embrace research and pedagogy as a vital part of training and reduce redundancy of contents. This document envisions a competent Physiologist who performs the roles of a Medical Teacher, Researcher, Member of Health Care Team (Clinical Physiologist), Administrator and Life Long learner with equal zeal and efficiency.

SUBJECT SPECIFIC LEARNING OBJECTIVES

Focus and Goal

The goal is to have uniform standards in the teaching of Physiology at the postgraduate level throughout the country. The guidelines will help in achieving such standards which will ensure availability of competent physiologists equipped with required skills for teaching, patient care (diagnostic, therapeutic and rehabilitative) and applied research.

The focus and goal of post-graduate medical education shall be to produce competent specialist and medical teachers recognised by the fraternity as the graduating scholars, building upon their undergraduate education and skills who shall –

- i. Recognise the health needs of the community and carry out professional obligations ethically keeping in view the objectives of the national health policy;
 - ii. Have mastered most of the competencies, pertaining to the respective speciality, that is required to be practised at the secondary and the tertiary levels of the health care delivery system;
 - iii. Be aware of the contemporary advancements and developments in the respective discipline concerned and shall progress accordingly;
 - iv. Have acquired a spirit of scientific inquiry and is oriented to the principles of research methodology and epidemiology;
 - v. Have acquired the basic skills in the teaching of medical and paramedical professionals;
 - vi. Acquire basic management skills in human resources, materials and resource management related to health care delivery, general hospital management, principal inventory skills and counselling;
 - vii. Develop personal characteristics and attitudes required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals;
 - viii. Become an exemplary citizen by observing the highest standards of professional ethics and working towards fulfilling social and professional obligations to respond to national aspirations.
- The institutions imparting post-graduate medical education shall continually work to synchronize the institutional goals with the national goals to produce the kind of trained manpower with high knowledge, appropriate skills and impeccable ethical standards required.

Learning Objectives

A postgraduate student having qualified for the MD (Physiology) examination should be able to:

1. Achieve comprehensive knowledge of general, systemic and applied Physiology.
2. Teach effectively the basic physiological mechanisms of human body in the context of pathophysiological basis of evolution, clinical presentation and management of disease states to undergraduate and postgraduate medical, dental and paramedical courses.
3. Acquire in-depth knowledge of physiology while catering to the learning needs of specific courses such as sports physiology, speech pathology etc.
4. Understand general principles of medical education (use of appropriate teaching techniques and resources) and apply theoretical frameworks in pedagogy.
5. Interpret and evaluate research publications critically.
6. Conduct research in core physiology, applied physiology and Education which may have significant application towards improving health, patient care and student learning.
7. Generate credible evidence towards advancement of Physiology and its application in basic and applied significance.
8. Acquire skills in conducting collaborative research in the field of physiology with allied sciences, clinical sciences and biomedical engineering.
9. Explain how the knowledge of physiology can be effectively applied in diagnostic and therapeutic clinical settings.
10. Integrate physiology with Diagnostic, Therapeutic, Preventive and Rehabilitative Medicine.
11. Interact with the allied departments and render services in advanced laboratory investigations.
12. Interact effectively with other paraclinical, clinical and allied health sciences departments to develop integrated modules in basic sciences and teach

competencies related to the same.

13. Acquire administrative skills to set up concerned department / laboratories and initiate purchase procedures and procure necessary items for running such laboratories.
14. Be an efficient Leader and member of academic, research and health care team.
15. Participate actively in various workshops/seminars/journal clubs of allied subjects to acquire various skills for collaborative research.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the postgraduate student should be able to:

A. Predominant in Cognitive Domain

1. Demonstrate in-depth understanding of basic physiological concepts, their clinical applications and physiological demands in special circumstances such as sports, environmental changes, yoga, meditation etc.
2. Demonstrate comprehensive knowledge of physiology of specific organ systems to cater to the learning needs of specialized courses such as speech pathology, kinesiology, aerospace physiology etc.
3. Impart knowledge about the basic physiological mechanisms of human body with reference to their implications in the pathophysiology of disease and the physiologic basis of their management to undergraduate medical and paramedical students.
4. Demonstrate knowledge of integrated study of basic sciences as per the needs of current CBME.
5. Demonstrate higher order thinking and problem-solving skills to exhibit interactive teaching techniques and facilitate contextual study of physiology in various teaching learning sessions.
6. Demonstrate knowledge and ability to participate in the present student centric TL strategies of CBME such as ECE, SDL, AETCOM and AITo (Aligned and Integrated Topic).

7. Demonstrate knowledge of the current assessment practices in undergraduate CBME such as DOAP.
8. Demonstrate knowledge of research methodologies and statistics.
9. Conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.
10. Incubate ideas and contribute towards generation of patents and copyrights related to the subject.
11. Interact with other departments by rendering services in advanced laboratory investigations and relevant expert opinion.
12. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.
13. Contribute to society by imparting physiological understanding of health problems. Disseminate knowledge of human physiology, the clinical applications and research as per the needs or specific demands of the society at large.
14. Outline the components of a basic physiology curriculum, demonstrate ability to develop or implement the same in future academic career.
15. Serve as interface with society at large.

B Predominant in Affective domain

At the end of the course, the postgraduate student should be able to:

1. Demonstrate responsibility, professionalism and ethical conduct in all professional undertakings.
2. Demonstrate ethical conduct in biomedical or animal research.
3. Follow ethical guidelines with regards to research and publications.
4. Demonstrate appropriate behavior of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.

5. Display principles of integrity and social accountability as a teacher.
6. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (Equity and social accountability).
7. Mentor/ counsel students to facilitate their holistic development.
8. Communicate effectively with peers, students and teachers in various curricular [teaching-learning, research] activities.
9. Function effectively as a member of the department, professional bodies and maintain professional conduct in interactions with students, peers, patient and staff.
10. Demonstrate the ability to give effective student feedback to undergraduate students.
11. Demonstrate the ability to receive feedback from teachers and peers.
12. Develop the capacity to reflect on own academic progress, develop self- directed learning skills and assess own learning needs.

C. Predominant in Psychomotor Domain

The postgraduate student should acquire practical competencies in the following tasks:

At the end of the course the postgraduate student should be able to

1. Demonstrate physiological concepts of various organ systems by performing amphibian experiments using simulated models
2. Demonstrate physiological concepts of specific organ systems by performing mammalian experiments using simulated models.
3. Perform and interpret a complete hematological profile
4. Perform clinical examination of various organ systems
5. Perform human experiments pertaining to specific organ systems and interpret results of the same
6. Perform human experiments related to physiological challenges such as exercise, yoga and meditation
7. Perform studies in stimulated environment - microgravity; high altitude; hot and cold environment.

Syllabus

Course contents:

A: Cognitive domain

Paper-I: *General and Cellular Physiology including Genetic Basis and Historical perspectives:*

1. Physiology of cell, various cellular mechanisms and genetic control mechanisms.
2. Various principles of Physics and Physical Chemistry involved in physiological phenomenon e.g. haemo-dynamics, bio-electrical potentials, body fluids, methods of measurements.
3. History of Physiology, Noebl laurates and discoveries.
4. Biostatistics, Biophysics, Biochemistry, Micro-anatomy.
5. Growth and Development including aging.

6. Excretion, pH, water and electrolyte balance.
7. Comparative Animal Physiology

Paper-II: *Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology.*

1. Blood and Immunity.
2. Cardiovascular System.
3. Respiratory System.
4. Gastro- Intestinal Tract (GIT) and dietary requirements.

Paper-III: *Systemic Physiology (system concerned with procreation, regulation and neural control)*

1. Nerve-Muscle Physiology including muscle mechanics
2. Endocrine Physiology
3. Nervous System (Central, peripheral and autonomic)
4. Special Senses
5. Reproduction & family planning/fetal & neonatal Physiology

Paper-IV: *Applied Physiology including recent advances*

1. Recent advances relevant to Physiology
2. Patho-physiology pertaining to systemic Physiology
3. Physiological basis of various clinical investigation tests

4. Interaction of human body in ambient environment- high altitude, space and deep sea
5. Exercise & Sports physiology
6. Transgender Physiology
7. Integrated Physiology
8. Yoga and Meditation
9. Social responsibilities of physiologists
10. Application of Artificial Intelligence in Physiology

B: Psychomotor domain:

A. The postgraduate student during the training period must PERFORM independently the following procedures:

i. Hematological profile

1. Estimation of hemoglobin
2. Determination of Total Erythrocyte (RBC) Count and RBC Indices (Blood Standards)
3. Determination of Total Leucocytes (WBC) Count : TLC
4. Preparation of a peripheral Blood Smear and Determination of Differential Leucocyte Count: DLC
5. Determination of Arneith Count
6. Determination of Bleeding Time (BT) and Clotting Time (CT)
7. Determination of Blood groups (A, B,O and Rh system)
8. Determination of Erythrocyte Sedimentation Rate (ESR) and Packed cell volume (PCV)
9. Determination of Osmotic Fragility of Red Blood Cells
10. Determination of Platelet Count
11. Determination of Reticulocyte Count

ii. Human Physiology

a. Clinical Physiology

1. Detailed clinical examination of various systems.

b. Nerve muscle physiology

1. Ergography and hand grip spring dynamography and study of human fatigue.
2. Recording of electromyography (EMG) and its application.
3. Recording of nerve conduction.

c. Cardiovascular system (CVS)

1. Clinical examination of CVS
2. Examination of arterial & venous pulses
3. Measurements of arterial blood pressure and effect of head-up/head-down tilt
4. Recording of 12 lead Electrocardiography (ECG) and its interpretation
5. Measurement of blood flow
6. Heart rate variability
7. Ambulatory Blood pressure monitoring

d. Respiratory system

1. Clinical examination of respiratory system.
2. Stethography – study of respiratory movements and effect of various factors.
3. Assessment of respiratory functions (spirometry, vitalography, and gas analysis).
5. Measurement of BMR.
6. Cardio pulmonary resuscitation (CPR) and Artificial respiration.

e. Gastrointestinal system:

1. Clinical examination of abdomen.

f. Integrative Physiology / Excretory system

1. Recording of body temperature/effect of exposure to cold and hot environment

g. Reproductive system

1. Determination of ovulation time by basal body temperature chart and pregnancy diagnostic test - Immunological Tests.
2. Semen analysis: sperm count, motility and sperm morphology.

h. Nervous System including Special senses

1. Clinical examination of the nervous system and its physiological basis.
2. Examination of higher mental functions.
3. Examination of cranial nerves.
4. Examination of sensory system.
5. Examination of motor system including reflexes.
6. Clinical examination of special senses:
 - (i) Smell and Taste
 - (ii) Test for hearing to differentiate deafness
 - (iii) Physiology of eye:
 - (a) Clinical examination of the eye and pupillary reflex
 - (b) Visual acuity
 - (c) Perimetry – mapping out of visual field and blind spot
 - (d) Accommodation
 - (e) Fundoscopy
 - (f) Colour vision and colour blindness
7. Reaction (visual and auditory) and reflex time.
8. Electroencephalography (EEG) and Polysomnography
9. Autonomic Nervous System (ANS) Testing.
10. **Neuro-electrodiagnostic techniques:** Nerve conduction study, Visual evoked potential (VEP), Brainstem auditory evoked potential (B.A.E.P), Somato-sensory evoked potential (SEP), Motor evoked potential (MEP).
11. Use of various test batteries for psychological evaluation of subject.

i. Sports Physiology

Tests for physical fitness: Cardio – respiratory responses to steady state exercise using:

- (i) Body Composition
- (ii) Conducting the Clinical Exercise Test
- (iii) Harvard step test
- (iv) Bicycle Ergometry
- (v) Treadmill test for determination of VO_2 max

j. Yoga and Meditation Physiology

- i. Physical, Mental and Emotional well being
- ii. Effect of yoga and pranayama on physiological parameters
- iii. Mindfulness
- iv. Concentration, anxiety and stress
- v. Counseling in health and diseases

k. Others

1. Construction of dietary chart for growing children, pregnant woman, elderly individuals, hypertensive patients, & diabetes mellitus patients.
2. Basic Life Support and Cardiac Life Support
3. Effective Digital presentation, medical photography, Good Clinical Practice, Humanities and Bioethics.

iii. Amphibian (Frog) Experiments

All animal experiments must be compliant with Government of India Regulations, notified from time to time). Experiments in Amphibian/Dog/Cat should be conducted by computer assisted simulation models/ facilities. Other experiments should be performed as permissible by CPCSEA guidelines.

Effect of temperature on simple muscle twitch.

1. Effect of two successive stimuli (of same strength) on skeletal muscle.
2. Effect of increasing strength of stimuli on skeletal muscle.
3. Effect of increasing frequency of stimuli on skeletal muscle (genesis of tetanus).

4. Effect of free load and after load on skeletal muscle.
5. Effect of repeated stimuli on skeletal muscle (study of phenomenon of Fatigue).
6. Study of isometric contraction in skeletal muscle.
7. Determination of conduction velocity of sciatic nerve and effect of variables on it.
8. Properties of cardiac muscle – Refractory period, All-or-None Law, extra-systole and compensatory pause, beneficial effect.
9. Regulation of Heart, Vagus dissection and effect of Vagal and WCL stimulation.
10. Effect of physiological and pharmacological variables on intact frog's heart.
11. Perfusion of isolated frog's heart-role of sodium, potassium, calcium ions and drugs.

B. The postgraduate student during the training period must ASSIST in the following procedures:

Human Physiology

i. Cardiovascular system (CVS)

- Cardiac TMT Holter Monitoring
- Collection and Assessment of Arterial blood gas

ii. Nervous System including Special senses

- Intra operative neuro monitoring (IONM)

C. The postgraduate student during the training period must OBSERVE the following procedures:

i. Hematological profile

- Determination of Absolute Eosinophil Count

- Study of Haemopoietic Cells present in the Bone Marrow
- Other high end hematological investigations (specify): Flow cytometry, Platelet functions, D Dimers, coagulation profile etc.

ii. Human Physiology

➤ **Cardiovascular system (CVS)**

- Echocardiography
- Central venous line insertion, CVP monitoring

➤ **Respiratory system**

- Introduction to working of continuous positive airway pressure and Bilevel positive airway pressure (CPAP & BiPAP) Therapy
 - Ventilator setting

➤ **Gastrointestinal system:**

- GI Manometry

➤ **Reproductive system**

- Ovulation study by using ultrasonography

➤ **Integrative Physiology / Excretory system**

- Pressure and PH studies in esophagus, stomach, intestine and rectum

➤ **Others**

- Genetic testing and introduction to procedural skills for clinical genetics/ prenatal diagnosis/ adult genetics - birth defects, genetic hematology, dysmorphology, skeletal dysplasia, neurological and muscular disorders, primary immunodeficiency diseases, autoimmune and multi-factorial disorders, biology and genetics of cancer.
- Interaction of human body in ambient environment - high altitude, space and deep sea
- Exercise & Sports physiology
- Integrated Physiology
- Yoga and Meditation
- Social responsibilities of physiologists

- Application of Artificial Intelligence in Physiology

iii. Mammalian Experiments (Dog/Rabbit/Guinea pig/Rat/Mice)

- General management of mammalian experiments.
- Recording of heart rate, blood pressure and respiration and study the effects of various factors; drugs; asphyxia; occlusion of common carotid artery.
- Effect of stimulation of central and peripheral end of vagus on arterial blood pressure and respiration after vagotomy.
- Effect of stimulation and distension of carotid sinus on blood pressure and respiration.
- Effect of stimulation of splanchnic nerve.
- Effect of stimulation of peripheral somatic nerve (sciatic nerve).
- Study of hypovolemic shock and its reversal.
- Perfusion of isolated mammalian heart and study the effects of drugs and ions.
- Recording of Isolated Intestinal movement and tone and studying the effect of drugs and ions.
- Study of various stages of menstrual cycle, cervical smear and vaginal smear.

Departmental resources

1. Clinical Neurophysiology Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

- (i) Electroencephalography
- (ii) Evoked potential recording
- (iii) Electromyography
- (iv) Nerve conduction studies
- (v) Autonomic nervous system (ANS) testing

- (vi) Any other newer technology like Functional Near infrared spectroscopy (fNIRS), Intra operative neuro monitoring (IONM), polysomnography
- (vii) Diabetic neuropathy assessment kit
- (viii) Reaction time apparatus
- (ix) Electroretinography

2. Cardio-Respiratory Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

- (i) Electrocardiography
- (ii) Blood-gas Analysis
- (iii) Computerized multifunctional spirometry
- (iv) Laboratory for measuring pulmonary diffusion capacity and functional residual capacity (FRC)
- (v) Whole-body plethysmography
- (vi) Laboratory for Blood flow measurements (Impedance plethysmograph/Laser flow meter/ Doppler flow meter)
- (vii) Ankle brachial pressure index/ Vascular Doppler

3. Exercise Physiology Laboratory

The department should generate liaison with sports authorities and clinical departments to provide services for testing and grading exercise and physical efficiency for health monitoring and diagnostics (disease). This should be done by using the following techniques:

- (i) Two step test exerciser
- (ii) Bicycle Ergometry
- (iii) Tread mill
- (iv) Respiratory gas analysis and measurement of basal metabolic rate (BMR)

4. Metabolic/Endocrinology/Reproductive Bio-medicine laboratory

This laboratory should perform various tests pertaining to gastrointestinal, renal, metabolic, endocrinal and reproductive bio-medicine. The department should generate liaison with clinical departments and provide routine services for health monitoring and diagnostics (disease).

1. Body Fat Analysis
2. Spectrophotometer
3. pH meter
4. Elisa Reader/Washer
5. Luminometer
6. Semi-autoanalyzer
7. Artificial reproductive techniques/ semen laboratory/ infertility laboratory

Post graduate students should be posted in the above laboratories and extend the required services on routine basis.

TEACHING AND LEARNING METHODS

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skills oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training

activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a log book for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used.

A. Lectures: Didactic lectures should be used sparingly. A minimum of 10 lectures per year in the concerned PG department is suggested. Topics to be selected as per subject requirements All postgraduate trainees will be required to attend these lectures. Lectures can cover topics such as:

1. Subject related important topics as per specialty requirement
2. Recent advances
3. Research methodology and biostatistics
4. **Salient features of** Undergraduate/Postgraduate medical curriculum
5. Teaching and assessment methodology.

(Topic numbers 3, 4, 5 can be done during research methodology/biostatistics and medical education workshops in the institute.)

B. Journal club: Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar: Minimum of once every 1-2 weeks is suggested.

Important topics should be selected as per subject requirements and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work / Bedside clinics: Minimum - once every 1-2 weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department should participate in moderating the teaching- learning sessions during clinical rounds.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest or clinical cases.

G. a. Rotational clinical / community / institutional postings

- Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions including Medical Education Unit (MEU) or Department of Medical Education (DOME). The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based Guidelines.
- **Clinical Postings:** Compulsory clinical postings in following departments must be undertaken as per specified number of days in table 1 depicted below:

Table 1: Plan of Clinical postings for MD Physiology

Prof Year	Department	Period of posting	Focus areas
1 st year	Biochemistry	15 days	<ol style="list-style-type: none"> 1. Auto & Semi auto Analyzer, Electrophoresis, Chromatography, RIA, Study of serum chemistry (proteins, Lipid, glucose, electrolytes, enzymes etc.) – 8 days 2. Constituents of normal and abnormal urine, liver function tests, Renal function tests, Gastric function tests – 7 days
I st year	Pharmacology	20 days	<ol style="list-style-type: none"> 1. Animal House (to learn technique of Animal Handling, Blood sampling, anesthesia, Euthanasia, effective Analgesia and infection control after

			<ol style="list-style-type: none"> surgery. Study of Animal behavior like eating, drinking, locomotion, sexual activity etc.) 2. Experimental Pharmacology lab to study ongoing animal experimental procedures including dissection for rat phrenic nerve hemidiaphragm and others – 10 days 2. Study various guidelines related to ethical use of animals in experiments. To study preparation of different animal models and various tests to study physiological parameters. – 15 days
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I st year	Pathology	30 days	<p>1. Blood bank - Cross matching, blood Storage, Immunohistochemistry, Immunological tests – 15 days</p> <p>2. Central Lab. - Tests for bleeding & clotting disorders, study of Haemopoietic Cells present in the Bone Marrow – 10 days</p> <p>3. Semen analysis, determination of ovulation time by basal body temperature chart and pregnancy diagnostic tests – 5 days</p>
I st year	Microbiology	10 days	<p>1. Fluorescent microscopy, use of Elisa reader & Washer – 5 days</p> <p>2. Immuno-physiology and other facilities available in the dept. – 5 days</p>
II nd year	Ophthalmology	15 days	<p>1. Direct and indirect Ophthalmoscopy, Retinoscopy – 8 days</p> <p>2. Slit lamp microscopy, Tonometry, Pachymetry, Study of corneal topology, Optometry, Auto-refractometer – 7 days</p>
II nd year	Tuberculosis & Chest Disease (Pulmonary Medicine)	15 days	<p>1. Whole body plethysmography – 8 days</p> <p>2. Bronchoscopy & other facilities available in the dept. – 7 days</p>
II nd year	ENT	15 days	<p>1. Audiometry – 7 days</p>

			<p>2. Oto-rhino-laryngoscopy, direct and Indirect Laryngoscopy, BERA, BSAEP – 8 days</p>
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III rd year	General Medicine	20 days	1. TMT, Holter analysis, ABG, ECG – 10 days 2. EMG, NCV – 10 days
III rd year	Psychiatry	10 days	1. EEG 2. Biofeedback
III rd year	Casualty	15 Days	1. To know basics of how to handle emergency 2. Minor procedures

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

G b. Posting under DISTRICT RESIDENCY PROGRAMME (DRP)

- **Preamble: Doctors have to be trained in diverse settings including those which are close to the community. Hence, they should be trained in the District Health System / the District Hospitals.**

Provided that in respect of M.D./M.S. students admitted with effect from academic session 2021, the training imparted as part of the District Residency Programme, shall be considered as training imparted in a medical institution.

- **District Residency Programme:** All post-graduate students pursuing M.D./M.S. in broad specialties in all **medical colleges/institutions under the purview of the National Medical Commission shall undergo a compulsory residential rotation of three months in District Hospitals/ District Health System as a part of the course curriculum. Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduate programme.** In the case of those students who have taken admission after completion of the Diploma in the relevant Speciality, the District Residency Programme shall take place in the third semester only. Similarly, the post-graduate diploma students shall undergo the District Residency

Programme in the third semester. This rotation shall be termed as 'District Residency Programme' (DRP) and the post-graduate medical student undergoing training shall be termed as a 'District Resident'.

- **Training during DRP and Certification thereof:**

- Quality of training shall be monitored by log books, supportive supervision, and continuous assessment of performance.** The attendance and performance of District Residents shall be tracked by the District Residency Programme Coordinator (DRPC) of the district concerned, as well as the parent Medical College through an appropriate electronic/digital or mobile enabled system. Such monitoring systems shall also be accessible to the State/Union Territory Steering Committee and the National Coordination Cell.
- The District Residents would remain in contact with their designated post-graduate teachers and departments at their parent Medical College / Institution by phone and e-communication for guidance, learning, and for being able to participate remotely in scheduled case discussions, seminars, journal clubs, thesis discussion, etc. and other academic activities.
- Satisfactory completion of the District Residency shall be an essential condition before the candidate is allowed to appear in the final examination of the respective post-graduate course.
- The District Residency Programme Coordinator (DRPC) shall issue certificate of satisfactory completion of DRP and report on the performance of the District Resident on a prescribed format to be decided by the PGMEB to the concerned medical college and the Govt. of the State/UT.

Opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with specialists / clinicians in different hospital settings must be scheduled to address antimicrobial resistance issues and strategies to deal with it.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the

department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

I. Training in teaching skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

J. Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in Wards, OPDs, Casualty and other areas of posting (as specified in table 1) . This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The log book is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the Log Book is to:

- a) help maintain a record of the work done during training,
- b) enable Faculty/Consultants to have direct information about the work done and intervene, if necessary,
- c) provide feedback and assess the progress of learning with experience gained periodically.
- d) The Log Book should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical

examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in log book particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the MCI Logbook Guidelines uploaded on the Website.

K. Course in Research Methodology

- a. All post-graduate students shall complete an online course in Research Methodology.
- b. The students shall have to register on the portal of the designated training institutions.
- c. The students are expected to **complete the course in the first year.**
- d. **The online certificate generated on successful completion of the course and examination thereafter, will be acceptable evidence of having completed this course.**
- e. The above certification shall be a mandatory requirement to be eligible to appear for the final examination of the respective post-graduate course.
- f. This requirement shall be applicable for all post-graduate students.

L. Course in Ethics

- a. All post-graduate students **shall complete course in ethics including Good Clinical Practices and Good Laboratory Practices, whichever is relevant to them, to be conducted by institutions/Universities.**
- b. The students are expected to complete the course in the first year.
- c. No post-graduate student shall be permitted to appear in the examination without the above certification.

M. Course in Cardiac Life Support Skills

- a. All post-graduate students shall complete a course in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS) skills to be conducted by the institution.
- b. The students are expected to complete the course in the first year.

c. No post-graduate student shall be permitted to appear in the examination without the above certification.

N. Other aspects

- The postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department shall encourage e-learning activities.
- The postgraduate trainees must undergo training in information technology and use of computers.

During the training program, patient safety is of paramount importance; therefore, relevant clinical skills are to be learnt initially on the models, later to be performed under supervision followed by independent performance.

ASSESSMENT

FORMATIVE ASSESSMENT, i.e. assessment to improve learning Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

The Internal Assessment should be conducted in theory and practical/clinical examination, should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

Quarterly assessment during the MD training should be based on:

- Case presentation, case work up,
case handling/management : once a week
- Laboratory performance : twice a week
- Journal club : once a week
- Seminar : once a fortnight
- Case discussions : once a fortnight/month
- Interdepartmental case or seminar : once a month

Note: These sessions may be organized and recorded as an institutional activity for all postgraduates.

- Attendance at Scientific meetings, CME programs (at least 02 each)

SUMMATIVE ASSESSMENT, ie., assessment at the end of training

Essential pre-requisites for appearing for examination include:

1. **Log book** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.
2. At least **two presentations** at national level conference. One research paper should be published / accepted in an indexed journal. (**Local or University Review committee assess the work sent for publication**).

The summative examination would be carried out as per the Rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. The theory

examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination.

The postgraduate examination shall be in three parts:

1. Thesis

Thesis shall be submitted at least six months before the Theory and Clinical /

Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A postgraduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory examination

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify postgraduate student's level of knowledge, skill and competence at the end of the training, as given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D./ M.S shall be held at the end of 3rd academic year.

There shall be four theory papers (as per PG Regulations).

Paper I: Basic sciences as applied to the subject (General and Cellular Physiology including Genetic basis and historical perspectives)

Paper II: Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology

Paper III: Systemic Physiology (system concerned with regulation, neural control and procreation)

Paper IV: Recent advances in the subject (including applied Physiology)

3. Practical/clinical and Oral/viva voce examination

Practical examination

Practical examination should be spread over **two** days and include various major components of the syllabus focusing mainly on the psychomotor domain.

Oral/Viva voce examination on defined areas should be conducted by each examiner **separately**. Oral examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

The practical examination should include:

- Case presentation pertaining to major systems
- Stations for clinical, procedural and communication skills
- Log Book Records and reports of day-to-day observation during the training
- It is emphasized that Oral/viva voce examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject

S.No.	Description	M.S./M.D./M.Ch./DM Courses
1	THEORY	
	No. of Theory Papers	4
	Marks for each Theory Paper	100
	Total marks for Theory Paper	400
	Passing Minimum for Theory	200/400 (40% minimum in each paper)
2	PRACTICAL/CLINICAL	300
3	VIVA VOCE	100
	Passing minimum for Practical/Clinical including Viva voce	200/400
	<p>The candidate shall secure not less than 50% marks in each head of passing which shall include</p> <p>(1) Theory – aggregate 50% (In addition, in each Theory paper a candidate has to secure minimum of 40%)</p> <p>(2) Practical/Clinical and Viva voce - aggregate 50%</p> <p>(3) If any candidate fails even under one head, he/she has to re-appear for both Theory and Practical/Clinical and Viva voce examination.</p> <p>(4) Five per cent of mark of total marks of Clinical/Practical and Viva Voce marks (20 marks) will be of dissertation/thesis and it will be part of clinical/practical examination marks. External examiner outside the state will evaluate dissertation/ thesis and take viva voce on it and marks will be given on quality of dissertation/thesis and performance on its viva voce.</p> <p>(5) No grace mark is permitted in post-graduate examination either for theory or for practical.</p>	

Recommended Reading:

Books (latest edition)

1. A.C. Guyton – Text book of Medical Physiology
2. W.F. Ganong – Review of Medical Physiology
3. William's Textbook of Endocrinology
4. J.E. Cotes- Respiratory Physiology
5. D.T. Harris – Experimental Physiology
6. Wintrobe's – Clinical Hematology
7. Principles of medical physiology by Sircar
8. Brown B.L. – Cell signaling, Biology and medicine of signal transduction

9. Berne and Levy- Medical Physiology

10. Textbook of Medicine by Harrison
11. Principles of Neural sciences edited by E. R. Kandel, J. H. Schwartz and T. M. Jessell
12. Williams Hematology edi. by M.A. Lichtman, E. Beutler, K. Kaushansky, T.J. Kipps, U. Seligsohn, J. Prchal
13. Medical Physiology: by W. F. Boron and E. L. Boulpaep
14. Medical Physiology: by A. Rhodes and G. A. Tanner
15. Neuroscience : by Dale Purves

Practical Books:

1. Hutchison's Clinical Methods: An Integrated Approach to Clinical Practice.
2. Macleod's clinical Examination
3. Textbook of Practical Physiology: by Dr. G. K. Pal and Dr. Pravati Pal
4. Textbook of Practical Physiology: by Dr. C. L. Ghai
5. Textbook of Practical Physiology: by Dr. Ranade
6. Textbook of Practical Physiology: by Dr. A. K. Jain

Journals:

03-05 International Journals and 02 National (all indexed) journals

Ordinance Governing B.Sc. Medical Laboratory Technology Degree Course (Semester System) Syllabus/Curriculum 2023-24



Accredited 'A+' Grade by NAAC (3rd Cycle) Placed
in 'A' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research

(Deemed-to-be-University)

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No. F.9 -19/2000-U.3 (A)]

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth. To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

Notification

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B.SC. MEDICAL LABORATORY TECHNOLOGY

PREAMBLE

The B.Sc. Medical laboratory Technology Course is of **3 years (6 semesters)** and **1 Year internship** duration aimed at training students in the laboratory aspects of medical care with a good scientific foundation. These students will be in a position to competently assist in the Biochemistry, Pathology, Microbiology laboratories & Blood bank in all types of Health care delivery systems. Along with the basic knowledge and advanced training in the latest technologies in laboratories and Blood bank, these graduates will play an important role in determining the quality of health care provided.

OBJECTIVE

The objective is to impart the basic knowledge & technical skills of Biochemistry, Pathology, Microbiology & Blood Bank and its application in the health care delivery system.

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – Medical Laboratory Technology Course shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

OR

- 4) Pre university vocational course from an approved Board with laboratory technology as vocational subject.

- 5) **Lateral Entry:** Candidates with three years diploma in Medical Laboratory Technology (DMLT) after 10 years of schooling or candidates with 2 years diploma in Medical Laboratory Technology (DMLT) after the second year Pre-University Examination with Physics, Chemistry and Biology as principal subjects. DMLT should be obtained from a recognized Government Board.

II. DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory Rotatory internship.

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Biochemistry III	60 + 20 + 20	Biochemistry III	80 + 20
		Haematology and Cytogenetics	60 + 20 + 20	Haematology and Cytogenetics	80 + 20
		Bacteriology	60 + 20 + 20	Bacteriology	80 + 20
4.	4th Semester	Analytic Biochemistry & Clinical Biochemistry	60 + 20 + 20	Analytic Biochemistry & Clinical Biochemistry I	80 + 20
		Histopathology	60 + 20 + 20	Histopathology	80 + 20
		Virology	60 + 20 + 20	Virology	80 + 20

Third Year					
5.	5th Semester	Clinical Biochemistry II	60 + 20 + 20	Clinical Biochemistry II	80 + 20
		Cytology	60 + 20 + 20	Cytology	80 + 20
		Parasitology and Mycology	60 + 20 + 20	Parasitology and Mycology	80 + 20
6.	6th Semester	Clinical Biochemistry VI	60 + 20 + 20	Clinical Biochemistry VI	80 + 20
		Blood Banking and Automation	60 + 20 + 20	Blood Banking and Automation	80 + 20
		Clinical Microbiology VI	60 + 20 + 20	Clinical Microbiology VI	80 + 20
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Automation in Biochemistry	
		2. Automation in Haematology	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits} \times \text{grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: $\text{Total No. of SGPA} / \text{No. of Semester}$

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BMLS01	Human Anatomy	02		02
2	BMLS02(A)	Human Physiology	02		02
	BMLS02(B)	Basics of Biochemistry	02		02
3	BMLS03(A)	Pathology : Basic Hematology	02		02
	BMLS03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	BMLS04	Human Anatomy		02	02
6	BMLS05 (A)	Human Physiology		02	02
	BMLS05(B)	Basics of Biochemistry		02	02
7	BMLS06(A)	Pathology : Basic Hematology		02	02
	BMLS06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BMLS01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BMLS02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	BMLS03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BMLS04	Practical 1	Human Anatomy	80 + 20	100
6	BMLS05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BMLS06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester I

PAPER 1: BMLS01 Human Anatomy

Theory 30 Hours

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation

Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief

Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: BMLS01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: BMLS04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of **different parts of Brain & Spinal Cord**

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: BMLS02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions
Classification of Body fluid compartments & composition, Homeostasis
Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis
Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - BMLS05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: BMLS02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: BMLS05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks

40 Marks

IA Marks:

10 Marks

Grand Total

50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata- 700009 (India)

Semester I

PAPER 3 - BMLS03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: BMLS06 Section A – Haematology

Practical 30 Hours

Basic Haematology

- Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- PCV
- Blood Indices**
- Preparation of blood smears and staining with Leishman stain
- WBC Total Count
- WBC -Differential Count
- Platelet Count
- Reticulocyte Count
- Absolute Eosinophil Count
- ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- BMLS03 Section B – Microbiology

Theory 30 Hours

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.

- **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methods
- Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
- **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: BMLS06
Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes

- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman

2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur

- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BMLS07	Anatomy	02		02
2	BMLS08(A)	Physiology	02		02
	BMLS08(B)	Biochemistry	02		02
3	BMLS09(A)	Hematology & Clinical Pathology	02		02
	BMLS09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02

5	BMLS10	Human Anatomy		02	02
6	BMLS11(A)	Human Physiology		02	02
	BMLS11(B)	Basics of Biochemistry		02	02
7	BMLS12 (A)	Hematology & Clinical Pathology		02	02
	BMLS12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	BMLS07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BMLS08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	BMLS09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50

		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	Elective Subject: Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BMLS10	Practical 1	Human Anatomy	80 + 20	100
6	BMLS11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BMLS12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - BMLS07 **Human Anatomy**

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.
 Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
 Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy
 Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - BMLS10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks

Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore

4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – BMLS08 **Section A - Physiology**

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – BMLS11
Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: BMLS08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: BMLS11

Practical : 30 Hours

Basics of Biochemistry II

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New

			Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: BMLS09

Theory : 30 Hours

Section A - Haematology & Clinical Pathology**Hematology**

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:**Reference books (Latest Edition)**

Sl · N o.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10 ·	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: BMLS12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid

10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

a. General Physical Examination

10 marks

b. Microscopy

10 marks

c. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: BMLS09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr.C.P.Baveja.

PRACTICAL 3: BMLS12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

1. **Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices),
Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
2. **Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
3. **Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
4. **Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
5. **Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
6. **Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
7. **Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
8. **Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
9. *Introduction to installation of different software and introduction about different software related to MLS.*

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
 - Youth development programmes at the National level, State level and voluntary sector
- Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking

- Self Confidence and Self esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BMLS13	Biochemistry III	02			02
2	BMLS14	Haematology and Cytogenetics	02			02
3	BMLS15	Bacteriology	02			02
4	AECC01	AECC: Environmental Sciences	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	BMLS16	Biochemistry III		02	02	04
7	BMLS17	Haematology and Cytogenetics		02	02	04
8	BMLS18	Bacteriology		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit 2-hour Clinical Posting per week for 15 weeks = 1 credit						

THIRD SEMESTER**Scheme of Examination**

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BMLS13	Paper 1	Biochemistry III	60 + 20 + 20	100
2	BMLS14	Paper 2	Haematology and Cytogenetics	60 + 20 + 20	100
3	BMLS15	Paper 3	Bacteriology	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BMLS16	Practical 1	Biochemistry III	80 + 20	100
6	BMLS17	Practical 2	Haematology and Cytogenetics	80 + 20	100
7	BMLS18	Practical 3	Bacteriology	80 + 20	100
Grand Total					300

SEMESTER III

BIOCHEMISTRY

PAPER 1: BMLS13 Biochemistry III

Theory 30 Hours

1. Metabolism of carbohydrates

a. Brief on glycolysis, TCA cycle and gluconeogenesis (Only Definition and importance)

- a. Glycogen Metabolism
- b. Minor metabolic pathways-HMP (hexose monophosphate) Shunt pathway, Galactose and fructose Metabolism.
- d. Regulation of Blood glucose
- e. Diabetes mellitus: **Definition, ADA classification, causes and clinical manifestations**
- f. OGTT (oral glucose tolerance test), **mini GTT, glycated Hemoglobin, DYPSI and diabetic profile.**

2. Metabolism of lipids

- a. beta oxidation of fatty acids
- b. ketone body metabolism.
- c. **Cholesterol synthesis and its derivatives**
- d. lipoproteins and its clinical significance.
- e. **NCEP –ATP guidelines for lipid profile**

3. Metabolism of amino acids

a. Metabolism of aromatic amino acids and inborn errors associated with it.

4. Plasma proteins

- a. Classification, functions & importance.
- b. Plasma protein electrophoresis: normal and abnormal pattern

5. Enzymes- Diagnostic and therapeutic application of enzymes

6. Hemoglobin:

- a. Structure of Hemoglobin and its derivatives
- b. hemoglobinopathies (only sickle cell anemia and thalassemia).
- c. Catabolism of Heme

7. Separation techniques

- a. Chromatography: Principle, types & applications,
- b. Centrifuge: **Principle, types & applications,**
- c. Electrophoresis, salting in and salting out and other precipitation techniques of protein.

8. Standardization and Calibration

a. Development of SOP

b. Introduction to Standardization and Calibration terms

9. Electron transport chain system: Biological oxidation, high energy compounds and electron transport chain.

**PRACTICAL 1: BMLS16
Biochemistry III**

Practical 30 Hours

1. Calibration of digital balance, pH meter and micropipette
2. Estimation of Total protein by biuret method, albumin by dye-binding method and A/G ratio
3. Estimation of serum bilirubin by Malloy Evelyn method.
4. Precipitation reactions of proteins
5. Electrophoresis separation of plasma proteins (demonstration)
6. Case reports-Jaundice, OGTT and Lipoproteins
7. Estimation of blood Glucose
8. Estimation of Blood Urea
9. Estimation of serum Cholesterol, HDL-C, TAG by kit method and LDL-C by calculation

**SCHEME OF EXAMINATION –
Semester III**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative estimation and case reports	1	1 x 40 1X5	45 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Precipitation reactions of proteins	1	1 x 35	35 Marks

Practical
I A Marks
Grand Total

80 Marks
20Marks
100 Marks

SEMESTER - III
PATHOLOGY

PAPER 2: BMLS14

Theory 30 Hours

HAEMATOLOGY AND CYTOGENETICS

1. Hemostasis and its disorders
 - a. Thrombopoiesis
 - b. Mechanism of hemostasis
 - c. Coagulation pathway
 - d. Thrombocytopenia – ITP
 - e. Thrombocytosis
 - f. Hemophilia
 - g. Disseminated Intravascular Coagulation
2. Investigation of Haemorrhagic Disorders
 - a. Mechanism of coagulation.
 - b. Collection and anticoagulants used in coagulation studies
 - c. Bleeding time and clotting time
 - d. Other coagulation studies PT, PTI, INR and APTT
 - e. Assay of clotting factors
3. Test for blood fibrinolytic activity and detection of FDP.
4. Platelet function tests, Platelet count
5. Automation in haematology

CYTOGENETICS

1. Human genetics; an introduction to the subject
2. Terminology, classifications and nomenclature of human Chromosomes
3. Methods for Karyotypic analysis Culture of bone marrow, peripheral blood lymphocytes, solid tumours, skin fibroblast, etc.
4. Characterisation of human chromosomes by various banding techniques.
5. Sex chromatin identification.
6. Karyotyping and analysis of chromosomal abnormalities
7. Common chromosomal aberrations in cancer.

PRACTICAL 2: BMLS17

Practical : 30 Hours

HAEMATOLOGY AND CYTOGENETICS

1. Bleeding time
2. Clotting time
3. Platelet count
4. PT
5. APTT
6. Charts: histogram of 3 part 5 part cell counters
7. Sex chromatin identification in cytology & peripheral smear – Demonstration

Spotters:

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Calcium chloride

THEORY ASSESMENT

Type of questions and distribution of marks for Theory examination in each subject for Third semester

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2.	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESSMENT

Scheme of Practical Examination for Third Semester.

Sr. no	Theory	Practical	IA	Grand Total
1	Practical	80	20	100

Pathology Practicals

- 80 marks

1	Perform APTT	20 Marks
2	Perform Prothrombin Time	20 Marks
3	Perform Platelet Count	20 Marks
4	Interpret the given chart & answer the questions & Write the procedure	20 Marks
5	Internal Assessment	20 Marks
	Grand Total	-100 marks

RECREOMMENDED TEXT BOOKS

Sl. No.	Reference of Books	Author's	Publisher Name, Place
1.	Text Book of Medical Laboratory Technology	ParfulGodkar	Bhalani Publication House, Mumbai
2.	Todd and Sanford, clinical Diagnosis and Management by laboratory Method's	John Bernard Henry	All India Traveller Book Seller, Delhi
3.	Practical Pathology	Dr. Ganga Pilli	Prabhu Publications, Dharwad
4.	Essentials in Hematology & clinical Pathology	Dr. Ramdas Nayak Dr. Sharada Rai	Jaypee Brother's Medical Publisher's Limited
5.	De Gnichy's clinical Hematology	Editors- Frank Firkin, C. Chesterman, P David, R Bryan	Oxford Univ. press

Semester III

MICROBIOLOGY

PAPER 3 : BMLS15 BACTERIOLOGY:

Theory 30 Hours

- **Systemic Bacteriology** –
 - a. Gram Positive Cocci – Staphylococci, Streptococci and Pneumococci
 - b. Gram Negative Cocci – *N.gonorrhoeae*, *N.meningitidis*.
 - c. Gram Positive Bacilli – Corynebacterium, Clostridium
 - d. Gram Negative Bacilli - Enterobacteriaceae
 - e. Mycobacteria: *M.tuberculosis*, *M. leprae*
 - f. Other Gram Negative Bacteria- a) Haemophilus, b) Brucella
 - g. Anaerobic Bacteria -Bacteroides
 - h. Spirochetes- Treponema Pallidum
- **Nosocomial Infection** : a) Introduction, sources and types of nosocomial infections. b) Bacteriological surveillance of hospital environment. c) Role of microbiology laboratory in control of nosocomial infections

Suggested Readings:

- 1) Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo

2) Textbook of Microbiology for MLT. Second Edition. Dr. C.P. Baveja.

PRACTICAL 3 : BMLS18 BACTERIOLOGY

Practical :30 Hours

- Media preparation, pouring and inoculation
- Biochemical tests for identification of organisms
- Processing of following clinical samples for culture and identification of pathogens:
 - a. Blood
 - b. Throat swab
 - c. Sputum
 - d. Pus
 - e. Urine
 - f. Stool
 - g. C.S.F. and other body fluids
- Methods of disposal of bacterial cultures.

Suggested Readings:

Practical Microbiology, Fourth Edition. C.P Baveja.

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination for Third Semester for Subject Code BMLS04:

- 1) Spotters -20 marks
- 2) Media pouring - 20 marks
- 3) Inoculation -20 marks
- 4) Interpretation of biochemical reactions -20 marks

Sr. no	Theory	Practical	IA	Grand Total
1	Practical	80	20	100

AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.

- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets
river/forest/grassland/hill/mountain

- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

B. Field Work: 20 Marks

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

ELS03

Theory: 30 Hours

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
- Uses and application of bio-statistics in public health research and medical sciences.
- Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
- Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
- Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
- Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.

- Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.

Basic Probability : Concept of probability, its terminology and different types of definition

Laws of probability: addition law, multiplication law and conditional probability.

Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BMLS19	Analytic Biochemistry & Clinical Biochemistry I	02			02
2	BMLS20	Histopathology	02			02
3	BMLS21	Virology	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	BMLS22	Analytic Biochemistry & Clinical Biochemistry I		02	02	04
7	BMLS23	Histopathology		02	02	04
8	BMLS24	Virology		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks = 1 credit, 2-hour Practical per week for 15 weeks = 1 credit 2-hour Clinical Posting per week for 15 weeks = 1 credit						

FOURTH SEMESTER

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BMLS19	Paper 1	Analytic Biochemistry & Clinical Biochemistry I	60 + 20 + 20	100
2	BMLS20	Paper 2	Histopathology	60 + 20 + 20	100
3	BMLS21	Paper 3	Virology	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	BMLS22	Practical 1	Analytic Biochemistry & Clinical Biochemistry I	80 + 20	100
7	BMLS23	Practical 2	Histopathology	80 + 20	100
8	BMLS24	Practical 3	Virology	80 + 20	100
Grand Total					300

SEMESTER IV
BIOCHEMISTRY

PAPER 1: BMLS19

Theory 30 Hours

ANALYTIC BIOCHEMISTRY & CLINICAL BIOCHEMISTRY I

1. **Photometry, Spectrophotometry**- Principles, instrumentation, Standardization and its application.
2. **Flame photometry and atomic absorption spectrophotometer** - Principle and application
3. **Electrochemistry -: Principle and applications - Ion Selective electrode**
4. **Acid base balance:** blood buffering systems, Henderson-hasselbach Equation, respiratory and renal regulation of blood pH. Disorders of acid base balance.
5. **Water and electrolyte balance:** Water electrolyte balance, basic principles and estimation of Electrolytes. Disorders of water and electrolyte balance.
6. **Organ function tests**
 - a. Liver function tests and their assessment.
 - b. Renal function tests and their assessment
 - c. Thyroid function tests and their assessment
7. Introduction to Quality control and quality assurance in a clinical biochemistry laboratory: Definition and examples of sensitivity, specificity, accuracy and precision and Laboratory errors.
8. **Laboratory management:** Laboratory organization, management and maintenance of record and Introduction to Laboratory statistics.
9. **Principles of assay procedures for:** - Normal range in blood, Serum, Plasma and Urine and reference values for: Glucose, Proteins, Albumin, Urea , Uric acid, Creatinine, Bilirubin ,Lipids, AST,ALT, ALP, T3, T4 and TSH.
10. **Point of care testing:** Definition, instrumentation, biochemical parameters of POCT, clinical applications

PRACTICAL 4: BMLS22

Practicals-30 Hours

ANALYTIC BIOCHEMISTRY & CLINICAL BIOCHEMISTRY I

1. Enzyme; Determination of Alkaline phosphatase, alanine transaminase (ALT), aspartate transaminase (AST), Amylase
2. Chromatographic separation of amino acids
3. Estimation of urinary and serum creatinine
4. Analysis of normal abnormal urine
5. Case reports-
 - a. Liver function tests
 - b. Renal function tests.
 - c. Cardiac markers.
- a. Demonstration of plotting of standard curve for creatinine
6. To demonstrate the principle, working & maintenance of spectrophotometer and colorimeter.
7. To demonstrate the principle, working & maintenance of Ion selective electrode
8. To demonstrate the principle & demonstration of TLC.

9. To demonstrate the principle & procedure of Electrophoresis.

10. Visit to High-tech laboratory of KLE's Dr. Prabhakar Kore Hospital and Medical Research Centre Belagavi and Basic Science Research Centre

SCHEME OF EXAMINATION

Theory Total- 100 Marks

Duration: 3 Hours

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative estimation and case reports	1	1 x 40 1x5	45 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of normal/abnormal urine	1	1 x 35	35 Marks

Practical Marks	80 Marks
IA Marks:	20 Marks
Grand Total	100 Marks

SEMESTER IV PATHOLOGY

PAPER 2: BMLS20 HISTOPATHOLOGY

Theory 30 Hours

1. Introduction to histopathology:

- a. Receiving Specimens in Laboratory
- b. Grossing techniques
- c. Various fixatives - Mode of action, Indications, Preparation , Basic concepts of fixation, Various types of fixatives used in a routine histopathology laboratory, Simple fixatives, Compound fixatives and Special fixatives for demonstration of various tissue elements
- d. Decalcification of calcified tissue before sectioning
- e. Processing of tissues for routine paraffin sections and other methods of embedding.

2. Laboratory organization

- a. Reception of specimen, dispatch of reports, “Records keeping” coding the lesions of cases.
- b. Follow up programme, quality control of techniques etc.

3. Instrumentation

- a) Tissue Processor, b) Knife sharpener, c) Automatic slide stainer, d) Microtome,
e) Knives f) Freezing Microtome; Cryostat, g) Instruments for grossing h) Electric saw.

4. Frozen Section Techniques: Co2 Freezing, Cryostat and freezing microtome

- #### **5. Processing of various tissues for histological examination:** Embedding – Definition, Various types of embedding media, Procedure followed by Dehydration, Clearing, Infiltration and routine timing schedule for manual or automatic tissue processing, Components & principles of various types of automatic tissue processors

- #### **6. Techniques and principles of sections cutting and routine staining (H&E) and special stains** -Theory of Staining, Classifications of Dyes, Principles of Dye Chemistry, Stains and Dyes and their uses, Types of Stains, Chemical Staining Action, Mordants and Accentuators, Metachromasy, Use of Controls in Staining Procedures, Equipment and Procedure for manual Staining and Automatic Staining Technique, Mounting of Cover Slips, Labeling and Cataloguing the Slides.

- #### **7. Mounting** - Techniques, various mounting media.

- #### **8.** Uses of various types of microscopes and polarisers

- #### **9.** Maintenance of records and filing of slides familiarization with computer.

- #### **10.** Museum Technology – Preservation.

II. IMMUNO - HISTOCHEMISTRY

1. Introduction

2. Basic concepts of immunochemistry

3. Monoclonal antibodies and their preparations

4. Fluorescence reactions

5. PAP Technique - principle, preparation of reagents and Procedure.

**PRACTICAL 2: BMLS23
HISTOPATHOLOGY**

Practical: 30 hours

1. Staining techniques – H & E
2. Special stains used in histopathology:
 - P.A.S
 - VG
 - Reticulin
 - MTS.
 - Alcian blue
3. Mounting block on microtome
4. Trimming & Block cutting
5. Embedding
6. Homing & stropping - Demo
7. Mounting the stained slides
8. Instruments used in Histopathology – Grossing instruments

Spotters:

Sl. No	SPOTTERS
1.	Grossing instrument - Saw
2.	Hot plate
3.	Microtome Blade
4.	DPX
5.	Paraffin Block
6.	Rotary Microtome
7.	Wedge Knife
8.	Carborandum Stone
9.	Stropping Leather
10.	Eosin
11.	Xylene
12.	Block Holder
13.	Haematoxyline
14.	Tissue Cassette
15.	L Block
16.	Scalpel

17.	Cover slip
18.	Formalin
19.	Alcohol
20.	Glass Slide
21.	Water Bath
22.	Petri dish

THEORY ASSESSMENT

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination for Third Semester.

Sr. no	Theory	Practical	IA	Grand Total
1	Practical	80	20	100

Maximum Marks

80 Marks

I. Spotters - Histopathology & Clinical Pathology

– 20 marks

II. H&E Staining

– 20 marks

III. Perform and Write Procedure for any one special stain

– 20 marks

PAS / MTS

IV. Histopathology techniques (any Two

- 20 marks

Block Cutting

Mounting

Stropping/ Honing

Embedding

Mounting block on Microtome

Trimming of Block

Internal Assessment

- 20 marks

Grand Total

- 100 marks

RECOMMENDED TEXT BOOKS

Sl. No.	Reference of Books	Author's	Publisher Name, Place
1.	Text Book of Medical Laboratory Technology	PrafulGodkar	Bhalani Publication House Mumbai
2.	Theory and Practice of Histological Techniques	J.D. Bancroft et al	Churchill livingstone, printed in china.
3.	Hand Book of Histopathological&Histo Chemical Techniques	C.F.A Culling	Butterworth's company ltd London
4.	Laboratory Techniques in Surgical Pathology	Dr.ShameemShariff	Prism Book Pvt. Ltd. Bangaluru
5.	Practical Pathology	Dr. Ganga Pilli	Prabhu Publications, Dharwad.
6.	Techniques in Histopathology Cytopathology	SadhanaVishwakarma	Jaypee Brothers, Medical Publishers ltd.

SEMESTER - IV
MICROBIOLOGY

PAPER 3: BMLS21
VIROLOGY

Theory 30 Hours

- Virology
 - General properties and classification of viruses
 - Laboratory diagnosis of viral infection
 - Viruses and diseases caused by them (Arboviruses, Enteroviruses, Myxovirus, Herpes, Pox and Adenovirus)
 - Hepatitis and retroviruses
 - Immunity in viral infection and antiviral agents
 - Viral vaccines
 - Bacteriophage
 - Tissue culture
- Equipments necessary for carrying out tissue culture studies
 - Laminar flow equipment
 - Carbondioxide incubator
 - Inverted microscope
 - Basic procedure for preparation of glassware, Media etc for sterilization
 - Dry heat sterilization
 - Autoclaving in an atmosphere of steam
 - Chemical sterilization
 - Filter sterilization of liquid media etc
- Derivation of culture from the tissue
 - Enzymatic digestion of tissue using collagens, protease etc
 - Plating of cells in tissue culture media
 - Observation of cells in inverted microscope
 - Subculturing and derivation of cell lines
- Characteristics of cell lines
 - Determination of biochemical markers in cells
 - Chromosomal and DNA content of cells

- Immunological properties of cells
- Preservation of immortalised cell lines.
 - Storage in glycerol in liquid nitrogen
 - Storage in Dimethyl sulfoxide in liquid nitrogen

Suggested Readings:

- 1) Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr. C.P. Baveja.

**PRACTICAL 3: BMLS24
VIROLOGY:**

Practicals 30 Hours

- Viral cultivation methods - Tissue culture technique
- Demonstration of CPE
- Haemagglutination and Haemagglutination inhibition test
- Viral serology - ELISA

Suggested Readings:

Practical Microbiology, Fourth Edition. C.P Baveja.

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination for Fourth Semester for subject code BMLS04:

Sr. no	Practical	IA	Grand Total
1	80	20	100

- 1) Spotters- - 20 marks
- 2) ELISA - 20 marks

3) Spot tests -20 marks

4) Haemagglutination tests -20 marks

AECC0 2 **Theory: 30 Hours**

LAW - INDIAN CONSTITUTION

I. GOAL :

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :

A) KNOWLEDGE :

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS

Theory:

- Unit I**
- a) Meaning of term Constitution.
 - b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
 - c) Salient Features of the Constitution.
 - d) Preamble of the Constitution.
- Unit II**
- The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.

Devolution of Powers to Panchayat Raj Institutions.

- Unit III** Fundamental Rights and Duties - Their content and significance
- Unit IV** Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.
- Unit V** Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities
- Unit VI** Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.
- Unit VII** The Election Commission and State Public Service Commissions.
- Unit VIII** Method of amending the Constitution.
- Unit IX** Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.
- Unit X** Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

S. No.	Title	Author	Publisher
1	The Constitution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04

Hours

Research Methodology & Bioethics

Theory: 30

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.
10. Health Education Methods and Media
 - **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
 - Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
 - Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
 - Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BMLS25	Clinical Biochemistry II	02			02
2	BMLS26	Cytology	02			02
3	BMLS27	Parasitology and Mycology	02			02
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	BMLS28	Clinical Biochemistry II		02	02	04
7	BMLS29	Cytology		02	02	04
8	BMLS30	Parasitology and Mycology		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit 2-hour Clinical Posting per week for 15 weeks = 1 credit						

FIFTH SEMESTER

Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BMLS25	Paper 1	Clinical Biochemistry II	60 + 20 + 20	100
2	BMLS26	Paper 2	Cytology	60 + 20 + 20	100
3	BMLS27	Paper 3	Parasitology and Mycology	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject : (Hospital Administration/ Disaster Management)	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BMLS28	Practical 1	Clinical Biochemistry II	80 + 20	100
6	BMLS29	Practical 2	Cytology	80 + 20	100
7	BMLS30	Practical 3	Parasitology and Mycology	80 + 20	100
Grand Total					300

SEMESTER V

BIOCHEMISTRY

PAPER 1: BMLS25 CLINICAL BIOCHEMISTRY II

Theory 30 Hours

1. Organ function test: Thyroid function test.
2. Gastric analysis: Composition of gastric juice, concepts of free and bound acid, fractional test meal.
3. Renal Calculi: Theory of formation and analysis.
4. Basic principles and estimation of blood gases and pH- moved to IV sem
5. Definition, units, measurements of radiation, uses, sources and application of radio isotope techniques **in diagnosis and treatment of diseases**
6. **Immunology- types of immunoglobulins, structure, function, assay and diagnostic importance.**
7. Immunochemistry and techniques- Radio Immunoassay (RIA) and Enzyme Linked Immunoassay (ELISA)- Principles, types and application.
8. **Principle, types, assay and application of chemiluminescence.**
9. Role of enzymes in clinical practice: Discuss the marker enzymes in myocardium, liver and pancreas.
10. Inorganic ions- Calcium and Phosphorous metabolism.
11. **Overview of molecular biology: Structure and function of DNA and RNA, Isolation of DNA, RNA and diagnostic importance.**
12. Molecular biology techniques- Blotting techniques, Recombinant DNA technology, Genetic engineering, Gene therapy, RFLP, PCR- **Principle, procedure, applications.**
13. Interpretation and reference values of- glucose, urea, creatinine, uric acid, Total cholesterol, High density cholesterol, triacylglycerol, calcium, proteins, albumin and A/G ratio.
14. **Analytical chemistry in forensic medicine.**
15. **Principles of assay of vitamins.**

Introduction to research methodology and ethics.

**PRACTICAL 1: BMLS28
CLINICAL BIOCHEMISTRY II**

Practical :30 Hours

1. Analysis of renal calculi.
2. Standardization and Estimation of blood glucose by glucose oxidase peroxidase method.
3. Standardization and Estimation of blood urea by diacetyl monoxime method.
4. Standardization and Estimation of serum creatinine, urine creatinine and calculation of creatinine clearance. By jaffe's method
5. Standardization and Estimation of serum total proteins by Biuret method albumin by BCG dye binding method and A/G ratio.
6. Standardization and Estimation of serum total bilirubin Evelyn Malloy method.
7. Standardization and Estimation of serum Alanine transaminase by Mohun and Cook.
8. Standardization and Estimation of serum Aspartate transaminase by Mohun and Cook DNPH method
9. Standardization and Estimation of serum Alkaline phosphatase by Kind and King method.
10. Standardization and Estimation of serum Amylase by Somogyi method.
11. Estimation of calcium.
12. Estimation of Inorganic phosphorus

SCHEME OF EXAMINATION

Theory Total – 100 marks

Duration 3 hours

Sl no	Questions	Question Asked	Question to attempt	Marks	Max. Marks	Theory Total	Viva	Internal assessment	Total Marks
1.	Long Essay	3	2	2 x 10	20	60	20	20	100
2.	Short Essay	6	5	5 x 5	25				
3.	Short answers	5	3	3 x 5	15				

Practical Examination -Semester V

Major Practical

Topic	No of questions	Marks	Total
Standardisation and estimation	1	1 x 40	40 marks

Minor Practical

Topic	No of questions	Marks	Total
Analysis of renal calculi	1	1 x 40	40 marks

Practical Marks: 80 Marks

Internal assessment marks: 20 Marks

Grand total: 100 marks

SEMESTER V
PATHOLOGY

PAPER 2 :BMLS26
CYTOLOGY

Theory 30 Hours

- I
 - 1) The study of basic concepts
 - 2) The use of Microscope, screening techniques
 - 3) Normal cell structure and function
 - 4) Normal Histology and cytology of epithelial and connective tissue
- II
 - 1. Collection and Preparation of Samples
 - 2. Fixation, fixatives
 - 3. Staining - Principles, Preparation of reagents, techniques
 - a. Papanicolaou's stain
 - b. May – Grunwald Giemsa stain
- III **Hormone Cytology:**
 - Anatomy, structure and physiology of female genital tract.
 - Correlation of structure of female genital tract & ovarian hormones
 - Various Cytological indices
 - (a) Maturation Index
 - (b) Karyopyknotic Index
 - (c) Maturation Value.
- IV **Malignant Cytology of Female Genital Tract :**
 - Female genital tract, techniques of collection of specimen
 - (a) Cervical Malignancy
 - (b) Classification of cervical smear and characteristics of normal, inflammatory, and dysplasia (mild, moderate, severe), CA-in-situ, squamous cell carcinoma and adenocarcinoma of cervix.
 - (c) Cytological screening of cervical cancer (organ screening programme, Evaluation and follow-up).

V Respiratory tract

- (a) Anatomy, Histology, Physiology and normal cytology of the respiratory tract.
- (b) Collection, processing of sample
- (c) Sputum cytology
- (d) Cytology of Bronchogenic carcinoma

VI. Urinary tract:

- a. Cytology of the urinary system
- b. Collection and preparation of samples
- c. Cytology of cells of urinary tract.

VII. Gastrointestinal tract:

- a. Cytology of the Oesophagus and Stomach.
- b. Collection and preparation of samples.
- c. Characteristics of malignant cytology

VIII. Effusions & C S F

Routine examination of CSF & other body fluid's (pleural, peritoneal & synovial)

- a. Collection and preparation of fluid for cytological examination
- b. Cytological features of non-malignant and malignant effusions.

IX. Glandular organs:

- a. Cytology of breast, thyroid, salivary glands.
- b. Preparation of samples and staining : Cytological features of Malignant cells

X. Automation Cytology

- a. Principles, equipments, procedure and evaluation
- b. Cytospin
- c. Liquid Based Cytology

PRACTICAL 2: BMLS29 CYTOLOGY

Practical 30 Hours

1. Papanicolaou's Stain
2. May – GrunwaldGiemsa Staining
3. Hormonal Cytology
4. Benign Cytology
5. Malignant Cytology

6. Fluid cytology : Ascitic / Pleural / Cardiac
7. Fine Needle aspiration cytology (FNAC) – Demonstration of Benign and Malignant Cells.
8. CSF : Cell Count / Cell Types
9. Synovial Fluid
10. Sputum
11. BAL
12. Brush Cytology

Spotters:

Sl. No	SPOTTERS
1	Hematoxylin
2	Eosin
3	Methanol / Ether fixative
4	Toluidine blue stain
5	O.G – 6
6	EA - 65
7	Xylene
8	MGG stain
9	Centrifuge Machine
10	Alcohol
11	Neubaur's Chamber
12	Benign cell microscopic features
13	Malignant cell microscopic features
14	Coupling jar
15	Glass slide

SCHEME OF EXAMINATION

Types of Questions and distribution of marks for Theory Examination in each subject :

Sl no	Questions	Question Asked	Question to attempt	Marks	Max. Marks	Theory Total	Viva	Internal assessment	Total Marks
1.	Long Essay	3	2	2 x 10	20	60	20	20	100
2.	Short Essay	6	5	5 x 5	25				
3.	Short answers	5	3	3 x 5	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination for fifth Semester

Sl. No	Practical	IA	Grand Total
1	80	20	100

Exercises :

1. Spotters : 20 Marks (10 Spotters of 2 marks each)
2. PAP Stain : 20 Marks (Stain the given slide with PAP Stain)
3. MGG Stain : 20 Marks (Stain the given slide with MGG Stain)
4. Fluid Cytology : 20 Marks (Perform the Cell Type and Cell count of given Fluid { Ascitic/ pleural/ CSF })

SEMESTER V
MICROBIOLOGY

**PAPER 3: BMLS27
PARASITOLOGY AND MYCOLOGY**

Theory 30 Hours

- Parasitology
 - Introduction of parasitology and classification
 - Protozoa-
 - a) Entamoeba
 - b) Haemoflagellates
 - c) Intestinal and Genital flagellates
 - d) Sporozoa (Malarial parasite, Toxoplasma, *Cystoisospora belli*, Cryptosporidium and Microspora)
 - Helminths
 - a) Nematodes (Ascaris, Hookworm, Whipworm, Pinworm, Strongyloides, Trichinella, Filarial worm)
 - b) Cestodes (*Taenia saginata*, *Taenia solium*, *Echinococcus*, *H.nana*)
 - c) Trematodes.
- Mycology
 - Fungi – Introduction
 - Eumycetoma
 - Dermatophytes
 - Yeasts and yeast like fungi
 - Fungi of deep mycoses

Suggested Readings:

- 1) Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT, Second Edition. Dr. C.P. Baveja.

**PRACTICAL 3: BMLS30
PARASITOLOGY AND MYCOLOGY**

Practical 30 Hours

- Stool examination
- Stool concentration techniques
- Peripheral smear preparation and staining for haemoflagellates, malarial and filarial parasites
- Mycology techniques
 - a) KOH preparation
 - b) Lactophenol cotton blue stain- Preparation and Mounting.
 - c) Culture demonstration of all fungi- Slide culture technique

Suggested Readings:

Practical Microbiology, Fourth Edition. C.P Baveja.

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS04:

Sl. No	Practical	IA	Grand Total
1	80	20	100

- 1) Spotters -20 marks
- 2) Parasitology exercise - 30 marks
- 3) Mycology techniques -30 marks

Disaster & Emergency Management

A. Introduction to Disaster management

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management

C. Modern disaster management – disaster cycle

D. Hazards

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
-stages

-Basic elements

ELS05

30 HOURS

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BMLS31	Clinical Biochemistry VI	02			02
2	BMLS32	Blood Banking	02			02
3	BMLS33	Clinical Microbiology VI	02			02
5	ELS06	Elective Subject : Automation in Biochemistry / Automation in Haematology	02			02
6	BMLS34	Clinical Biochemistry VI		02	02	04
7	BMLS35	Blood Banking		02	02	04
8	BMLS36	Clinical Microbiology VI		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit 2-hour Clinical Posting per week for 15 weeks = 1 credit						

SIXTH SEMESTER
Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BMLS31	Paper 1	Clinical Biochemistry VI	60 + 20 + 20	100
2	BMLS32	Paper 2	Blood Banking and Automation	60 + 20 + 20	100
3	BMLS33	Paper 3	Clinical Microbiology VI	60 + 20 + 20	100
4	ELS06	Paper 4 Subsidiary	Elective Subject : Automation in Biochemistry / Automation in Haematology	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BMLS34	Practical 1	Clinical Biochemistry VI	80 + 20	100
6	BMLS35	Practical 2	Blood Banking	80 + 20	100
7	BMLS36	Practical 3	Clinical Microbiology VI	80 + 20	100
Grand Total					300

SEMESTER VI
BIOCHEMISTRY

PAPER I: BMLS31

Theory 30 Hours

CLINICAL BIOCHEMISTRY VI

1. Quality Assurance:
Principles of Quality assurance and standard of clinical chemistry.
Pre analytical, analytical and post analytical factors.
Limits of error allowable in laboratory, percentage errors.
2. Quality Control Charts:
West guard rules its different types.
Rules for rejection and interpretation of Levey-Jennings charts.
3. Clinical Laboratory records:
Requisition forms, patient data registers, electronic records, report forms, reference forms, equipment maintenance registers/log books, reagent stock books and quality control records.
4. Accreditation Process:
NABL Accreditation and its importance, rules and regulations.
5. Automation:
Basic features, principles and application and different types of analyzers along with their advantages and disadvantages
6. Laboratory audit.
7. Selection and evaluation of analytical methods.
8. Evidence base laboratory medicine.
9. Establishment and use of reference values.
10. Preparation of solutions:
Normal solution, molar solution, percentage solutions, buffer solutions, indicators and primary standard solutions.
11. Core blood analytes: Normal ranges and alteration by disease.
12. Collection and Processing of Various biological fluids:
General approach to patient identification, Phlebotomy, Collection of blood, urine, cerebrospinal fluid and other body fluids and their preservation methods, transport and disposal.
13. Biomedical waste management:
Definition, different types, segregation and disposal methods.
14. Inborn errors of metabolism:
PKU, alkaptonuria, albinism, MSUD and galactosemia, Von Gierke's disease and Niemann pick disease

PRACTICAL 1: BMLS34
CLINICAL BIOCHEMISTRY VI

Practicals-30 Hours

1. Demonstration of PCR, HPLC – visit to BSRC
2. Kit validation and automation – visit to hi tech laboratory.
3. Liver panel- Estimation of liver parameters (Total protein, Albumin, Total bilirubin, Direct bilirubin, AST, ALT and ALP) by kit method using semi autoanalyzer.
4. Renal panel- Estimation of renal parameter (Serum creatinine, blood urea, uric acid) by kit method using semi autoanalyzer.
5. Diabetic panel- Estimation of blood glucose, urine sugar and ketone by using kit method and dip stick method.
6. Screening for inborn errors of metabolism. Benedict's test, Rothera's test, Salwinoff's tests, Ninhydrin test DNPH test and Ferric chloride test.

SCHEME OF EXAMINATION

Theory Total – 100 marks
hours

Duration 3

Sl no	Questions	Question Asked	Question to attempt	Marks	Max. Marks	Theory Total	Viva	Internal assessment	Total Marks
1.	Long Essay	3	2	2 x 10	20	60	20	20	100
2.	Short Essay	6	5	5 x 5	25				
3.	Short answers	5	3	3 x 5	15				

Practical Examination -Semester VI

Major Practical

Topic	No of Questions	Marks	Total
Estimation of analytes in given panel	1	1 x 40	40 marks

Minor Practical

Topic	No of Questions	Marks	Total
Test for Inborn errors of metabolism	1	1 x 40	40 marks

Practical Marks: 80 Marks

Internal assessment marks: 20 Marks

Grand total: 100 marks

SEMESTER VI **PATHOLOGY**

PAPER 2: BMLS32 **BLOOD BANKING AND AUTOMATION**

Theory 30 Hours

I. BLOOD TRANSFUSION AND IMMUNOHAEMATOLOGY

1. Collection & processing of Blood –Donor selection, Registration, Medical history, Physical examination.
2. Collection of Blood
3. Processing of Donor Blood
4. Storage & preservation of Blood.
5. ABO Blood group System
6. Rh typing and weaker variants in Rh system
7. Subgroup and weaker various of A and B and Bombay Phenotype
8. Preparations and standardization of Anti Human globulin reagent
9. Coomb's test.
10. Blood grouping and cross-matching in blood bank.
11. Diseases transmitted by Blood and their screening - Australia Antigen and Hepatitis
C. Virus (HCV), HIV, Syphilis, CMV & Malaria in Blood transfusion
12. Investigation of transfusion reaction.
13. HLA Antigens and their significance in blood transfusion.
14. Blood Components- its preparation and their use in clinical practice.
15. Haemapheresis- Apheresis using cell separators Leucapheresis, plateletpheresis, plasmapheresis Adverse effects on donors.
16. Blood Bank Administration.
17. Record keeping

PRACTICAL 2:BMLS35 **BLOOD BANKING**

Practicals- 30 Hours

1. Blood grouping
2. Cross matching – Demonstration
3. Coomb's test – Demonstration

Spotters:

Sl. No	SPOTTERS
1.	Blood Collection Bag - All types
2.	Anti Human globulin
3.	Antisera A
4.	Antisera B
5.	ABO cross matching
6.	Direct Coomb's Test interpretation
7.	Indirect Coomb's Test interpretation
8.	Charts of Blood group
9.	Charts of cross matching
10.	Gel Card Method – Identify blood group
11.	EDTA vacutainer
12.	Plain vacutainer
13.	Sodium Citrate vacutainer
14.	Copper Sulphate Reagent
15.	Blood Transfusion set

SCHEME OF EXAM FOR THEORY

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination for Sixth Semester.

Sl. No	Practical	IA	Grand Total
1	80	20	100

Pathology Practicals

80 marks

1. Spotters – 20 marks
2. Blood Grouping – 20 marks
3. Cross Matching - 20 marks
4. Coomb's test procedure – 20 marks

Internal assessment

20 marks

Grand Total

100 marks

SEMESTER VI
MICROBIOLOGY

PAPER 3: BMLS33
CLINICAL MICROBIOLOGY VI

Theory : 30 Hours

1. Maintenance of Equipment
2. Biomedical waste management
3. Sterilization & Disinfection
4. Sample Collection & processing
2. Blood culture.
3. Universal precautions
4. ELISA
5. Agglutination Test
6. Stool Examination
7. Nosocomial infection
8. Rapid diagnostic tests for parasites
9. Bacterial & fungal stock culture
10. Laboratory diagnostics of fungal infections
11. Culture media
12. Automation
13. Biosafety cabinets

Suggested Readings:

- 1) Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT, Second Edition. Dr. C.P. Baveja.

PRACTICAL 3: BMLS36
CLINICAL MICROBIOLOGY VI

Practical : 30 Hours

1. Media Preparation
2. Media Pouring

3. Sample inoculation
4. Gram stain
5. ZN Stain
6. LPCB Mount
7. Spot test
8. Saline & Iodine wet mount

SCHEME OF EXAM FOR THEORY

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL ASSESMENT

Scheme of Practical Examination

Sl. No	Practical	IA	Grand Total
1	80	20	100

- 1) Spotters- - 20 marks
- 2) Inoculation Techniques - 20 marks
- 3) Gram Stain -20 marks
- 4) LPCB Tease mount/Spot test -20 marks

 Total =80 marks

ELS06**AUTOMATION IN BIOCHEMISTRY**

Sl No	Content	Hrs
1	To understand the work flow for all the Automated Instruments in the Biochemistry Laboratory. Dr. Prabhakar Kore's Charitable Hospital and Research Centre, Belagavi. Introduction to Pre analytical variable , Analytical Variable and Post analytical variable.	4
2	Hands-on training for Automated Instruments working on the principle of Chemiluminescence under observation Principle Normal values and Interpretation Quality Control Trouble Shooting	2
3	Hands-on training for the Automated Instruments working on the principle of Photometry under observation Principle Normal values and Interpretation Quality Control Trouble Shooting	2
4	Hands-on training for the Automated Instruments working on the principle of Electrical Potential such ABG Analyzer and Electrolyte Analyzer under observation Principle Normal values and Interpretation Quality Control Trouble Shooting	2
5	Perform Dry Chemistry Analysis on their own Principle Normal values and Interpretation Quality Control Trouble Shooting	2
6	Validate the Reagent Kit under observation	2
7	Run Quality Control samples on Automated Instruments under observation and should be able to Plot the values(on a Graph sheet) and Interpret QC values taking standard LJ charts into consideration	4

AUTOMATION IN HAEMATOLOGY

Sl. No.	
1.	Haematology analyzers <ul style="list-style-type: none">- Principle (General)- Analysis of each parameter (specific)- Histograms- Normal Values- Quality control- Trouble shooting
2.	Coagulation analysers <ul style="list-style-type: none">- Principle- Individual parameters- Reagents- Normal values & interpretation- Quality control- Trouble shooting
3.	ESR analyser <ul style="list-style-type: none">- Principle- Normal values & interpretation- Quality Control- Trouble shooting
4.	Slide stainer <ul style="list-style-type: none">- Principle- Reagents required- Quality Control- Trouble shooting
5.	Platelet function tests <ul style="list-style-type: none">- Principle- Individual parameters- Normal values & interpretation- Quality Control- Trouble shooting

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in all the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.

- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass

- a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
- b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
- d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA):**

SGPA= Credits X grade points/ Total Credits

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the first year subjects shall have Postgraduate degree in the respective subject with 3 years of teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Radiography Degree Course (Semester System) Syllabus/Curriculum 2023-24



Accredited 'A+' Grade by NAAC (3rd Cycle) Placed
in 'A' Category by Government of India (MHRD)

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth. To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

CONTENTS

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IV	Course contents and scheme of examination of 3 rd to 6 th Semester B.Sc. Radiography	
V	Internal Assessment	

B.Sc. Radiography

PREAMBLE

The B.Sc. Radiography Technology Course is of **3 years (6 semesters) and 1 Year internship** duration program aimed at training students in the technological aspects of Radiography with a good scientific foundation. These students will be in a position to competently assist in the Radiologist, especially in high tech medical procedure. They will be in much demand both within the country and outside as radiography skilled technical personnel. With advanced training in the latest technologies in Radiography Specialty, these graduates will play an important role in determining the quality of health care provided.

OBJECTIVE

The objective is to impart the basic knowledge of Physics, General Physics, Medical Physics & Radiographic Technique including the latest technical skills and its application in the health care delivery system.

I. TITLE OF THE COURSE

The course shall be called as Bachelor of Science in -Radiography (Radio-Diagnosis).

II. ELIGIBILITY FOR ADMISSION

Candidates for admission to the Bachelor of Science – Radiography (Radio-Diagnosis) Course shall have passed:

- 1) Pre-University examination conducted by any recognized state board with English, Physics, Chemistry and Biology as optional subjects.

OR

- 2) Pre university course from a recognized Board with vocational course in Radiography / Radiology as vocational subject / paramedical course recognized by paramedical Board.

OR

- 3) Any equivalent examination approved by the KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

III. DURATION OF COURSE

The duration of the Course shall be for **period of three years and one year compulsory rotatory internship.**

IV. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

V. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

VI. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Radiation physics part I	60 + 20 + 20	Radiation physics part I	80 + 20
		Radiation Physics part II	60 + 20 + 20	Radiation Physics part II	80 + 20
		Radiographic Photographs	60 + 20 + 20	Radiographic Photographs	80 + 20
4.	4th Semester	Radiography Technique-I	60 + 20 + 20	Radiography Technique-I	80 + 20
		Radiography Technique-II	60 + 20 + 20	Radiography Technique-II	80 + 20
		Quality Control, Radiobiology and Radiation Safety in Radio-diagnosis/Imaging	60 + 20 + 20	Quality Control, Radiobiology and Radiation Safety in Radio-diagnosis/Imaging	80 + 20

Third Year					
5.	5th Semester	Imaging Technique – USG	60 + 20 + 20	Imaging Technique – USG	80 + 20
		Imaging Technique- CT	60 + 20 + 20	Imaging Technique- CT	80 + 20
		Imaging Technique MRI	60 + 20 + 20	Imaging Technique MRI	80 + 20
6.	6th Semester	Nuclear medicine (NM)	60 + 20 + 20	Nuclear medicine (NM)	160 + 40
		Biomedical research and Medical Ethics in Radiology	60 + 20 + 20	Biomedical research and Medical Ethics in Radiology	160 + 40
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skills	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Digital Subtraction Angiography	
		2. Interventional Radiology	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: $\frac{\text{Total No. of SGPA}}{\text{No. of Semester}}$

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BRGS01	Human Anatomy	02		02
2	BRGS02(A)	Human Physiology	02		02
	BRGS02(B)	Basics of Biochemistry	02		02
3	BRGS03(A)	Pathology : Basic Hematology	02		02
	BRGS03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	BRGS04	Human Anatomy		02	02
6	BRGS05 (A)	Human Physiology		02	02
	BRGS05(B)	Basics of Biochemistry		02	02
7	BRGS06(A)	Pathology : Basic Hematology		02	02
	BRGS06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	BRGS01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BRGS02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	BRGS03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BRGS04	Practical 1	Human Anatomy	80 + 20	100
6	BRGS05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BRGS06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester I

PAPER 1: BRGS01 Human Anatomy

Theory 30 Hours

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: BRGS01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: BRGS04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of different parts of Brain & Spinal Cord

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: BRGS02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions
Classification of Body fluid compartments & composition, Homeostasis
Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis
Neuron and Neuroglia
Classification and Properties of Nerve fibers
Classification of Muscles
Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - BRGS05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: BRGS02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: BRGS05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks

40 Marks

IA Marks:

10 Marks

Grand Total

50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata- 700009 (India)

Semester I

PAPER 3 - BRGS03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: BRGS06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubauer's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- BRGS03 Section B – Microbiology

Theory 30 Hours

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.

- **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methods
- Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
- **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: BRGS06
Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes

- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.

3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur
- 16) Discussion about examination and future plan

- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BRGS07	Anatomy	02		02
2	BRGS08(A)	Physiology	02		02
	BRGS08(B)	Biochemistry	02		02
3	BRGS09(A)	Hematology & Clinical Pathology	02		02
	BRGS09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	BRGS10	Human Anatomy		02	02
6	BRGS11(A)	Human Physiology		02	02
	BRGS11(B)	Basics of Biochemistry		02	02
7	BRGS12 (A)	Hematology & Clinical Pathology		02	02
	BRGS12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BRGS07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BRGS08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	BRGS09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BRGS10	Practical 1	Human Anatomy	80 + 20	100
6	BRGS11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BRGS12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - BRGS07 **Human Anatomy**

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			

3.	Short Answers	5	5	5 x 3	15			
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Practical 1: - BRGS10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BRGS11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – BRGS08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, Conducting system, Types of blood vessels & blood flow

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, Shock- definition & types

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and Secretion - Na⁺, Glucose, Water, K⁺ & Urea

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No .	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No .	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: BRGS08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid ,Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. **Composition of Whole Blood, Serum**

and Plasma

2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. **Nutritional Disorders, Diabetic and DASH diets**
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: BRGS11 Basics of Biochemistry II

Practical : 30 Hours

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No .	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
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1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: BRGS09
Section A - Haematology & Clinical Pathology

Theory : 30 Hours

Hematology

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films

4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No .	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black

16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: BRGS09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr. C.P. Baveja.

PRACTICAL 3: BRGS12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

1. **Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.

- a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices),
Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
- b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
- c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
- a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
- b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
- Youth development programmes at the National level, State level and voluntary sector

Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking
- Self Confidence and Self esteem

- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BRGS13	Radiation physics part I	02			02
2	BRGS14	Radiation Physics part II	02			02
3	BRGS15	Radiographic Photographs	02			02
4	AECC01	AECC: Environmental Sciences	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	BRGS16	Radiation Physics Part I		02	02	04
7	BRGS17	Radiation Physics Part II		02	02	04
8	BRGS18	Radiographic Photographs		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER
Scheme of Examination:

Sl. No.	Subject Code	Examination	Subjects	Max. + IA + Viva	Grand Total
1	BRGS13	Paper 1	Radiation physics part I	60 + 20 + 20	100
2	BRGS14	Paper 2	Radiation Physics part II	60 + 20 + 20	100
3	BRGS15	Paper 3	Radiographic Photographs	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500

Sl. No	Subject Code	Practical	Practical	IA	Total
6	BRGS16	Radiation Physics Part I	(Major 50 + Minor 30)	20	100
7	BRGS17	Radiation Physics Part II	(Major 50 + Minor 30)	20	100
8	BRGS18	Radiographic Photographs	(Major 50 + Minor 30)	20	100
Grand Total					300

SEMESTER III

PAPER 1: BRGS13

Theory 45 Hours

Radiation Physics part I

- ◆ Basic concepts: Basic Units, Heat, Acoustics etc. Basic concepts of power, work, force, energy - Einstein's formula - Electronics, Electricity & Magnetism, electromagnetic waves - Units and measurements - temperature and heat-SI units of above Parameters-Atomic structure- Nucleus - Atomic Number, Mass Number electron orbit and energy Levels-Periodic table -Isotopes-Isobars-Ionisation and excitation.

◆ Introduction to radiation protection

- ◆ Need for protection
- ◆ Aim of radiation protection
- ◆ Basic radiation units and quantities
- ◆ Exposure
- ◆ Absorbed dose
- ◆ Tissue weighting factor

◆ Principles of radiation physics detection:

- ◆ Gas-filled detectors (ionization chambers, proportional counters and Geiger Muller counters)
- ◆ Scintillation detectors

◆ Atomic structure and nuclear physics review

- ◆ The structure of the atom Nucleus,
- ◆ Atomic number (Z),
- ◆ Mass number (A),
- ◆ Ionisation & Excitation,
- ◆ Isotopes
- ◆ Radioactivity
- ◆ Half life

◆ X rays

- ◆ History
- ◆ Properties of x-ray
- ◆ Production of x-ray
- ◆ Interaction of x-rays with target
- ◆ Quality and intensity of x-ray
- ◆ The factors influencing quality and intensity

◆ Interactions of x-rays and gamma rays with matter

- ◆ Classical scattering
- ◆ Compton scattering
- ◆ Photoelectric absorption
- ◆ Pair production
- ◆ Photo disintegration
- ◆ Practical aspect of radiation absorption and transmission through body tissue

10. Limits for radiation exposure

- ◆ Concept of ALARA (or ALARP)
- ◆ ICRP regulation

Maximum permissible dose

◆ Protection in diagnostic radiology

- ◆ Protection for primary radiation
- ◆ Work load
- ◆ Use factor
- ◆ Occupancy factor
- ◆ Protection for scatter radiation and leakage radiation
- ◆ X ray room design
- ◆ Structural shielding
- ◆ Protective devices
- ◆ Radiation signage

◆ Technical protective consideration during radiography

- ◆ Evaluation of hazards
- ◆ Effective communication
- ◆ Immobilization
- ◆ Beam limiting devices
- ◆ Filtration
- ◆ Exposure factors
- ◆ Protection in:
 - Fluoroscopy
 - Mammography
 - Mobile radiography CT scan
 - Angiography room

◆ Biological aspects of radiological protection

- ◆ Direct and indirect actions of radiation
 - ◆ Concept of detriment - deterministic & stochastic effect of radiation - somatic and genetic effects
 - ◆ Dose relationship
 - ◆ Effects of antenatal exposure
 - ◆ Chemical effects of radiation
 - ◆ Radiolysis of water
 - ◆ Production of free radicals reaction

◆ Radiation measuring instruments:

- ◆ Area monitoring
- ◆ Personal dosimeters
- ◆ Film badge
- ◆ Thermoluminescent dosimeter
- ◆ Pocket dosimeter

- ◆ Physics of Diagnostic Radiology: X-ray Tube: Anode & Cathode - Thermionic diode - X ray valves and tubes -principle and practical

aspects - semiconductors - triode valves - cathode ray oscilloscopes - X-ray circuits - self rectifying circuits - half wave pulsating voltage circuits

- full valve pulsating voltage circuits - measurement of high voltage - control of KV circuit - mA circuit. X-ray beam quality.

- ◆ X-Ray generators and Circuits-Filament current and voltage, X-Ray circuits - primary circuit auto transformer-switch and timers - principle of automatic exposure control and practical operation - filament circuit - high voltage circuits-half wave & full wave rectification - three phase circuits. Types of generators, 3 phase, 6 and 12 pulse circuits - falling load generators capacitors discharge and grid control systems.

- ◆ X-ray tables-floating top table & variable height table.

- ◆ X-Ray Grids /Bucky Scattered Radiation -Significance of scatter - Beam limiting devices. - Grid principle and structure - Types of Grids - vertical bucky- versatile bucky -Stationary grid, parallel grid, focused grid - crossed grid, moving grid - Potter Bucky Diaphragm - Control of scattered radiation and grids/Bucky - Methods of minimizing formation of scatter radiation, types of grids and grid ratio - use of cones - diaphragm / light beam devices

- effectiveness of collimation - limitations of the primary beam / the light beam diaphragm

- Effects of scatter radiation on radio graph image quality, patient dose and occupational exposure. X-Ray Cassettes & Intensifying screens: Fluorescence - constituents of intensifying screens - types of screens - intensification factors-speed of screen-screen unsharpness. Cassette construction-types of cassettes- use of fluorescent screen in radiology, effect of screen in reduction of patient dose.

Text Books Recommended (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1.	Fundamentals of Physics of Radiology	W.J.Meredith & J. B. Massey	Varghese publishing House
2.	Principles of Radiological Physics.	Graham	Churchill Livingstone
3.	Physics for Radiographer (ELBS).	George A. Hay & Donald Hughus	

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Third Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL 1: BRGS16

Practicals: 50 Hours

Radiation Physics part -I

- ◆ Limits for radiation exposure
- ◆ Protection in diagnostic radiology
- ◆ Technical protective consideration during radiography
- ◆ Biological aspects of radiological protection
- ◆ Radiation measuring instruments:
- ◆ Physics of Diagnostic Radiology: X-ray Tube: Anode & Cathode - Thermionic diode - X ray valves and tubes - principle and practical aspects
- ◆ X-Ray generators and Circuits-Filament current and voltage, X-Ray circuits - primary circuit auto transformer-switch and timers- principle of automatic exposure control and practical operation
- ◆ X-ray tables-floating top table & variable height table.
- ◆ X-Ray Grids /Bucky Scattered Radiation -Significance of scatter

Practical Assessment

Scheme of Practical Examination for Third Semester

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical 1	80	20	100

PAPER 2: BRGS14

Theory : 45 hours

Radiation physics part II

Applied Mathematics:

Elementary use of Algebraic

symbols and signs. Indices:

Power of 10 simple equations.

Measurement of angles. Geometry of triangles.

Proportion, Inverse square law, Elementary explanation of exponential law.

Main Supply:

- ◆ Generation of Electrical Energy,
- ◆ Distribution of Electrical Energy,
- ◆ Use of Electrical Energy,
- ◆ Polyphase Supplies,
- ◆ Availability of different voltages,
- ◆ Feeder Cables,
- ◆ Line Voltage Drop,
- ◆ Mains Switches,
- ◆ Fuses,
- ◆ Circuit Breakers.
- ◆ Earthing,
- ◆ Insulation,
- ◆ High tension cables construction,
- ◆ Design.

Electromagnetic radiation

- ◆ The quantum theory of radiation (Planck's concept of quanta. Photon and its characteristic properties).
- ◆ The electromagnetic spectrum,
- ◆ Common properties of electromagnetic radiation
- ◆ Relationship between energy frequency wavelength and velocity eg. X rays and gamma rays.

Generation of electrical energy

- ◆ AC/DC
- ◆ Polyphase supply
- ◆ Distribution of electric charge
- ◆ Use of electrical energy
- ◆ Current loads and power loss
- ◆ Uses of electricity in hospitals
- ◆ Safety rules for radiographers

Rectifiers

- ◆ Vacuum diode - variation of anode current with anode voltage and filament temperature
- ◆ Gas filled diode and triode
- ◆ Principles of rectification
- ◆ Wave form and half wave and full wave current/voltage wave form
- ◆ Rectifiers: valves, metal rectifiers semiconductors rectifiers and relative merits and demerits
- ◆ Diodes

X-Ray circuits

- ◆ Filament circuit
- ◆ High voltage circuits
- ◆ Tube rating

X-Ray tube

- ◆ Gas filled X-ray tube: Construction, working and limitation: thermionic emission.
- ◆ Stationary anode X-ray tube: construction, working and methods of cooling anode, rating chart and cooling chart.
- ◆ Rotating anode X-ray tube: Construction, working & rating chart, speed of anode rotation, angle of anode inclination.
- ◆ Grid control X-ray tube.

Generators

- ◆ Types of generators
- ◆ Capacitor discharge generator
- ◆ Battery powered generator
- ◆ Medium frequency & high frequency generators.

Devices improving radiographic quality

- ◆ Cone
- ◆ Cylinder
- ◆ Collimator
- ◆ Grids
- ◆ Filter

Fluoroscopy and image intensifiers

- ◆ Construction & working principles of image intensifiers
- ◆ Viewing the intensified image
- ◆ Recording the intensified image
- ◆ Digital fluoroscopy
- ◆ Panel type and image intensifiers

Equipment for special procedures:

- ◆ Special trolleys and chairs
- ◆ Portable and mobile X-ray units
- ◆ Cordless mobile x-ray equipment
- ◆ Capacitor discharge mobile equipment
- ◆ Equipment's for O.T.
- ◆ Bi-plane radiography
- ◆ Cranial and dental equipment
- ◆ Skull tables
- ◆ Mammography
- ◆ Mass-miniature radiography
- ◆ Tomography

- ◆ Rapid cassette changer
- ◆ Rapid film changer
- ◆ Magnification radiography
- ◆ Subtraction radiography

Care maintenance and tests

- ◆ General care
- ◆ Functional tests
- ◆ Quality assurance program
- ◆ Acceptable limits or variation
- ◆ Corrective action

PRACTICAL 2: BRGS17
Radiation physics part II

Principles of radiation physics detection:

- ◆ Gas-filled detectors (ionization chambers, proportional counters and Geiger Muller counters)
- ◆ Scintillation detectors

Protection in diagnostic radiology

- ◆ Protection for primary radiation
- ◆ Work load
- ◆ Use factor
- ◆ Occupancy factor
- ◆ Protection for scatter radiation and leakage radiation
- ◆ X ray room design
- ◆ Structural shielding
- ◆ Protective devices
- ◆ Radiation signage

Technical protective consideration during radiography

- ◆ exposure factors
- ◆ mammography
- ◆ angiography room

Radiation measuring instruments:

- ◆ Area monitoring
- ◆ Personal dosimeters
- ◆ Film badge
- ◆ Thermoluminescent dosimeter
- ◆ Pocket dosimeter

Text Books Recommended (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1.	Fundamentals of Physics of Radiology	W.J.Meredith & J. B. Massey	Varghese publishing House
2.	Principles of Radiological Physics.	Graham	Churchill Livingstone
3.	Physics for Radiographer (ELBS).	George A. Hay & Donald Hughus	

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Third Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical Assessment

Scheme of Practical Examination for Third Semester

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical 2	80	20	100

PAPER 3: BRGS15
Radiographic Photographs

Theory: 45 hours

♦ **X-RAY FILMS:**

- ♦ Glass, Cellulose and polyester bases
- ♦ Structure of X-ray films - emulsion, gelatin, Base and super coating
- ♦ Types of X-ray films - Single coated, duplitised
- ♦ Spectral sensitivity and Color sensitivity
- ♦ Graininess of films
- ♦ Speed of films
- ♦ Screen & non screen films
- ♦ Various formats of films
- ♦ Films for special procedures
- ♦ Storage of film materials and radiographs
- ♦ Record of film stock and radiographs
- ♦ Deterioration of films on storage
- ♦ Characteristic curves - uses of step wedge
- ♦ Information on basic fog, film gamma, contrast, speed, film latitude, effects on development.

♦ **INTENSIFYING SCREENS:**

- ♦ Fluorescence - Phosphors
- ♦ Phosphors employed - Calcium tungstate
- ♦ Barium Fluochloride
- ♦ Rare earths
- ♦ Construction of intensifying screens
- ♦ The influence of kilovoltage in different phosphors
- ♦ Intensification factor
- ♦ Resolving power of Intensifying screens
- ♦ Speed of screens
- ♦ Screen film contact tests
- ♦ Types of intensifying screens
- ♦ Advantages and limitations of Intensifying screens.

♦ **X-RAY CASSETTE:**

- ♦ Construction of X-ray cassettes
- ♦ Types of cassettes
- ♦ Mounting Intensifying screens on cassettes
- ♦ Identification of cassette
- ♦ Care of Cassettes

♦ **PHOTOCHEMISTRY:**

- ♦ Chemistry of image formation
- ♦ Formation of latent image
- ♦ Conversion latent image to visible image
- ♦ Meaning of pH
- ♦ Importance of pH in processing films

♦ **PROCESSING METHODS:**

- ◆ Preparation of solution
- ◆ Manual processing apparatus
- ◆ Control of temperature
- ◆ Rapid processing
- ◆ Automatic processor - Principle and features, water supply, use of thermostat, regeneration of solution, maintenance, advantage and limitations.
- ◆ Processing of cut films and roll films.

◆ RADIOGRAPHIC IMAGE:

- ◆ The emergent beam related to densities on film contrast - Objective and subjective, Long scale and short scale, Radiation contrast, film contrast and Radio graphic contrast
- ◆ Density, Sharpness- Sources of unsharpness, Avoiding different unsharpness
- ◆ Resolution and Factors affecting resolution
- ◆ Choice of kilovoltage and milliamperage
- ◆ Choice of short focus and broad focus
- ◆ Selection of focus to film distance and object to film distance
- ◆ Selection of cassettes
- ◆ Avoiding scatter radiation, magnification, distortion, penumbra
- ◆ Presentation of a radiograph- Identification markers, - Name printer
- ◆ Viewing equipment
- ◆ Magnifiers for cut films and roll films.

◆ DEVELOPER:

- ◆ Constituents
- ◆ Characteristic
- ◆ Manual and automatic processors
- ◆ Effects on developing time, temperature, agitation
- ◆ Replenisher
- ◆ Exhaustion

◆ RINSING:

- ◆ Acid stop-bath
- ◆ Methods
- ◆ Objects

◆ FIXER

- ◆ Constituents
- ◆ Characteristic
- ◆ Manual and automatic processors
- ◆ Fixing time and clearing time
- ◆ Factors affecting fixing time
- ◆ Replenisher
- ◆ Exhaustion

◆ WASHING AND DRYING:

- ◆ Objects
- ◆ Methods
- ◆ Factors affecting washing and drying
- ◆ Wetting agents
- ◆ Comparison of different methods

◆ DAY LIGHT FILM HANDLING:

- ◆ Day light system using cassettes
- ◆ Day light system without cassettes

◆ FILM FAULTS:

- ◆ Fog - Various fogging in films, causes and prevention.
- ◆ Stains - types, causes and prevention
- ◆ Spots and Splashes - types, causes and prevention.
- ◆ Marks and prints - types, causes and prevention.
- ◆ Drying marks - types, causes and prevention
- ◆ Faults in automatic processor - types, causes.

◆ REPRODUCTION OF RADIOGRAPHS:

- ◆ Copying Radiographs
- ◆ Magnification and minification
- ◆ Contact prints
- ◆ Types of paper
- ◆ Equipment.

◆ COMPUTERISED RADIOGRAPHY

- ◆ Introduction
- ◆ Components
- ◆ Cassettes and imaging plates
- ◆ Digitizer
- ◆ Image formation
- ◆ Advantages and disadvantages

◆ DIGITAL RADIOGRAPHY

- ◆ Introduction
- ◆ Work flow
- ◆ System components
- ◆ Image formation
- ◆ Advantages and disadvantages

Text Books Recommended (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1.	Radiographic Imaging	D.N.Chesney & M.O Chesney	C.B.S. Publication.
2.	Protection of the Patient in Medical Radiography	I.C.R.P.	
3.	Radiographic Imaging a Practical approach	Derrick P. Roberts & Nigel L. Smith	
4.	Radiological science (Work book and laboratory)	Stewart C. Suchong	
5.	Fundamentals of Radiographic Photography Books 1,2,3,4,5	Kodak	Kodak Ltd.
6.	Physical and Photography Principles Principles of Medical Radiography	Seeman & Herman	Wiley
7.	Manual of Photography		Iiford
8.	Elementary Photogenic Chemistry	Bouthworth & Bently	Pitmans Publication
9.	Medical Photography (Focal press)	Longmore	Kodak data books.
10.	Developing	Jackson	

PRACTICAL 3: BRGS18
Radiographic Photographs

Practical: 45 Hours

- ◆ X-ray Films
- ◆ Intensifying Screens
- ◆ X-ray Cassette
- ◆ Photochemistry
- ◆ Processing methods
- ◆ Radiographic image
- ◆ Developer
- ◆ Rinsing
- ◆ Fixer
- ◆ Washing and drying
- ◆ Day light film handling
- ◆ Computerized radiography
- ◆ Digital radiography

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Third Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical Assessment

Scheme of Practical Examination for Third Semester

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical 3	80	20	100

Compulsory subject

ELS03: ENVIRONMENTAL STUDIES

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

b) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

Theory and Field work: 50 Hours

◆ Theory- 45 hours

◆ Field work - 5 hours

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2 hours

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles **8 hours**

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems: -
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) **6 hours**

4: Biodiversity and its conservation

8 hours

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

8 hours

Definition

- ◆ Cause, effects and control measures of: -
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

7 hours

From Unsustainable to Sustainable development

- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

6 hours

Population growth, variation among nations.

- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets river/forest/grassland/hill/mountain

- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

SCHEME OF EXAMINATION

A Theory: 80Marks

- ◆ **Long Essay** **2 X 10 = 20**
- ◆ **Short Essay** **8 X 5= 40**
- ◆ **Short Answers** **5 X 4= 20**

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
- Uses and application of bio-statistics in public health research and medical sciences.
- Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
- Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
- Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
- Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
- Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.

Basic Probability : Concept of probability, its terminology and different types of definition Laws of probability: addition law, multiplication law and conditional probability.

ELS03 : Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BRGS19	Radiography Technique-I	02			02
2	BRGS20	Radiography Technique-II	02			02
3	BRGS21	Quality Control, Radiobiology and Radiation Safety in Radio-diagnosis/Imaging	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	BRGS 22	Radiography Technique-I		02	02	04
7	BRGS23	Radiography Technique-II		02	02	04
8	BRGS24	Quality Control, Radiobiology and Radiation Safety in Radio diagnosis/Imaging		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER

Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory+ IA +Viva Voce	Total
1	BRGS19	Paper 1	Radiography Technique-I	60 + 20+20	100
2	BRGS20	Paper 2	Radiography Technique-II	60 + 20+20	100
3	BRGS21	Paper 3	Quality Control, Radiobiology and Radiation Safety in Radio- diagnosis/Imaging	60 + 20+20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Practical	IA	Grand Total
6	BRGS22	Radiography Technique-I	80 (Major 50 + Minor 30)	20	100
7	BRGS23	Radiography Technique- II	80 (Major 50 + Minor 30)	20	100
8	BRGS24	Quality Control, Radiobiology and Radiation Safety in Radio diagnosis/Imaging	80 (Major 50 + Minor 30)	20	100
Grand Total					300

SEMESTER IV

PAPER 1: BRGS19 Radiography Technique – I

Theory 45 Hours

- ◆ **PRINCIPLES OF RADIOGRAPHY:**
- ◆ Preparation of the room, apparatus and instruments
- ◆ Positions of the patient: erect, sitting, supine, prone, lateral, oblique, decubitus etc.,
- ◆ Relative positions of x-ray tube and patient, relevant exposure factors.
- ◆ Use of accessories such as Radiographic cones, grid and positioning aids.
- ◆ Anatomic and physiological basis of the procedure, association with theory with practical work.
- ◆ Radiographic appearances, both normal and common abnormal conditions where elementary knowledge of the pathology involved will ensure the application of the appropriate radiographic technique. Modifications in technique for various disabilities and types of subject. Radiation protection, use of gonad shield, practical methods reducing radiation dose to the patient.
- ◆ **UPPER LIMB:** Routine projections for the whole hand, fingers, wrist joint, forearm, elbow joint and humerus. Supplementary projections for scaphoid, carpal tunnel ball catchers projections, head of the radius, supracondylar fracture and olecranon process.
- ◆ **LOWER LIMB:** Routine projections for the whole foot, toes, calcaneum, ankle joint, leg, knee joint, patella and femurs. Supplementary projections for talo-calcaneal joint, forced projections for torn ligaments, flat feet, club feet, intercondylar projections for loose bodies in the knee, axial projection for patella.
- ◆ **SHOULDER GIRDLE AND THORAX:** Routine projections for the shoulder joint, scapula, acromio-clavicular joint, clavicle, sternoclavicular joint, sternum and ribs. Supplementary projections for the axial projection of clavicle, bicipital groove carotid process, classification of tendons, subluxation, upper ribs and axillary ribs.
- ◆ **PELVIC GIRDLE AND HIP REGION:** Routine projections for the whole pelvis, Sacroileac joints, hip joint and neck of femur. Supplementary projections for the greater and lesser trochanters of femur, Frog leg projection, ischeumsymphysis pubis, ileum, acetabulum and congenital dislocation of hip arthrodesis.
- ◆ **VERTEBRAL COLUMN:** Routine projections for atlanto occipital joint, cervical spine, Cervico thoracic junction, thoracic spine, lumbar spine, lumbo sacral region, sacrum and coccyx. Supplementary projection for the intervertebral foramina, posterior arch of atlas, flexion and extension of cervical spine, scoliosis and kyphosis, sacro iliac joint.
- ◆ **SKELETAL SURVEY:** Skeletal survey for metabolic bone diseases, metastases, hormonal disorders, renal disorders.
- ◆ **SKULL:** Routine projections for cranium and facial bones. Supplementary projections for trauma, Towne's method, sella, turcica, optic foramina, jugular foramina, temporal bones, mastoids petrous bone, Zygomatic arches, orbits, maxillae, nasal bones, mandible, temporomandibular joints.
- ◆ **NASAL SINUSES:** Techniques for frontal maxillary, ethmoidal and sphenoid sinuses, Erect and horizontal projections for fluid levels.
- ◆ **TEETH:** Routine projections of all teeth - intra oral and extra oral projections. Supplementary projections for localization of roots, children, edentulous subjects and use of occlusals and bitewings, Orthopantomography.
- ◆ **CHEST:** Routine projections for lungs, cardia and diaphragm. Supplementary projections for opaque swallow, thoracic inlet, soft tissue neck, decubitus, apicograms, paediatric cases.
- ◆ **ABDOMEN:** KUB, erect abdomen and decubitus projection. Supplementary projections for acute abdomen.

PRACTICAL 1: BRGS22
Radiography Technique - I

Practicals: 50 Hours

Radiography - plain views of upper Limb Hands.
Fingers Thumb Wrists Forearm Elbow
Humers

Radiography - plain views of shoulder:

Shoulder Joint
Acromio - clavicular joint
Scapula Various Views and Projections. Clavicle
Sterno - Clavicular joint.

Radiography - plain views of Lower Limb:

Foot Toes
Tarsus & calcis Ankle
Tibia, fibula & Patella Knee joint
Pelvis & Sacro-iliac joint

Radiography of Vertebrae:

Cervical spine upper, cervical spine lower Cervico-thoracic,
Thoraco Lumbar Lumbo-Sacral Sacrum & Coccyx Ribs Upper & Lower Sternum

Radiography of skull plain views:

AP, Lateral & Towns Sinuses, Mandible, Teeth. Mastoids.

Radiography of Chest:

Lungs & Trachea; Heart-Diaphragm Radiography of G.I. Tract
Plain X-rays Abdomen-Erect; Liver, Spleen.

Text books recommended (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1.	Atlas of Radiographic positioning and Radiological Procedures	Philip W. Ballinger :	Mosby
2.	Clarks positioning in Radiography	RA Swallow, E Naylor	C.B.S. Publication
3.	Roentgenologic technique	Sante L R	Edward Arnold
4.	A Radiographic index	Goldman	WRIGHT Publication
5.	A handbook of Radiography	Ross and Gailway	Lewis
6.	Diagnostic Radiography	Glenda J. Bryan	Mosby
7.	Medical Radiographic Technique	Piles	Thomas

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Fourth Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical Assessment

Scheme of Practical Examination for Fourth Semester

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical 1	80	20	100

Radiographic Technique – II

◆ INTRODUCTION:

- Responsibility of Radiographer during Radiological Procedures.
- Preparation of patient for different procedures.
- Contrast media - Positive and Negative, ionic & non - ionic
- Adverse reactions to contrast media and patient management
- Emergency drugs in the Radiology Department
- Emergency equipments in the Radiology Department
- Asepsis
- Radiation protection - Ten day Rule.
- The following should be dealt with indication, contraindications, patient preparation, contrast media used, method of administration of contrast media, accessories required, technique to be adopted, variation in normal technique in specific circumstances, films taken, complications, precautions and after-care of the patient.

◆ GASTRO-INTESTINAL TRACT:

- Barium Swallow - Tracheo - oesophageal fistula
- Barium Meal - single contrast and double contrast
- Hypotonic duodenography
- Barium meal follow through
- Small bowel enema
- Barium enema - Gastrograffin enema for reducing intussusception Loopogram
- Additional Investigation - Computed Tomography, Radio isotopes Scanning.

◆ BILIARY TRACT:

- Oral cholecystography
- Intravenous Cholelithography
- Pre operative Cholelithography
- Post operative Cholelithography - Percutaneous extraction of retained biliary calculi
- Percutaneous Transhepatic Cholelithography - Biliary drainage.
- Endoscopic Retrograde Cholelithography
- Additional Investigation : Ultrasound Scanning,
- Radio isotope scannings
- Computed Tomography
- MRI, Magnetic resonance cholangio-pancreatography.

◆ URINARY SYSTEM:

- Excretion Urography
- Percutaneous Renal Puncture
- Percutaneous Nephrostomy
- Percutaneous Nephrolithotomy
- Lithotripsy
- Retrograde Pyeloureterography
- Micturating Cystourethrography - Urodynamic investigations
- Ascending Urethrography

- Additional Investigation: Ultrasound Scanning,
Radio-isotope Scanning
Computed Tomography
Magnetic Resonance Imaging, MR Urogram.

◆ **REPRODUCTIVE SYSTEM:**

- HysteroSalphinogram
- Gynaecography
- Pelvimetry
- Vesiculography
- Additional Investigation: Ultrasound Scanning, Sono- Salpingography
Computed Tomography
Magnetic Resonance and Imaging

◆ **CARDIO - VASCULAR SYSTEM:**

- Angiography:
- Percutaneous Catheterization
- Catheterization sites, asepsis
- Guide Wire, Catheter, pressure injector and accessories
- Use of Digital subtraction, single plane and biplane
- Head and neck Arteriography
- Pulmonary Arteriography
- Coronary Arteriography
- Ascending Aortography
- Trans lumbar Aortography
- Celiac axis, Superior mesenteric and inferior mesenteric Arteriography
- Renal Arteriography
- Trans femoral Arteriography
- Interventional vascular Radiography
- Additional Investigation: Echo cardiogram (Doppler)
Radio-isotope
Scanning Computed
Tomography
Magnetic Resonance and Imaging, MR Angiography,
MDCT angiography.

◆ **VENOGRAPHY:**

- Peripheral Venography - lower limb, Upper limb
- Central Venography - Superior venacavography, Inferiorvenacavography,
Pelvic venography, Ascending lumbar venography,

Intra osseous venography

Percutaneous splenoportography

transhepatic portography

Selective Retrograde venography - Renal venography,
- Adrenal venography
- Hepatic venography
- Internal jugular venography
- Orbital venography

Interventional Vascular Radiography

additional Investigation: - Ultrasound imaging, Color Doppler, Scanning.
Radio isotope scanning Computed
Tomography

♦ **Central Nervous System:**

Cervical Myelography - Cisternal puncture and lateral cervical puncture

Lumbar myelography

Myelography with water soluble and
oily contrast media

Air encephalography

Ventriculography

Lumbar discography

Addition Investigation: Compute Tomography
Radio isotope scanning
Magnetic Resonance and Imaging, MR Myelogram, CT
Myelogram.
Ultrasound imaging

♦ **Respiratory system:**

- Nasopharyngography
- Laryngography
- Bronchography
- Percutaneous lung Biopsy

♦ **Additional Investigation:** Radio isotope scanning

Computed Tomography
Ultrasound Imaging
Magnetic Resonance and Imaging

♦ **Miscellaneous:**

- Arthrography
- Sialography
- Lymphography
- Sonography
- Fistulography
- Dacryocystography
- Mammography

- Xeroradiography
- Thermography
- Kymography
- Stereo-radiography
- Duplication radiography
- Macro radiography
- High Kilovoltage Technique
- Soft tissue Radiography
- Multiple radiography
- Subtraction radiography
- Foreign body Localisation
- Mobile Radiography
- Theatre Radiography
- Domiciliary Radiography
- Forensic Radiography
- Tomography.

Text books recommended (Latest Edition)

Piles	: Medical Radiographic Technique (Thomas)
Sante L. R.	: Roentgenologic Technique (Edwards Inc).
Philip W Balliger	: Merils atlas of Radiographic Positions and Radiological Procedures (Mosby)
Goldman	: A Radiographic index, Wright publ.
Patesson	: Printed notes for radiographers in India (CMAI)
Achwaz	: Unit step Radiography (Thomas)
Ross & Galloway	: A handbook of Radiography (Lewis)
Glenda J. Bryan	: Diagnostic Radiography (Churchill Livingstone)
Jacobi & Paris	: Textbook of Radiological Technology (Mosby)
Scarrow	: Contrast Radiography (Schering Chemicals)
Vander Plasts	: Medical x-ray technique (Mac Millan)
Stephen Chapman &	
Richare Nakielny	: A Guide to Radiological Procedures (Jaypee Brothers).

PRACTICAL 2: BRGS23
Radiographic Technique – II

Practicals 50 Hours

- ◆ Barium swallow exam (E) Radiology Technique II
- ◆ Barium meal exam (E)
- ◆ Barium follow through exam
- ◆ Barium enema exam (E)
- ◆ Hypotonic duodenography
- ◆ Barium double contrast study (E)
- ◆ Intravenous pyelography (E)
- ◆ Angiographic studies 1. Arterial 2. Venous.
- ◆ Myelographic studies
- ◆ Macroradiography studies
- ◆ M.M.R.
- ◆ Mammography
- ◆ Hystero-salpingography - HSG.
- ◆ **Note:** (E) Indicates practicals prescribed for University examination.

Text books recommended (Latest Edition)

V. R. Narayana, Sharma Strengthen your writing,
 Orient Longman, New Delhi.

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Fourth Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical Assessment

Scheme of Practical Examination for Fourth Semester

BRGS23				
Sr. No.	Practical	Practical	I A	Grand Total
1	Radiographic Technique – II	80 (Major 50 + Minor 30)	20	100

- ♦ **Radiation Quantities and Units Radiation-** Radioactivity- Sources of radiation - natural radioactive sources -cosmic ray terrestrial radiation - man made radiation sources. Units of radiation - Quality factor - Flux Fluence- Kerma- Exposure- Absorbed dose- Equivalent Dose- Weighting Factors- Effective Dose - Occupational Exposure Limits - Dose limits to public.
- ♦ **Biological Effects of radiation Ionization,** excitation and free radical formation, hydrolysis of water, action of radiation on cell -Chromosomal aberration and its application for the biological dosimetry- Effects of whole body and acute irradiation, dose fractionation, effects of ionizing radiation on each of major organ system including fetus -Somatic effects and hereditary effects- stochastic and deterministic effects- Acute exposure and chronic exposure- LD50 - factors affecting radiosensitivity. Biological effects of non-ionizing radiation like ultrasound, lasers, IR, UV and magnetic fields.
- ♦ **Radiation detection and Measurements:** Ionization of gases- Fluorescence and Phosphorescence -Effects on photographic emulsion. Ionization Chambers - proportional counters- G.M counters- scintillation detectors - liquid semiconductor detectors - Gamma ray spectrometer. Measuring systems - free air ionization chamber - thimble ion chamber - condenser chamber - Victorian electrometer - secondary standard dosimeters - film dosimeter - chemical dosimeter- thermoluminescent Dosimeter. -Pocket dosimeter- Radiation survey meter- wide range survey meter -zone monitor-contamination monitor - their principle function and uses. Advantages & disadvantages of various detectors & its appropriateness of different detectors for different type of radiation measurement.
- ♦ **Radiation protection:** Radiation protection of self and patient- Principles of radiation protection, time - distance and shielding, shielding - calculation and radiation survey - ALARA - personnel dosimeters (TLD and film badges)- Occupational exposure.
- ♦ **Q. A. in Diagnostic Radiology (Q.A),** acceptance testing and quality control tests in Radiology Meaning of the terms used and aspects of a QA programme, equipment and staff requirements, benefits of QA procedures in an imaging department -NABH guidelines. Verification of Optical & Radiation field congruence, Beam alignment, Focal spot size, Linearity of tube current mA and Timer, applied potential, HVT and total tube filter, Contact between film and intensifying screen, contrast resolution, Grid alignment, Special techniques like mammography, CT - CT Dose Modulation-Patient dose management.
- ♦ **Radiation Hazard evaluation** and control Philosophy of Radiation protection, effects of time, Distance & Shielding. Calculation of Work load, weekly calculated dose to radiation worker & General public Good work practice in Diagnostic Radiology. Planning consideration for radiology, including Use factor, occupancy factors, and different shielding material.
- ♦ **Regulatory Bodies & regulatory Requirements:** International Commission on Radiation Protection (ICRP) / National Regulatory body (AERB - Atomic Energy Regulatory Board) - Responsibilities, organization, Safety Standard, Codes and Guides, Responsibilities of licenses, registrants & employers and Enforcement of Regulatory requirements.

- ♦ **Role of Radiographer in Planning, Radiation Protection:** Role of technologist in radiology department - Personnel and area monitoring., Setting up of a new X-Ray unit, staff requirement, AERB specifications for site planning and mandatory guidelines - Planning of X-ray rooms- Registration of X-Ray equipment installation- Certification -Evaluation of workload versus radiation factors - Occupational exposure and protection Tools/devices. ICRP, NRPB, NCRP and WHO guidelines for radiation protection, pregnancy and radiation protection.

PRACTICAL 3: BRGS24

Quality Control, Radiobiology and Radiation Safety in Radio diagnosis/Imaging

Practical Exam:

1. CT protection & quality
2. TLD badge & its significance
3. Lead collar & lead apparatus
4. Leakage in CT room
5. AERB guidelines

BRGS24

	Practical	Practical	IA	Grand Total
Practical 3	Quality Control, Radiobiology and Radiation Safety	80 (Major 50 + Minor 30)	20	100

Reference books:

1. Radiologic science for technologist by Stewart Carlyle Bushong,
2. Text Book of Radiological Safety by K. Thaylan.
3. Quality Control in Diagnostic Imaging J.E.Gray.

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- Unit I** a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution.
- Unit II** The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions.
- Unit III** Fundamental Rights and Duties - Their content and significance
- Unit IV** Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.
- Unit V** Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities
- Unit VI** Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.
- Unit VII** The Election Commission and State Public Service Commissions.
- Unit VIII** Method of amending the Constitution.
- Unit IX** Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.
- Unit X** Constitution and Sustainable Development in India.

- Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)
2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)
3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)
4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/mpi/files/coi_part_full.pdf
5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015
6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04
Research Methodology & Bioethics

Theory: 30 Hours

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.
10. Health Education Methods and Media
 - **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
 - Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
 - Preparation of selected health education media in classroom and field setting:
 - poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
 - Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BRGS25	Imaging Technique – USG	02			02
2	BRGS26	Imaging Technique- CT	02			02
3	BRGS27	Imaging Technique MRI	02			02
4	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
5	BRGS28	Imaging Technique – USG		02	02	04
6	BRGS29	Imaging Technique- CT		02	02	04
7	BRGS30	Imaging Technique MRI		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER

Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BRGS25	Paper 1	Imaging Technique – USG	60 + 20+20	100
2	BRGS26	Paper 2	Imaging Technique- CT	60 + 20+20	100
3	BATS27	Paper 3	Imaging Technique MRI	60 + 20+20	100
4	ELS05	Paper 4	Elective Subject : (Hospital Administration/ Disaster Management)	80 + 20	100
Grand total					400

Sr. No.	Subject Code	Practical	Practical Marks	IA	Grand Total
5	BRGS28	Imaging Technique – USG	80	20	100
6	BRGS29	Imaging Technique- CT	80	20	100
7	BRGS30	Imaging Technique MRI	80	20	100
Grand total					300

PAPER 1: BRGS25
Imaging Technique

ULTRASOUND IMAGING:

History

Ultrasound characteristics -

- Nature,
- Propagation,
- Frequency,
- Wavelength,
- Velocity,
- Amplitude intensity,
- Acoustic Impedance,
- Reflection,
- Refraction
- Interference with media,
- Interface,
- Attenuation.

Transducer

- Construction and operation
- Types
- Beams and focusing
- Resolution

Piezoelectric effects

- Definition
- Types of elements
- Properties
- Use

Transducers

- Construction and operation
- Types
- Beams and focusing
- Resolution

USG display

- A mode
- B mode
- M mode
- TM mode
- Gray scale imaging
- Time gain compensator

Doppler

- Principle
- Doppler effect
- Flow

Instrumentation

- Color Doppler

- Continuous wave Doppler
- Pulse wave Doppler

Artifacts

- Definition
- Types
- Causes
- Remedies

Performance and safety

- Performance measurement
- Bio effects
- Safety

Practical aspect

- Scanning artifacts
- Indications
- Patient preparation
- Positioning
- Knowledge of all USG guided procedures

Basic diagnostic aspects.

Documentation

Safety consideration - effects of heating, cavitation.

Quality assurance -

- Phantoms,
- Performance,
- Accuracy,
- Sensitivity,
- Spatial resolution tests.

PRACTICAL 1: BRGS28

Imaging Technique USG

- USG protocols
- USG display
- A mode
- B mode
- M mode
- TM mode
- Gray scale imaging
- Time gain compensator

Doppler

- Principle
- Doppler effect
- Flow

Instrumentation

- Color Doppler

- Continuous wave Doppler
- Pulse wave Doppler

Artifacts

- Definition
- Types
- Causes
- Remedies

F Form

- Importance of F form
- contents in F forms

TEXT BOOKS RECOMMENDED (Latest Edition)

- Roger C. Saunders : Clinical Sonography : A practical guide (Little Brown & Company)
- PES Palmer : Manual of Diagnostic Ultrasound (WHO)
- Sandra L Hagen Ansert : Text book of Diagnostic Ultrasonography (BI Publications).
- Rehani : Diagnostic Imaging - Quality Assurance.

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Fifth Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Maxi. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

BRGS28

Sl. No.	Practical	Practical	IA	Grand Total
Practical 1	Imaging Technique USG	80 (Major 50 + Minor)	20	100

		30)		
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PAPER 2: BRGS26
Imaging Technique- CT

CT Scan systems

12hrs

- a. History of CT and Hounsfield Units
- b. Generations of scanners: Evolution from single slice to helical/spiral & multi slice CT
- c. Image quality, methods of image reconstruction,
- d. Radiation dose measurements and technical aspects of Q.A - calibration and image acquisition, Radiation safety in CT.
- e. CT artefacts.

CT scan protocols, techniques

12hrs

- a. CT terminology: Window width and window level, Pitch, Slice thickness.
- b. CT scan studies acquisition/ protocols /techniques: CT of brain, head and neck, PNS, thorax & abdomen, extremities, spine & CT angiogram: Brief overview of anatomy, clinical indications and contraindications, patient preparation, Contrast media-types, dose, injection technique; timing, sequence, image display, patient care.
- c. Post processing Techniques like MIP, MPVR, Virtual endoscopy & bronchoscopy, TLVR and others.
- d. Paediatric CT: Principles of dose reduction.

PRACTICAL 2: BRGS29
Imaging Technique CT

Practical Exam:

1. **CT instruments**
2. **Interventional C. T. guided procedures**

Image quality

- Qualities
- Resolution
- Contrast
- Sharpness

Documentation

- Role of CT technologist in documentation
- Documentation of information about patient care

Safety consideration

- Staff safety

- Patient safety
- Universal precautions

Cross sectional anatomy

- Head
- Neck
- Abdomen
- Thorax
- Extremities

Quality Assurance

Reference Books

1. Text Book of Radiology for Residents & Technicians by Satish K. Bhargava.
2. Computed Tomography for Technologists by Lois E. Romans
3. Computed Tomography: Physical Principles, Clinical Applications and quality control by Euclid Seeram.

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Fifth Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 2: BRGS29

Sl. No.	Practical	Practical	IA	Grand Total
Practical 2	Imaging Technique CT	80 (Major 50 + Minor 30)	20	100

PAPER 3: BRGS27
Physics and Hardware of MRI

Unit I

Basic Physics and Historical aspects **10hrs**

- a. Electricity and Magnetism
- b. Nuclear Magnetism, Basic physical principles of NMR signals.
- c. History of MRI.

Unit II

The MR image **10hrs**

- a. Principles of Image acquisition and formation: Precession - Larmour frequency, Radiofrequency pulse, T1 and T2 relaxation times, Fourier transformation.
- b. Basic MR Sequences: T1 and T2 sequences.
- c. Advantages of MRI over CT.

Unit III

The Imaging System **14hrs**

- a. Instrumentation and Installation: Magnet system; Types of magnets and strengths, Open and Closed MR systems, Safety, Shimming - Shim coils, Quench, Faraday Cage.
- b. Radiofrequency, RF coils
- c. Gradient Coils: Slice Selection, Phase and Frequency Encoding.
- d. Surface coils.

Unit IV

MR Sequences and their Acquisition. **14hrs**

- a. Basic MR Spin Echo sequences: T1 and T2 sequences.
- b. Proton density, Inversion Recovery, Gradient Echo.

Unit V

Implications of MRI **12hrs**

- a. Safety issues in MRI
- b. Biological effects of MRI
- c. Artefacts in MRI and Contraindications in MRI.

Reference text books:

1. MRI physical and biological principles by Stewart Bushong.
2. MRI for technologists by Peggy Woodward.
3. Text Book of Radiology for Residents & Technicians by Satish K. Bhargava

IMAGING SEQUENCES AND ADVANCES IN MRI

Unit I

Imaging Sequences and Protocols in Neuroimaging

12hrs

- a. Patient preparation, positioning, slice selection and sequences.
- b. Clinical indications and contraindications for the same.
- c. MR Spectroscopy, Diffusion Weighted MRI, Diffusion Tensor Imaging.

Unit II

Imaging Sequences and Protocols in Abdomen Imaging

12hrs

- a. Patient preparation, positioning, slice selection and sequences.
- b. Clinical indications and contraindications for the same.
- c. MR Cholangiopancreatography.

Unit III

Imaging Sequences and Protocols in Spine Imaging & Extremities

12hrs

- a. Patient preparation, positioning, slice selection and sequences.
- b. Clinical indications and contraindications for the same.
- c. MR Myelography.
- d. Post-operative & Trauma spine imaging.

Unit IV

MR Angiography and Venography

12hrs

- a. Patient preparation, positioning, slice selection and sequences, indications.
- b. MR angiography & venography.

Unit V

Recent Advances and Contrast Media in MRI

12hrs

- a. Types of Contrast Media, dosage of Gadolinium, Indications and Contraindications.
- b. Side effects: Nephrogenic systemic fibrosis.
- c. MR mammography.
- d. MR elastography.

PRACTICAL 3: BRGS30 **Imaging Technique MRI**

Practical Exam:

1. MRI precautions

Reference text books:

1. MRI Made Easy for Beginners - Govind B. Chavhan.
2. CT & MRI Protocol - Satish K. Bhargava, CBS publishers.
3. Text Book of Radiology for Residents & Technicians by Satish K. Bhargava

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Fifth Semester:

Theory Total 60 marks

Duration 180 minutes

No.	Question	Question asked	Question to attempt	Marks	Maxi. Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20	20	20	100
2.	Short Essay Question	5	5	5 x 5	25			
3.	Short Answers	5	5	5 x 3	15			

Sl. No.	Practical	Practical	IA	Grand Total
Practical 3	Imaging Technique MRI	80 (Major 50 + Minor 30)	20	100

Disaster & Emergency Management**A. Introduction to Disaster management**

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management**C. Modern disaster management – disaster cycle****D. Hazards**

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning

-stages

-Basic elements

ELS05

30 Hours

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BRGS31	Nuclear Medicine (NM)	03			03
2	BRGS32	Biomedical Research and Medical Ethics in Radiology	03			03
3	ELS06	Elective Subject : Digital Subtraction Angiography / Interventional Radiology	02			02
4	BRGS33	Nuclear Medicine (NM)		4	2	06
5	BRGS34	Biomedical Research and Medical Ethics in Radiology		4	2	06
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER

Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory+ IA + Viva Voce	Total
1	BRGS31	Paper 1	Nuclear Medicine (NM)	60 + 20 + 20	100
2	BRGS32	Paper 2	Biomedical Research and Medical Ethics in Radiology	60 + 20 + 20	100
3	ELS06	Paper 3	Digital Subtraction Angiography / Interventional Radiology	80 + 20	100
Grand Total					300

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
4	BRGS33	Practical 1	Nuclear medicine (NM)	160+40	200
5	BRGS34	Practical 2	Biomedical research and Medical Ethics in Radiology	160+40	200
Grand Total					400

PAPER 1: BRGS31
NUCLEAR MEDICINE IMAGING:

History

Radioactivity

- ♦ The periodic Table. Radioactivity,
- ♦ Properties of alpha, beta, gamma radiation,
- ♦ Radioactive transformation process (Radioactive displacement law),
- ♦ Radioactive decay (Radioactive disintegration law),
- ♦ Decay constant, half-life,
- ♦ Units of radioactivity,
- ♦ Artificial radioactivity or induced radioactivity (Production of artificial radioactive isotopes), the uses of radioactive nuclides in medicine.
 - Isotopes and Radionuclides
 - Production of Radionuclides
 - Radio activity
 - Radioactive transformations
 - Specific activity
 - Radiopharmaceuticals and their preparation
 - Precautions while handling radiopharmaceuticals
 - Principles of tracer techniques
 - Instrumentation
 - Multihole collimator,
 - Crystal,
 - Photomultiplier,
 - Computer,
 - Monitor.
 - Scanning technique
 - Resolution - spatial temporal
 - Gamma camera
 - Rectilinear scanner.
 - Position Emission Tomography (PET)
 - Single photon emission computed Tomography (SPECT)
 - Radio Immuno Assay (RIA)
 - Documentation
 - Safety considerations - Radiation dose Quality Assurance.

PRACTICAL1:BRGS33
Nuclear medicine (NM)

- Scanning technique
- Gamma camera
- Rectilinear scanner.
- Position Emission Tomography (PET)
- Single photon emission computed Tomography (SPECT)
- DTPA
- DMSA
- HIDA
- DROTA TEC

TEXT BOOKS RECOMMENDED (Latest Edition)

- ♦ R. F. Farr & P. J. Allisy : Physics for medical Imaging , Publication: W.B.Saunders.
- ♦ D. N. Chesney & M. O. Chesney : X-ray equipment for student Radiographers, S. publication, Blackwell Scientific.
- ♦ Christensen, Curry & Dowdey : An introduction of Physics to Diagnostic Radiography, Lea & Febiger, Williams Wilkisons.
- ♦ Cullinan : Illustrated guide techniques (Blackwell)
- ♦ Jamdrell, Thompson & Ashworth : X-ray physics and equipment (Blackwell)
- ♦ Adrian K. Dixon : Body C. T. - A handbook (Churchill Livingstone)
- ♦ John M. Stevens, Alan R. Valentine & Brian E. Kendall : Computed cranial & spinal Imaging (Williams & Wilkins)
- ♦ John R. Haaga, Charles F. Lanzion, David J. Sartoris & Elias A. Aershouni : Computerised Tomography and magnetic Resonance Imaging of the whole body (vol.I&vol.II), W.B.Saunders,
- ♦ Philip T. English & Christine Moore : MRI for Radiographers (Springer).
- ♦ Pablo R. Ros & W. Dean Bidgood : Abdominal Magnetic Resonance imaging (Mosby)
- ♦ Roger C. Saunders : Clinical Sonography : A practical guide (little Brown & Company)
- ♦ PES Palmer : Manual of Diagnostic Ultrasound (WHO)
- ♦ Sandra L Hagen Ansert : Text book of Diagnostic Ultrasonography (BI Publications).
- ♦ Rehani : Diagnostic Imaging - Quality Assurance.

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Sixth Semester:

Theory Total 60 marks

Duration 180 minutes

Sr. No.	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20		20	100
2	Short Essay Question	5	5	5 X 5	25	20		
3.	Short Answers	5	5	5 x 3	15			

Practical 1: BRGS33

Sl. No.	Practical	Practical	IA	Grand Total
1	Nuclear Medicine	160 (Major 100 + Minor 60)	40	200

Paper 2: BRGS32
Biostatistics and Research Methodology

Learning Objectives

1. To have a basic knowledge of biostatistics and its applications in medicine
2. To know various types of data presentation and data summarization in Medical field
3. To have overview of data analysis and sampling techniques
4. To understand various study designs in Medical field
5. To know applications of various study designs in Medical Research

Biostatistics

Unit I

Introduction and Presentation of data

Meaning, Branches of Statistics, Uses of statistics in medicine, Basic concepts, Scales of measurement, Collection of data, Presentation of data; Tabulation, Frequency Distribution, Diagrammatic and Graphical Representation of Data.

Unit II

Measures of central tendency and Measures of Variation

Arithmetic Mean (Mean), Median, Mode, Partition values, Range, Interquartile range , Mean Deviation, Standard Deviation, Coefficient of Variation.

Unit III

Probability and standard distributions

Definition of some terms commonly encountered in probability, Probability distributions; Binomial distribution, Poisson distribution, Normal distribution, Divergence from normality; Skewness and kurtosis

Unit IV

Census and Sampling Methods

Census and sample survey, Common terms used in sampling theory, Non-probability (Non-random) Sampling Methods; Convenience sampling, Consecutive Sampling, Quota sampling, Snowball sampling, Judgmental sampling or Purposive sampling, Volunteer sampling, Probability (Random) Sampling methods; Simple random sampling, Systematic Sampling, Stratified Sampling, Cluster sampling, Multi-stage sampling, Sampling error, Non-sampling error.

Unit V

Inferential statistics

Parameter and statistic, Estimation of parameters; Point estimation, Interval Estimation, Testing of hypothesis; Null and alternative hypotheses, Type-I and Type-II Errors.

Research Methodology

Unit I

Introduction to research methodology

Types of research; Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, Some Other Types of Research

Unit II

Study Designs-Observational Studies

Epidemiological study designs; Observational studies, Descriptive studies; Case reports, Case series, Analytical studies; Case control studies, Cohort studies, Cross sectional

Unit III

Experimental Studies

Experimental studies (Interventional studies); Randomized control trials (Clinical trials), Field trials, Community trials, Nm - Randomized trials

Unit IV

Uses of Epidemiology

Unit V

Application of study Designs in Medical Research

References

1. K.R.Sundaram, S.N.Dwivedi and V Sreenivas (2010), Medical statistics, Principles and Methods, BI Publications Pvt Ltd, New Delhi
2. NSN Rao and NS Murthy (2008), Applied Statistics in Health Sciences, Second Edition, Jaypee Brothers Medical Publishers (P) Ltd.
3. J.V.Dixit and L.B.Suryavanshi (1996), Principles and practice of biostatistics, First Edition, M/S Banarsidas Bhanot Publishers.
4. GetuDegu and Fasil Tessema (2005), Biostatistics, Ethiopia Public Health Training Initiative.
5. Essentials of Community Medicine for Allied Health Sciences, JSS University Publications, 20.
6. Park K. Park's Textbook of Preventive and Social Medicine. 23rd ed. Jabalpur: Banarsidas Bhanot Publishers, 2015. p.135-141.
7. Suryakantha. Textbook of Community medicine with recent advances. 4th edition.
8. Bhalwar R. Textbook of Public Health and Community Medicine. 2nd Edition. Pune, Department of Community Medicine AFMC, 2012.
9. Leon Gordis. Epidemiology Fourth Edition - Elsevier Saunders Publication.

Medical Ethics in Radiology

Theory 45 Hours

- **Patient Care:**

- ♦ Patient vital signs - temperature, pulse, respiration and blood pressure - normal values and methods of taking and recording them.
- ♦ Development of communication skills with patient- general comfort and reassurance to the patient-patient education and explaining about the study-drugs used in the preparation of the patient.
- ♦ Handling of an unconscious patient-shifting of patients-hazards of lifting and

maneuvering patients - rules for correct lifting- transfer from chair/wheel chair or trolley to couch and vice-versa - safety of patient and worker while lifting & shifting of patients-

- ◆ handling of geriatric, pediatric and trauma patients
- ◆ handling female patients-pregnant women.
- ◆ Communicable diseases-hygiene in the department-cross infection and preventionhandling
- of infectious patients in the department -application of asepsis.
- ◆ Ethics of medical practice- Radiography professionalism-essential qualities of the radiographer-improving professional and personal qualities- Radiographer as a part of Hospital /Organization-responsibilities. Medico-legal considerations - radiographers clinical and ethical responsibilities- misconduct and malpractice.

• **Principles of Medical Emergencies:**

- ◆ Trauma care & Emergency Radiography: procedures in the event of an accident-
- ◆ Special positioning procedures & projections -
- ◆ modification of techniques needed for seriously injured patients.
- ◆ Radiographic factors - patient care & responsibilities
- ◆ Search of profession confidence-maintenance decorum of the job responsibility
- ◆ The importance of records maintenance.
- ◆ Fluoroscopy and its application in emergency radiology -
- ◆ Medico legal aspects of the radiographers work.
- ◆ Common medical emergencies-helping in first aids & zero hour care / know to help in critical hour care
- ◆ Trauma patients handling - trauma ward bed X-rays - mass casualty managementsselection of study / procedures & radiographic views.
- ◆ Knowing the emergency care places in the hospital & preplanning- checking & readiness of mobile units in functioning status -screening of the high risk patients in various procedure-
- ◆ supportive facilities to encounter emergency-practical training.

Reference Books:

1. Notes on Radiological Emergencies - Ansell and Churchill
2. Care of patient in diagnostic Radiography - Chesney & Chesney.
3. First Aid - Haugher and Gardner. 4. Practical Nursing and First Aid - Ross and Wilson.

Scheme of examination

Type of questions and distribution of marks for Theory examination in each subject in Sixth Semester:

Theory Total 60 marks

Duration 180 minutes

Sr. No.	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	2	2 x 10	20			
2	Short Essay Question	5	5	5 X 5	25	20		

3.	Short Answers	5	5	5 x 3	15		20	100
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Practical 2 **BRGS34**

Sl. No.	Practical	Practical	IA	Grand Total
1	Biomedical research and Medical Ethics in Radiology	160 (Major 100 + Minor 60)	40	200

ELS06 – DIGITAL SUBTRACTION ANGIOGRAPHY

Unit – I

Equipment

- a. Equipment Basics, Types of equipment (Single plane and biplane systems) & Imaging techniques revisited.
- b. Infections control, checking & readiness of mobile units & supportive facilities to encounter emergency – practical training.

Unit – II

Radiography

- a. Principles of catheter angiography: History and Evolution.
- b. Special positioning procedures & projections.
- c. Selection of study / procedures & Radiographic views.

ELS06– INTERVENTIONAL RADIOLOGY

Equipments

- a. Basics
- b. Types of Equipments
- c. Sterilisation of equipment

Principles

- a. Basics of vascular & Non – Vascular intervention
- b. Various imaging modalities used.

Reference books:

1. Text Book of Radiology for residents & Technicians by Satish K. Bhargava.
2. The Essential Physics of Medical Imaging by Bushberg JT, 2nd Ed.

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in all the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.
- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass
 - a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
 - b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
 - c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
 - d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to Semester Grade Point Average (SGPA):

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA / No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the First year subjects shall have Postgraduate degree in the respective subject with 3 years teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Cardiac Care Technology Degree Course (Semester System)

Syllabus/Curriculum 2023 - 24



Accredited '**A+**' Grade by **NAAC** (3rd Cycle)
Placed in '**A**' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research (Deemed-to-be-University)

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry/organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth.
- To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of lifelong learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the SevenStars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

Notification

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B.Sc. CARDIAC CARE TECHNOLOGY

PREAMBLE

The B.Sc. Cardiac Care Technology Course is of **3 years (6 semesters) and 1 year internship** duration program aimed at training the young graduates in the technological aspects of cardiac care with a good scientific foundation. These students will be in a position to competently assist the Cardiologist, in procedures Echocardiography, Holter monitoring, ECG, TMT, Cath Lab procedures etc. They will be in demand both within the country and outside as Allied Health Care personnel. With advanced training in the latest technologies in Cardiology specialty, these graduates will play an important role in determining the quality of health care provided.

OBJECTIVE

The course shall be called Bachelor of Science in Cardiac Care Technology.

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – Cardiac Care Technology Course shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

II. DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory Rotatory internship.

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Applied Pharmacology	80+20	Cardiology Practical	120+30
		Cardiology	60 + 20 + 20	Basics of Cardiac Technology Practical	120+30
		Basics of Cardiac Technology	60 + 20 + 20		
4.	4th Semester	Applied Pharmacology	80+20	Electrocardiography	120+30
		Electrocardiography I	60 + 20 + 20	Cardiac catheterization	120+30
		Cardiac Catheterization	60 + 20 + 20		

Third Year					
5.	5th Semester	Electrocardiography II	60 + 20 + 20	Electrocardiography II	120+30
		Echocardiography	60 + 20 + 20	Echocardiography	120+30
		Interventional Cardiology	60 + 20 + 20		
6.	6th Semester	ECG & ECHO	60 + 20 + 20	(ECG + Therapeutic Cath.)	160+40
		Cardiac Catheterization	60 + 20 + 20	Echocardiography	160+40
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Stress Testing (TMT)	
		2. Recent Advances in Cardiology	

Compulsory Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: **Total No. of SGPA /No. of Semester**

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	CCTS01	Human Anatomy	02		02
2	CCTS02(A)	Human Physiology	02		02
	CCTS02(B)	Basics of Biochemistry	02		02
3	CCTS03(A)	Pathology : Basic Hematology	02		02
	CCTS03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	CCTS04	Human Anatomy		02	02
6	CCTS05 (A)	Human Physiology		02	02
	CCTS05(B)	Basics of Biochemistry		02	02
7	CCTS06(A)	Pathology : Basic Hematology		02	02
	CCTS06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	CCTS01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	CCTS02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	CCTS03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	CCTS04	Practical 1	Human Anatomy	80 + 20	100
6	CCTS05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	CCTS06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief

Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: CCTS04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of different parts of Brain & Spinal Cord

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code CCTS04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks**Suggested Readings:**

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: CCTS02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions
Classification of Body fluid compartments & composition, Homeostasis
Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis

Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - CCTS05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry
- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting

- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: CCTS02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

- a. Definition, Classification and biological importance.
- b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

- a. Definition, Classification and biological importance.
- b. Simple lipids: Triacylglycerol and waxes-composition and functions.
- c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins :
Composition and functions.
- d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

- a. Amino acids: Classification, properties, side chains of amino acids.
- b. Protein: Definitions, Classifications and functions.
- c. Peptides: Biologically active peptides
- d. Overview of Structural organization of proteins.
- e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

- b) DNA Structure and function
- c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: CCTS05

Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and	Total
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		Marks	
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks 40 Marks
IA Marks: 10 Marks
Grand Total 50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

Semester I

PAPER 3 - CCTS03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Bookseller, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: CCTS06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count

9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergrens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrobes Tube
7	Westergrens Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- CCTS03 Section B – Microbiology

Theory 30 Hours

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.
- **Microscopy:** - Introduction and history - Types of microscopes
(a) Light microscope

- (b) Dark ground Microscope
- (c) Fluorescent Microscope
- (d) Phase contrast Microscope
- (e) Electron microscope:

-Principles and operational mechanisms of various types of microscopes

- **Classification and Morphology of Bacteria.**
- **Physiology of Bacteria**
- **Sterilization:** - Definition -- Types and principle of sterilization methods.

(a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration.

Efficiency testing to various sterilizers.

(b) Chemical methods

Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.

- **Antibiotics and drug resistance**
- **Bacterial genetics and mechanisms of Bacterial gene transfer.**
- **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: CCTS06 Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes
- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram

Stain=15Marks

ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur
- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	CCTS07	Anatomy	02		02
2	CCTS08(A)	Physiology	02		02
	CCTS08(B)	Biochemistry	02		02
3	CCTS09(A)	Hematology & Clinical Pathology	02		02
	CCTS09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	CCTS10	Human Anatomy		02	02
6	CCTS11(A)	Human Physiology		02	02
	CCTS11(B)	Basics of Biochemistry		02	02
7	CCTS12 (A)	Hematology & Clinical Pathology		02	02
	CCTS12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	CCTS07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	CCTS08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	CCTS09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	CCTS10	Practical 1	Human Anatomy	80 + 20	100
6	CCTS11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	CCTS12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - CCTS10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – CCTS08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – CCTS11 Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: CCTS08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism
Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle
Protein Metabolism- General Reactions of amino acids and Urea cycle
Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: CCTS11
Basics of Biochemistry II

Practical : 30 Hours

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and	Total
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		Marks	
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical 40 Marks
 IA Marks: 10 Marks
Grand Total 50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: CCTS09

Theory : 30 Hours

Section A - Haematology & Clinical Pathology

Hematology

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No .	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl . No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London

5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: CCTS12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I.HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: CCTS09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
- Immunology
 - a) Introduction
 - b) Immunity

- c) Antigens.
- d) Antibodies – Structure and function.
- e) Complement
- f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker’s Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr.C.P.Baveja.

PRACTICAL 3: CCTS12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy

- Youth development programmes at the National level, State level and voluntary sector
Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking
- Self Confidence and Self esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CCTS13	Applied Pharmacology	02			02
2	CCTS14	Cardiology	02			02
3	CCTS15	Basics of Cardiac Technology	02			02
4	AECC01	AECC: Environmental Studies	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	CCTS16	Cardiology Practical		03	02	05
7	CCTS17	Basics of Cardiac Technology Practical		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER
Scheme of Examination:

Sl. No.	Subject Code	Examination	Subjects	Max. + IA + Viva	Grand Total
1	CCTS13	Paper 1	Applied Pharmacology	80+20 (No Viva Voce)	100
2	CCTS14	Paper 2	Cardiology	60 + 20 + 20	100
3	CCTS15	Paper 3	Basics of Cardiac Technology	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	CCTS16	Practical 1	Cardiology Practical	120 + 30	150
7	CCTS17	Practical 2	Basics of Cardiac Technology Practical	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject in Third Semester

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2.	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code CCTS018 and CCTS019:

(Cardiology Practical & Basics of Cardiac Technology Practical)

Marks	University Exam + + IA	Total marks
Practical I Cardiology	120+ 30	150
Practical II Basics of Cardiac Technology	120 + 30	150

SEMESTER III

PAPER 1: CCTS13

APPLIED PHARMACOLOGY

PHARMACOLOGY

THEORY

30 hours

This course introduces the students to basic pharmacology of common drugs used and their importance in different treatments.

Units	Contents	30 Hours
1	General Pharmacology: Principles of drug administration and routes of administration, absorption distribution, metabolism and excretion of drugs and Mechanisms of drug action (various ways in which they act) Factors influencing drug action. Adverse drug reactions	08
Enumeration of drugs, uses and adverse effects of the following drugs:		
2	Drugs acting on autonomic nervous system: Cholinergics, anticholinergics, adrenergics and antiadrenergics	05
3.	Skeletal Muscle Relaxants: Drugs acting at neuromuscular junction and other muscle relaxants.	01
3	Analgesics NSAIDs and opioid analgesics.	02
4.	Drugs acting on renal system: Diuretics	01
5.	Drugs acting on the Cardiovascular System Drugs acting on renin angiotensin system Antianginal drugs Drugs used in heart failure Antihypertensives Antiarrhythmic drugs	05
7.	Chemotherapy of infections: Introduction to antimicrobials Sulfonamides, penicillins, cephalosporins, fluoroquinolones, aminoglycosides, macrolides, antitubercular drugs and anti HIV drugs.	08

Scheme of Examination:

Sl.No.	Questions	Questions asked	Questions to attempt	Marks	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2x10	20	100
2	Short Essay Questions	7	6	6x5		
3	Short Answer Questions	10	10	10x3		

Duration: 3 Hours

No Practical Examination

Recommended Text Books (Latest Edition)

Sl. no	Author	Name of the text	Publication
1.	K.D. Tripathi	Essentials of Medical Pharmacology	Jaypee brothers medical publishers pvt. Ltd
2	R.S. Satoskar, S.D. Bhandarkar, Nirmala N. Rege	Pharmacology and Pharmacotherapeutics	Popular Prakashan
3	Laurence and Bennett	Clinical Pharmacology	Churchill Livingstone
4	Bertram G. Katzung	Basic and Clinical Pharmacology	McGraw hill
5	Goodman & Gilman's	The Pharmacological Basis of Therapeutics	McGraw Hill publications
6	Rang H P & Dale M M	Pharmacology	Churchill Livingstone

PAPER 2: CCTS14

Theory 45 Hours

CARDIOLOGY

- I. Prevalence, causes and prevention of cardiovascular diseases : a) IHD b) RHD C) Hypertension
d) CHD
- II. Heart failure: Causes, Types, symptoms and signs, diagnosis, management, prevention.
- III. Arrhythmias: Brady and Tachyarrhythmia's, causes, diagnosis and management.
- IV. Atherosclerosis: Definition, risk factors, pathogenesis, Clinical significance and prevention.
- V. Coronary artery disease: Types, Causes, Symptoms and signs, diagnosis, investigations, management, complications.
- VI. Hypertension: Definition, causes, signs and symptoms, diagnosis, evaluation, management.
- VII. Pulmonary Hypertension: Definition, Causes, diagnosis and treatment.
- VIII. Rheumatic fever, Rheumatic Heart disease, Mitral valve and aortic valve disease. Infective endocarditis.
- IX. Congenital Heart Diseases: Common CHD, Diagnosis and management ASD, VSD, PDA, PS, AS, Coarctation of aorta, Dextrocardia.
- X. Cardiomyopathies: Dilated Cardiomyopathy, Hypertrophic Cardiomyopathy, Restrictive Cardiomyopathy
- XI. Pericardial diseases: Acute Pericarditis, Pericardial effusion, Pericardial tamponade. Chronic constrictive pericarditis.
- XII. Peripheral vascular diseases
- XIII. Anaemia
- XIV Chronic obstructive Lung disease
- XV. Acute and chronic renal failure
- XVI. Fluid therapy, Central venous lines. Interpretation of Investigation reports.
- XVII. Basics of 64 slice CT angio, CT and MRI.

Marks	University Exam + Viva Voce + IA	Total marks
Paper II Cardiology (Theory)	60+20+20	100
Cardiology (Practical)	120 + 30 (No viva voce)	150

PAPER 3: CCTS15

Theory 45 Hours

BASICS OF CARDIAC TECHNOLOGY

1) Medical ethics & the relevant medico legal aspects.

- Responsibilities and duties
- Ethical behavior & conduct
- Medico legal aspects & its relation to consumer protection act

2) Basics of computer application

- Basic structure of computers
- Micro processors in computers
- Principles of programming
- Principles of computer application in various fields
- Data processing

3) Basics of medical statistics

- Common statistical terms
- Sources and presentation of data
- Measures of location –average and percentiles
- Measures of central tendency and dispersion
- Normal distribution and normal curve
- Sampling and probability
- Sampling variability and its significance
- Significance of difference in mean

- Chi –square test
- Designing and methodology of an experiment of a study
- Representation of data as tables and graphs
- Demography of vital statistics
- Standard deviation
- P value and its significance , -Recording of data and maintenance of records.

4) Biomedical waste & its management.

5) Cardiopulmonary resuscitation –Basic cardiac life support

- Advanced cardiac life support

6) Intensive coronary unit & recovery room concepts

7) Electricity & electro medical equipments & their safe guards

-Basics of electricity & functioning of electro medical equipments. Earthing & care of apparatus. Static electricity.

8) Basic principles of blood transfusion & fluid therapy

* Sterilization-Materials & methods.

* Preparation of Scientific paper and presentation

9) ECG

i) Basic principles of ECG The Electrocardiographic paper

The Electrocardiograph

The Electrical field of Heart

The leads. standard limb lead, Precordial lead, ‘V’ lead & ‘ AV’ lead

Basic ECG deflections.

ii) Normal ECG

The ‘P’ wave

The ‘QRS’ complex

T wave, the S-T segment, P-R segment

The 'U' wave

Rate & rhythm

Rotation of the heart, The Q-T interval.

iii) The Electrical axis

iv) Precordial pattern of ECG

v) Chamber enlargement-atrial enlargement, LV hypertrophy & RV hypertrophy

10. Echocardiography

- * Basic principles of ultrasound
- * M-Mode Echocardiography
- * Two dimensional Echocardiography
- * Doppler Echocardiography, colour flow
- * Trans esophageal Echocardiography

11. Instrumentation:

- * Basic pulse Echo system
- * Transducers
- * Pulse generation
- * Echo detection
- * Echo displays
- * A mode, B mode, M-mode
- * Display & recording

12. Echocardiographic Examination:

- * Selecting transducers
- * Position of the patient
- * Placement of the transducer
- * Setting control

* M-Mode labelling

* 2 D Echo

* Normal variants

*Terminology

*Identification of segments

13. Doppler Echocardiography

a. Introduction to Doppler colour Echocardiography

The Doppler principles

Doppler ultrasound techniques

Colour Doppler flow imaging

Clinical application of Doppler Echocardiography

b. Physical principles & instrumentation in spectral & color Doppler flow imaging.

c. Physical principles and Doppler effect. The Doppler echocardiography system display.

d. Blood flow pattern-Laminar & non-laminar flow.

e. Doppler echo cardiograph modes

* Continuous wave Doppler frequency

* Pulsed Doppler system

* High pulse repetition frequency

*Problems of color- imaging

14. Contrast Echo

15. Echo measurements - 'ASE' recommendation.

Marks	University Exam + Viva Voce +	Total marks
	IA	
Paper III	Basics of Cardiac	60+20+20
		100

Technology (Theory)

Paper IV Basics of Cardiac 120 + 30 (No viva voce) 150

Technology (Practical)

Practical 1: CCT16
Cardiology

Practical: 75 hours

Practical 2: CCT17

Practical: 75 hours

Basics of Cardiac Technology

PRACTICAL EXAMINATION FOR CARDIOLOGY & BASICS OF CARDIAC TECHNOLOGY WILL BE CONDUCTED TOGETHER.

Spotters (8 Echo spotters + Echo views) = 120marks

Internal Assessment marks = 30marks

Viva Voce examination marks

(Marks included in theory) = 20marks

AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water

- logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
 - f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
 - g) Role of an individual in conservation of natural resources.
 - h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution

- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

♦ Long Essay 2 X 10 = 20

♦ Short Essay 8 X 5 = 40

♦ Short Answers 5 X 4 = 20

B. Field Work: 20 Marks**Recommended Books:**

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

ELS03

Theory: 30 Hours

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
 - Uses and application of bio-statistics in public health research and medical sciences.
 - Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
 - Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
 - Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
 - Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
 - Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.
- Basic Probability : Concept of probability, its terminology and different types of definition
- Laws of probability: addition law, multiplication law and conditional probability.

ELS03 : Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CCTS18	Applied Pharmacology	02			02
2	CCTS19	Electrocardiography I	02			02
3	CCTS20	Cardiac Catheterization	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject: (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	CCTS21	Electrocardiography		03	02	05
7	CCTS22	Cardiac catheterization		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks = 1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	CCTS18	Paper 1	Applied Pharmacology	80 + 20 (No viva voce)	100
2	CCTS19	Paper 2	Electrocardiography I	60 + 20 + 20	100
3	CCTS20	Paper 3	Cardiac Catheterization	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	CCTS21	Practical 1	Electrocardiography	120 + 30	150
7	CCTS22	Practical 2	Cardiac catheterization	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject in Fourth Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Semester IV

**PAPER 1:CCTS18
APPLIED PHARMACOLOGY**

Theory 30 Hours

PHARMACOLOGY

THEORY

30 hours

This course introduces the students to basic pharmacology of common drugs used and their importance in different treatments.

Units	Contents	30 Hours
Enumeration of drugs, uses and adverse effects of the following drugs:		
1	Antihistaminics	01
2	Pharmacotherapy of respiratory disorders: a. Drugs used in bronchial asthma - Bronchodilators, corticosteroids, mast cell stabilizers and leukotriene antagonists. b. Drugs used in cough – Expectorants, mucolytics and cough centre suppressants	03
3	Drugs acting on blood: Drugs used in treatment of anaemia: iron, vitamin B12 and folic acid Drugs used in haemostasis – coagulants, anticoagulants, antiplatelet drugs, fibrinolytics (thrombolytics) and antifibrinolytic drugs. Drugs used in the treatment of shock	05
4	Drugs acting on CNS: Alcohol, sedatives, hypnotics, antiepileptic drugs and antianxiety drugs.	04
5	Anaesthetic agents Inhalational anaesthetics and intravenous anaesthetics – Advantages and disadvantages of individual agents.	03

	Adjuvants to general anaesthesia and preanaesthetic medication Local anaesthetics	
6.	Endocrine Pharmacology Thyroid hormones and Antithyroid Drugs Corticosteroids Insulin and oral hypoglycaemic agents	06
7.	Drugs acting on GIT: Drugs for treatment of peptic ulcer disease Antiemetics Drugs used in treatment of diarrhoea Drugs used in treatment of constipation	04
8.	Antiseptics and Disinfectants	02
9.	Miscellaneous IV fluids- various preparations and their usage b. Overview and classification of common vaccines	02

Scheme of Examination:

Sl.No.	Questions	Questions asked	Questions to attempt	Marks	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2x10		
2	Short Essay Questions	7	6	6x5		
3	Short Answer Questions	10	10	10x3	20	100

Duration: 3 Hours

No Practical Examination

Recommended Text Books (Latest Edition)

Sl. no	Author	Name of the text	Publication
1.	K.D. Tripathi	Essentials of Medical Pharmacology	Jaypee brothers medical publishers pvt. Ltd
2.	R.S. Satoskar, S.D. Bhandarkar, Nirmala N. Rege	Pharmacology and Pharmacotherapeutics	Popular Prakashan
3	Laurence and Bennett	Clinical Pharmacology	Churchill Livingstone

4	Bertram G. Katzung	Basic and Clinical Pharmacology	McGraw hill
5	Goodman & Gilman's	The Pharmacological Basis of Therapeutics	McGraw Hill publications
6	Rang H P & Dale M M	Pharmacology	Churchill Livingstone

**PAPER 2: CCTS19
ELECTROCARDIOGRAPHY**

Theory 45 Hours

1. Bundle branch block

General principles

Right Bundle branch block

Left Bundle branch block

The Hemi blocks (Fascicular blocks)

2. Exercise stress Testing

1. Exercise
2. Exercise protocols
3. Electrocardiographic measurements
4. Exercise testing-Indication and techniques.

3. ECG in myocardial infarction –ECG in anterior wall, Inferior wall, true posterior wall and sub endocardial infarction and RV infarction

4. ECG in rheumatic heart disease–ECG in mitral stenosis, mitral incompetence, aortic stenosis and aortic incompetence.

5.ECG in hypertension

6. .ECG in congenital heart disease-common congenital heart disease-ASD,VSD, PDA, pulmonary stenosis, aortic stenosis, coarctation of aorta, TOF, definition of all these conditions, ECG changes in all these conditions.

7..ECG in other conditions-ECG in various types of Cardiomyopathy, Myxedema, pericardial effusion, acute pericarditis and other vascular diseases. WPW syndrome, Dextrocardia.

8. Interpretation of common ECG

PAPER 3:CCTS20

Theory 45 Hours

CARDIAC CATHETERIZATION

1. Preparation for Cath procedure and post procedure care.
2. Cardiac Catheterization laboratory- General details of Cardiac Catheterization equipment, how to handle the machine, common problems, one may come across and how to overcome it.
Radiation hazards.
3. Materials used in the Cath Lab- All catheters , balloons, guidewires, pacemakers, contrast materials & other materials used in the Cardiac Catheterization Laboratory and Sterilisation of all these materials.
4. Right heart Catheterization- procedure, cath position, Oxymetry at various levels, angios done & its interpretation.
5. Left heart catheterization- procedure, cath position, Oxymetry at various levels, angios done & its interpretation.
6. Coronary Angiogram-procedure, materials used, type & amount of dye used, indications & contra indications, various pictures recorded in various angles and gross interpretation.
7. Peripheral Angiogram- procedure, indication & contra indication.
8. Coronary Angioplasty- procedure, materials used, complications one may encounter and how to manage it.
9. Peripheral Angioplasty- materials used & procedure. Angioplasty of coarctation of aorta
10. Valvuloplasties- procedure, indications, complications and preparation of balloons, mitral valvuloplasty, balloon aortic valvuloplasty, Balloon pulmonary valvuloplasty & Balloon tricuspid valvuloplasty,
11. Coil closure & device closure of PDA- procedure, indications & materials used for coil & device closure of PDA
12. Device Closure of ASD- procedure, indications & materials used for device closure of ASD
13. Device Closure of VSD procedure, indications & materials used for & device closure of VSD
14. Electrophysiological studies-basic knowledge of electrophysiological studies.

15. Oxymetry – handling of the instruments & use fullness of the instruments, normal & abnormal values.
16. Pressure recording- handling of the instrument & pressures in various chambers, normal & abnormal values.
17. Temporary & permanent pacing- materials used, procedure, complications one may encounter & management.
18. CD recording & storage- Recording & storage of all the procedures over CD.
19. Procedure during pregnancy- precautions to be followed.
20. Nuclear cardiology- instrumentation, radiopharmaceuticals, patient imaging techniques.

Practical 1: CCTS21

Practical 100 hours

Electrocardiography –I

Spotters (spotters) = 120marks

Internal Assessment marks = 30marks

Viva Voce examination marks (marks included in theory) = 20marks

Practical 2:CCTS22

Practical 100 hours

Cardiac Catheterization:

Spotters (8 Cathlab spotters / Identification of catheters & materials) = 120marks

Internal Assessment marks = 30marks

Viva Voce examination marks (marks included in theory) = 20marks

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- Unit I**
- a) Meaning of term Constitution.
 - b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
 - c) Salient Features of the Constitution.
 - d) Preamble of the Constitution.
- Unit II**
- The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions.
- Unit III**
- Fundamental Rights and Duties - Their content and significance
- Unit IV**
- Directive Principles of State policies - The need to balance Fundamental Rights with

Directive Principles.

Unit V Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities

Unit VI Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.

Unit VII The Election Commission and State Public Service Commissions.

Unit VIII Method of amending the Constitution.

Unit IX Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.

Unit X Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/mpi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04
Research Methodology & Bioethics

Theory: 30 Hours

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.
10. Health Education Methods and Media
 - **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
 - Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
 - Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
 - Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CCTS23	Electrocardiography II	03			03
2	CCTS24	Echocardiography	02			02
3	CCTS25	Interventional Cardiology	03			03
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	CCTS26	Electrocardiography II Practical		03	02	05
7	CCTS27	Echocardiography Practical		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA + Viva Voce	Total
1	CCTS23	Paper 1	Electrocardiography II	60 + 20 + 20	100
2	CCTS24	Paper 2	Echocardiography	60 + 20 + 20	100
3	CCTS25	Paper 3	Interventional Cardiology	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject (Hospital Administration/ Disaster Management)	80+20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	CCTS26	Practical 1	Electrocardiography II Practical	120 + 30	150
6	CCTS27	Practical 2	Echocardiography Practical	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject in Fifth Semester

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2.	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

1. Scheme of Practical Examination for Fifth Semester

Sr. no		Practical	IA	Grand Total
1	Practical paper	120	30	150

Semester V

PAPER 1: CCT23

Theory 45 Hours

ELECTROCARDIOGRAPHY II

1. Cardiac monitoring –definition, purpose of cardiac monitoring, how to recognize various arrhythmias, how set up a intensive coronary care unit & usefulness of ICCU.
2. Interpretation of TMT report- Criteria for TMT positive test, contra indication of TMT, conditions where TMT is not useful, complications that may occur in TMT room and its management.
3. Use of Defibrillator-Indications, how to use the defibrillator, complications during the procedure & its management.
4. Management of Cardiac arrest- definition, causes, external cardiac massage, artificial respiration & other drugs and procedures used in the management of cardiac arrest.
5. Myocardial perfusion scan- procedures & usefulness of Myocardial perfusion scan.
6. Cardiac arrhythmias- Brady-arrhythmia & Tachy arrhythmias and ECG diagnosis of all rhythm disturbances.

Sinus arrhythmia, APC, JPC, VPC, VF, Ventricular Tachycardia, af, AF, SVT, I⁰ HB, II⁰ HB, Complete heart block.
7. Electrolyte disturbances- ECG in hypokeleemia, Hyperkeleemia
8. Holter Monitoring- procedure & and usefulness.

PAPER 2: CCT24
ECHOCARDIOGRAPHY

Theory 45 Hours

1. Echo in rheumatic heart disease-Echo in mitral stenosis, mitral incompetence, aortic stenosis, aortic incompetence, pulmonary hypertension, post MVR, Post AVR. Prosthetic valve. Malfunction, LA clot.
2. Echo in congenital heart disease- Echo in ASD, SD, PDA, pulmonary stenosis, aortic stenosis, coarctation of aorta, TOF, Dextrocardia.
3. Echo in ischemic heart disease- Echo in acute myocardial infarction, old myocardial infarction & other ischemic heart disease related conditions, LV aneurysm.
4. Echo in other cardiovascular disease- Echo in various types of Cardiomyopathy, infective endocarditis, diseases of aorta, mitral valve prolapse, myxoma & other cardiovascular diseases.
5. Trans esophageal echocardiogram- indications, procedures, usefulness & complications, one may encounter and its management.
6. Stress Echo- procedure & indications.
7. Fetal echocardiogram- procedure, basic interpretation
8. Peripheral Doppler- procedure & usefulness of peripheral Doppler
9. Assessment of cardiac function- measurements of all cardiac chambers and assessment of cardiac function.
10. Contrast Echo cardiogram-Procedure & usefulness of Contrast Echo cardiogram.
11. Myocardial Contrast Echo- Basic knowledge
12. Echo in pericardial disease-pericardial effusion, cardiac tamponade, constrictive pericarditis.
 - 1) 3D Echo
 - 2) Other latest developments in the field of Echocardiogram

INTERVENTIONAL CARDIOLOGY

1. Coronary Angioplasty- procedure, materials used, complications one may encounter and how to manage it.
2. Peripheral Angioplasty- materials used & procedure. Angioplasty of coarctation of aorta
3. Valvuloplasties- procedure, indications, complications and preparation of balloons, mitral valvuloplasty, balloon aortic valvuloplasty, Balloon pulmonary valvuloplasty & Balloon tricuspid valvuloplasty,
4. Coil closure & device closure of PDA- procedure , indications & materials used for coil & device closure of PDA
5. Device Closure of ASD- procedure , indications & materials used for device closure of ASD
6. Device Closure of VSD procedure , indications & materials used for & device closure of VSD
7. Temporary & permanent pacing- materials used, procedure, complications one may encounter & management.
8. Nuclear cardiology- instrumentation, radiopharmaceuticals, patient imaging techniques.
9. Cardiac Imaging ; Cardiac CT Scan, Cardiac MRI Scan
10. Optical Coherence Tomography
11. Fractional Flow Reserve
12. TAVR (Transcatheter aortic valve replacement)

Practical 1: CCT26

Practical 50 Hours

Electrocardiography II

In the practical examination candidate will be asked questions from syllabus in Electrocardiography.

Practical 2: CCT27

Practical 50 Hours

Echocardiography

In the practical examination candidate will be asked questions from syllabus in Echocardiography.

ELS05

Theory: 30 Hours

Disaster & Emergency Management

A. Introduction to Disaster management

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management

C. Modern disaster management – disaster cycle

D. Hazards

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
 - stages

-Basic elements

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CCTS28	ECG & ECHO	04			04
2	CCTS29	Cardiac Catheterization	04			04
3	ELS06	Elective Subject : Stress Testing (TMT) / Recent Advances in Cardiology	02			02
4	CCTS30	(ECG + Therapeutic Cath.)		03	02	05
5	CCTS31	Echocardiography		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA	Grand Total
1	CCTS28	Paper 1	ECG & ECHO	60 + 20 + 20	100
2	CCTS29	Paper 2	Cardiac Catheterization	60 + 20+ 20	100
3	ELS06	Paper 3	Elective subject: Stress Testing (TMT) / Recent Advances in Cardiology	80+20	100
Grand Total					300

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
4	CCTS30	Practical 1	(ECG + Therapeutic Cath.)	160 + 40	200
5	CCTS31	Practical 2	Echocardiography	160 + 40	200
Grand Total					400

PAPER 1: CCTS28

ECG & ECHO

Electrocardiography

- 1) ECG- Bradyarrhythmias, Tachyarrhythmias
- 2) Electrolyte disturbances - Hypokalemia and Hyperkalemia
- 3) Defibrillator , Cardiac arrest, CPR
- 4) Holter monitoring

Echocardiography

- 1) Echo in RHD
- 2) IHD
- 3) TOF, Pulmonary stenosis
- 4) Cardiomyopathy (ICM, DCM, HCM, RCM)
- 5) Echo in pericardial disease
- 6) Infective Endocarditis
- 7) MVP, Myxoma & other (CVDs)
- 8) 3D Echocardiography
- 9) TEE
- 10) Contrast Echo
- 11) Diseases of Aorta- COA, Aortic aneurysm,
- 12) Dextrocardia

PAPER 2: CCTS29

Cardiac Catheterization:

- 1) Valvoplasty, - BMV, BAV, PBPV
- 2) RHC, LHC
- 3) Device closure- ASD, VSD, PDA
- 4) EP study
- 5) Procedure during Pregnancy
- 6) Oxymetry & Pressure recording
- 7) TPI, PPI
- 8) Cath lab, Materials, Dyes
- 9) Preparation of cath procedure & post procedure.

Practical 1: CCTS30

(ECG + Therapeutic cath)

(160 +40 = 200marks)

Contents: Electrophysiology + Therapeutic cath

Therapeutic cath (Angiography, Pacemaker, Balloon mitral valvotomy, TAVI, BAV)

Practical 2: CCTS31

(Echocardiography)

(160 +40 = 200marks) Echocardiography

ELS06

STRESS TESTING (TMT)

1. Stress Testing
2. Indications & contraindications on TMT
3. Various Protocols of TMT
4. Dobutamine Stress Echo
5. Physiology of exercise testing
6. Different types of Stress Tests
7. Diagnostic characteristics of the exercise ECG.

ELS06

RECENT ADVANCES IN CARDIOLOGY

1. OCT-Optical Coherence Tomography
2. FFR – Fractional Flow Reserve
3. ROTA –Rotablation (Rotational Atherectomy)
4. TAVR – Transcatheter Aortic Valve Replacement
5. IVUS-Intravascular Ultrasound
6. EXCIMER Laser Coronary Angioplasty
7. Orbital Atherectomy

Text Book:

1. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Other Suggested Readings / Books:

1. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and HarperCollins, USA
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
4. Susan George, 1976, *How the Other Half Dies*, Penguin Press. Reprinted 1986, 1991
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Commonwealth Publishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers
7. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers* Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd

11. B P Banerjee, 2005, *Foundations of Ethics and Management*, Excel Books.

12. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New

13. ELLESTAD , 5 th Edition -Stress testing (TMT) Text book.

Internal assessment + Project/Practical file + Practical (Performance) and viva

- Internal Assessment
 1. Work behavior
 2. Clinical work (compulsory for all students)

- Project/Practical file

Every candidate shall maintain a work diary and record. His/her participation in the training programmes conducted by the department such as journal reviews, seminars etc. special mention may be made of the presentation by the candidate as well as details of clinical of laboratory procedures. If any, conducted by the candidate. The work diary shall be scrutinized and certified by the Head of the department and presented in the university practical/clinical examination.

- Practical Performance
- Performing 12 lead ECG's
- Performing TMT in presence of Consultant
- Assisting in 2D Echo
- Assisting interventional procedures in cath lab

Guest Lecture/ Tutorial/ Seminar/visit to any medical research institution or reputed clinical laboratory (Compulsory)

The Practicals learned in all five semesters will be part of final practical exam at the end of sixth semester

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in al the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.

- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass

- Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
- Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
- A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to Semester Grade Point Average (SGPA):

SGPA= Credits X grade points/ Total Credits

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the first year subjects shall have Postgraduate degree in the respective subject with 3 years of teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Perfusion Technology Degree Course

(Semester System)

Syllabus/Curriculum

2023 - 24



Accredited 'A+' Grade by NAAC (3rd Cycle)
Placed in 'A' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research (Deemed-to-be-University)

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry/organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth.
- To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

CONTENTS

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B.Sc. PERFUSION TECHNOLOGY

PREAMBLE

The B.Sc. Perfusion Technology Course is of **3 years (6 semesters) and 1 Year internship** duration program aimed at training students in the technological aspects of Medical care with a good scientific foundation. These students will be in a position to competently assist in the Anesthetist and the surgeons in high tech Anaesthesia and surgical theatre. They will be in much demand both within the country and outside as Allied Healthcare personnel. With advanced training in the latest technologies in their Specialty, these graduates will play an important role in determining the quality of health care provided.

I. TITLE OF THE COURSE

The Course shall be called Bachelor of Science in Perfusion Technology.

II. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – Perfusion Technology Course shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

III. DURATION OF COURSE

The duration of the Course shall be for period of three years and compulsory one year rotatory internship.

IV. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

V. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

VI.ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Applied Pharmacology	80+20	Basics of Perfusion Technology I	120+30
		Basics of Perfusion Technology I	60+20+20	Basics of Perfusion Technology II	120+30
		Basics of Perfusion Technology II	60+20+20		
4.	4th Semester	Applied Pharmacology	80+20	Applied Perfusion Technology I	120+30
		Applied Perfusion Technology I	60+20+20	Applied Perfusion Technology II	120+30
		Applied Perfusion Technology II	60+20+20		

Third Year					
5.	5th Semester	Advanced Perfusion Technology I	60+20+20	Advanced Perfusion Technology I	120+30
		Advanced Perfusion Technology II	60+20+20	Advanced Perfusion Technology II	120+30
		Medicine Relevant to Perfusion Technology	60+20+20		
6.	6th Semester	Recent Advances in Perfusion	60+20+20	Recent Advances in Perfusion	160+40
		Clinical Perfusion Technology	60+20+20	Clinical Perfusion Technology	160+40
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Biomedical Engineering	
		2. Fundamentals of Electricity and Electronics	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
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50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: $\frac{\text{Total No. of SGPA}}{\text{No. of Semester}}$

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	PTBS01	Human Anatomy	02		02
2	PTBS02(A)	Human Physiology	02		02
	PTBS02(B)	Basics of Biochemistry	02		02
3	PTBS03(A)	Pathology : Basic Hematology	02		02
	PTBS03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	PTBS04	Human Anatomy		02	02
6	PTBS05 (A)	Human Physiology		02	02
	PTBS05(B)	Basics of Biochemistry		02	02
7	PTBS06(A)	Pathology : Basic Hematology		02	02
	PTBS06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	PTBS01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	PTBS02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	PTBS03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	PTBS04	Practical 1	Human Anatomy	80 + 20	100
6	PTBS05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	PTBS06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: PTBS01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: PTBS04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of different parts of Brain & Spinal Cord

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code PTBS04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals**Histology**

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: PTBS02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions

Classification of Body fluid compartments & composition, Homeostasis

Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis

Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - PTBS05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: PTBS02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: PTBS05

Practical 30 Hours

Section B: Biochemistry

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks

40 Marks

IA Marks:

10 Marks

Grand Total

50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

Semester I

PAPER 3 - PTBS03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: PTBS06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- PTBS03

Theory 30 Hours

Section B – Microbiology

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.
- **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope

- (c) Fluorescent Microscope
- (d) Phase contrast Microscope
- (e) Electron microscope:

-Principles and operational mechanisms of various types of microscopes

- **Classification and Morphology of Bacteria.**
- **Physiology of Bacteria**
- **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methods
- Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
- **Antibiotics and drug resistance**
- **Bacterial genetics and mechanisms of Bacterial gene transfer.**
- **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: PTBS06 **Section B – Microbiology**

Practical 30 Hours

- Focusing, handling and care of Microscopes
- Hanging drop
- Simple stain
- Gram stain
- ZN stain

- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur
- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	PTBS07	Anatomy	02		02
2	PTBS08(A)	Physiology	02		02
	PTBS08(B)	Biochemistry	02		02
3	PTBS09(A)	Hematology & Clinical Pathology	02		02
	PTBS09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	PTBS10	Human Anatomy		02	02
6	PTBS11(A)	Human Physiology		02	02
	PTBS11(B)	Basics of Biochemistry		02	02
7	PTBS12 (A)	Hematology & Clinical Pathology		02	02
	BMLS12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	PTBS07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	PTBS08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	PTBS09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	PTBS10	Practical 1	Human Anatomy	80 + 20	100
6	PTBS11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	PTBS12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - PTBS07 Human Anatomy

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy

Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - PTBS10

Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code PTBS11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – PTBS08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – PTBS11 Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: PTBS08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. **Composition of Whole Blood, Serum and Plasma**
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. **Nutritional Disorders, Diabetic and DASH diets**
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: PTBS11

Practical : 30 Hours

Basics of Biochemistry II

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine	1	1 x 20	20 Marks

/Estimation of urine creatinine			
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Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical 40 Marks
 IA Marks: 10 Marks
Grand Total **50 Marks**

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: PTBS09

Theory : 30 Hours

Section A - Haematology & Clinical Pathology

Hematology

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine

- e. Haemoglobin electrophoresis
- f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No .	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl . N	Name of Book & title	Author	Publisher, Name, Place of publication
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0.			
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10 .	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: PTBS12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine
11	Sickling test

12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: PTBS09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
- Immunology
 - a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr. C.P. Baveja.

PRACTICAL 3: PTBS12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :	15 marks
• Spotters	15 marks
IA	10 marks
	Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
- Youth development programmes at the National level, State level and voluntary sector

Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking

- Self Confidence and Self esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
 - Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	PTBS13	Applied Pharmacology	02			02
2	PTBS14	Basics of Perfusion Technology I	02			02
3	PTBS15	Basics of Perfusion Technology II	02			02
4	AECC01	AECC: Environmental Sciences	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	PTBS16	Basics of Perfusion Technology - I		03	02	05
7	PTBS17	Basics of Perfusion Technology - II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit 2-hour Clinical Posting per week for 15 weeks = 1 credit						

THIRD SEMESTER

Scheme of Examination:

Sl. No.	Subject Code	Examination	Subjects	Max. + IA + Viva	Grand Total
1	PTBS13	Paper 1	Applied Pharmacology	80+20	100
2	PTBS14	Paper 2	Basics of Perfusion Technology I	60 + 20 + 20	100
3	PTBS15	Paper 3	Basics of Perfusion Technology II	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	PTBS16	Practical 1	Basics of Perfusion Technology - I	120 + 30	150
7	PTBS17	Practical 2	Basics of Perfusion Technology - II	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject in Third Semester

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

Scheme of Practical Examination for third Semester for subject code PTBS018

Sr. no	Theory	Practical	IA	Grand Total
1	Practical paper - I (Major 70 X 1 + Minor 40 X 2)	120	30	150
2	Practical paper - II (Major 70 X 1 + Minor 40 X 2)	120	30	150

SEMESTER III

PAPER 1: PTBS13 APPLIED PHARMACOLOGY

PHARMACOLOGY

THEORY

30 hours

This course introduces the students to basic pharmacology of common drugs used and their importance in different treatments.

Units	Contents	30 Hours
1	General Pharmacology: Principles of drug administration and routes of administration, absorption distribution, metabolism and excretion of drugs and Mechanisms of drug action (various ways in which they act) Factors influencing drug action. Adverse drug reactions	08
Enumeration of drugs, uses and adverse effects of the following drugs:		
2	Drugs acting on autonomic nervous system: Cholinergics, anticholinergics, adrenergics and antiadrenergics	05
3.	Skeletal Muscle Relaxants: Drugs acting at neuromuscular junction and other muscle relaxants.	01
3	Analgesics NSAIDs and opioid analgesics.	02
4.	Drugs acting on renal system: Diuretics	01
5.	Drugs acting on the Cardiovascular System Drugs acting on renin angiotensin system Antianginal drugs Drugs used in heart failure Antihypertensives Antiarrhythmic drugs	05
7.	Chemotherapy of infections: Introduction to antimicrobials Sulfonamides, penicillins, cephalosporins, fluoroquinolones, aminoglycosides, macrolides, antitubercular drugs and anti HIV drugs.	08

Scheme of Examination:

Sl.No.	Questions	Questions asked	Questions to attempt	Marks	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2x10	20	100
2	Short Essay Questions	7	6	6x5		
3	Short Answer Questions	10	10	10x3		

Duration: 3 Hours

No Practical Examination

Recommended Text Books (Latest Edition)

Sl. no	Author	Name of the text	Publication
1.	K.D. Tripathi	Essentials of Medical Pharmacology	Jaypee brothers medical publishers pvt. Ltd
2	R.S. Satoskar, S.D. Bhandarkar, Nirmala N. Rege	Pharmacology and Pharmacotherapeutics	Popular Prakashan
3	Laurence and Bennett	Clinical Pharmacology	Churchill Livingstone
4	Bertram G. Katzung	Basic and Clinical Pharmacology	McGraw hill
5	Goodman & Gilman's	The Pharmacological Basis of Therapeutics	McGraw Hill publications
6	Rang H P & Dale M M	Pharmacology	Churchill Livingstone

BASICS OF PERFUSION TECHNOLOGY I

1. Chest X-ray: Normal chest X-ray, postero-anterior-view, views in different positions, identification of borders of heart.
 - cardiomegaly, pneumothorax, hydrothorax, pleural effusion, etc.
2. ECG- Normal electro cardio graph different waves, its significance, atrial arrhythmias, ventricular arrhythmias, heart blocks etc.
3. Angiography- coronary angiography, peripheral angiography,
 - Coronary- normal coronary and its branches in different views, indications and limitations.
 - Peripheral- cerebral, renal, limbs (upper and lower).
 - Nuclear cardiology-thallium scan, indications, advantages and disadvantages.
4. Echo-trans thoracic echo, Transesophageal echo, indications, applications, different views and information.
5. Laboratory investigations in relation to perfusion technology Hemoglobin, blood grouping, urine analysis, renal function tests (RFT), Liver Function Tests (LFTS, PT, INR, APTT, Spirometry for lung function, Activated Clotting Time (ACT), TEG (Thrombo Elastography)
6. History of cardiac surgery and perfusion
Specific reference of Gibbon Lillehei, Carrel Pre cardio pulmonary bypass surgery Axygous flow principle Hypothermic/nonhypothermic non-cardio pulmonary surgery including gross's well technique and controlled cross circulation.
7. Monitoring and instrumentation
Concepts of monitoring-instrumentation technology of ECG machine, pressure transducers, syringe and peristaltic pumps, monitors, ventilators, pulse oximeters, temperature probes and thermo regulatory monitoring, defibrillators and fibrillators. Piped and piped gad delivery systems and connections. Basic physics related to medically used gases.
8. Haemodynamic monitoring.
9. Haemostatic monitoring.
10. Haemotologic monitoring.

BASICS OF PERFUSION TECHNOLOGY II

1. Maintenance of oxygen, carbon dioxide and acid base status and their monitoring.
2. Neurological monitoring (SSPE, EEG and cerebral function monitor).
3. Aseptic technique.
4. Physiology of extra-corporeal circulation.
Heart – Lung machine.
Principles of extra-corporeal circulation.
Materials used in extracorporeal circuit.
Principles of extracorporeal gas exchange.
5. Various types of oxygenators Bubble oxygenators Rotating spiral/cylinder/disc oxygenator Membrane oxygenators.
6. Theory of blood pump, ideal blood pump, pulsatile versus non-pulsatile flow, occlusive and non-occlusive pumps, types of pumps – roller, bellow, diaphragm, ventricular and centrifugal pumps.
7. Element of extracorporeal circulation/hazards of:
 - a. Blood failure
 - b. Bubble trap
 - c. Flow meters
 - d. Temperatures
 - e. Heart exchanger
 - f. TemperatureRegulating devices
8. Connection of the vascular system with extracorporeal circulation: Arterial and venous cannulae, connecting tubes and connectors, vents, suckers, cardioplegia deliverysystem, venous drainage.
9. Haemodynamics of arterial return, venous drainage, cardioplegia delivery and venting.
10. Blood grouping, handling of blood products and their management blood components and their use.

PRACTICAL 1:PTBS16

Practicals: 45 Hours

Basics of Perfusion Technology Practical – I

Content:

1. Spotters - Elaborate The Names of Spotters
2. Heart Lung Machine
3. Identification of cardiopulmonary bypass components.

PRACTICAL 2: PTBS17

Basics of Perfusion Technology Practical – II

1. Cardio Pulmonary Bypass Circuits (CPB)
2. Anaesthesia Drug and equipments.
3. Calculation of body surface area and maximum flows.

The following Spotters can be Considered for Practical Exams:

Chest X-ray

- ❖ ECG
- ❖ Echo
- ❖ Coronary Angiography Nuclear Cardiology, ACT Machine
- ❖ Laboratory investigations- arterial blood gas, Venous blood gas, Renal function test, liver function test, coagulation profile.
- ❖ Haemoglobin, haematocrit, platelet, RBC, WBC, Electrolytes, Heart lung machine
- ❖ Oxygenator
- ❖ Heater cooler unit
- ❖ Blood cardioplegia device
- ❖ ACT Machine
- ❖ Setting up of ECG machine
- ❖ Pressure transducer
- ❖ Syringe and peristaltic pumps
- ❖ Anaesthesia Monitors

- ❖ Pulse oximeters
- ❖ Temperature probes and Thermoregulatory monitoring
- ❖ Defibrillators
- ❖ Fibrillators

Compulsory Course AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
 - ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
 - ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution

- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards
- ♦ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ♦ Role of an individual in prevention of pollution.
- ♦ Pollution case studies.
- ♦ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ♦ From Unsustainable to Sustainable development
- ♦ Urban problems related to energy
- ♦ Water conservation, rain water harvesting, watershed management
- ♦ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ♦ Environmental ethics: Issues and possible solutions.
- ♦ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ♦ Wasteland reclamation.
- ♦ Consumerism and waste products.
- ♦ Environment Protection Act.
- ♦ Air (Prevention and control of Pollution) Act.
- ♦ Wildlife Protection Act
- ♦ Forest Conservation Act
- ♦ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ♦ Population growth, variation among nations.
- ♦ Population explosion - Family Welfare Programme.
- ♦ Environment and human health.
- ♦ Human Rights.
- ♦ Value Education.
- ♦ HIV/AIDS
- ♦ Women and Child Welfare.
- ♦ Role of Information Technology in Environment and human health.
- ♦ Case Studies.

8: Field work

- ♦ Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- ♦ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ♦ Study of common plants, insects, birds.
- ♦ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
 - Uses and application of bio-statistics in public health research and medical sciences.
 - Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
 - Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
 - Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
 - Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
 - Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.
- Basic Probability : Concept of probability, its terminology and different types of definition
- Laws of probability: addition law, multiplication law and conditional probability.

ELS03: Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	PTBS18	Applied Pharmacology	02			02
2	PTBS19	Applied Perfusion Technology I	02			02
3	PTBS20	Applied Perfusion Technology II	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject: (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	PTBS21	Applied Perfusion Technology I		03	02	05
7	PTBS22	Applied Perfusion Technology II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks = 1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Theory Max. + IA + Viva Voce	Grand Total
1	PTBS18	Paper 1	Applied Pharmacology	80+20	100
2	PTBS19	Paper 2	Applied Perfusion Technology I	60 + 20 + 20	100
3	PTBS20	Paper 3	Applied Perfusion Technology II	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	PTBS21	Practical 1	Applied Perfusion Technology I	120 + 30	150
7	PTBS22	Practical 2	Applied Perfusion Technology II	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

Scheme of Practical Examination for Fourth Semester

Sl. no		Practical	IA	Grand Total
1	Applied Perfusion Technology I	120	30	150
2	Applied Perfusion Technology II	120	30	150

SEMESTER IV

PAPER 1: PTBS18 APPLIED PHARMACOLOGY

PHARMACOLOGY

THEORY

30 hours

This course introduces the students to basic pharmacology of common drugs used and their importance in different treatments.

Units	Contents	30 Hours
Enumeration of drugs, uses and adverse effects of the following drugs:		
1	Antihistaminics	01
2	Pharmacotherapy of respiratory disorders: a. Drugs used in bronchial asthma - Bronchodilators, corticosteroids, mast cell stabilizers and leukotriene antagonists. b. Drugs used in cough – Expectorants, mucolytics and cough centre suppressants	03
3	Drugs acting on blood: Drugs used in treatment of anaemia: iron, vitamin B12 and folic acid Drugs used in haemostasis – coagulants, anticoagulants, antiplatelet drugs, fibrinolytics (thrombolytics) and antifibrinolytic drugs. Drugs used in the treatment of shock	05
4	Drugs acting on CNS: Alcohol, sedatives, hypnotics, antiepileptic drugs and antianxiety drugs.	04
5	Anaesthetic agents Inhalational anaesthetics and intravenous anaesthetics – Advantages and disadvantages of individual agents. Adjuvants to general anaesthesia and preanaesthetic medication Local anaesthetics	03
6.	Endocrine Pharmacology Thyroid hormones and Antithyroid Drugs Corticosteroids Insulin and oral hypoglycaemic agents	06
7.	Drugs acting on GIT: Drugs for treatment of peptic ulcer disease Antiemetics Drugs used in treatment of diarrhoea Drugs used in treatment of constipation	04
8.	Antiseptics and Disinfectants	02
9.	Miscellaneous IV fluids- various preparations and their usage b. Overview and classification of common vaccines	02

Scheme of Examination:

Sl.No.	Questions	Questions asked	Questions to attempt	Marks	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2x10		
2	Short Essay Questions	7	6	6x5		
3	Short Answer Questions	10	10	10x3	20	100

Duration: 3 Hours

No Practical Examination

Recommended Text Books (Latest Edition)

Sl. no	Author	Name of the text	Publication
1.	K.D. Tripathi	Essentials of Medical Pharmacology	Jaypee brothers medical publishers pvt. Ltd
2.	R.S. Satoskar, S.D. Bhandarkar, Nirmala N. Rege	Pharmacology and Pharmacotherapeutics	Popular Prakashan
3	Laurence and Bennett	Clinical Pharmacology	Churchill Livingstone
4	Bertram G. Katzung	Basic and Clinical Pharmacology	McGraw hill
5	Goodman & Gilman's	The Pharmacological Basis of Therapeutics	McGraw Hill publications
6	Rang H P & Dale M M	Pharmacology	Churchill Livingstone

Semester IV

PAPER 2: PTBS19

Theory 30 Hours

APPLIED PERFUSION TECHNOLOGY I

1. Pharmacokinetics :Haemodilution, hypothehrima, perfusion, acidbasestauts. Sequestration and pharmacodymamics : Binding (to issue protein), age tissue penetration, temp, acid base status, anesthetic agents, specific drugs with CPB influence, properties, oiods, neuromuscular blocking drugs, antibiotics, anesthetic of : antithrombic agents, antiplatelet drugs, calcium channel blockers, vasodilators, nirates, beta – blockers, calcium entry blocking drugs in pulmonary bypass surgery.
2. Drugs used in cardiopulmonary bypass : Pre medication drugs used by anesthesiologist example beta adrenergic blocking drugs, antihypertensive drugs, anticholinergic drugs, sedative / hypnotics dugs etc.
3. Conduct and monitoring of cardiopulmonary bypass. : ECG, Arterial blood pressureCVP, Arterial pressure pulwelge, pressure measurement, arterial pump flow rate, suction pump flow, temp, biochemistry, central function, computer linked monitor,
4. Adequacy of perfusion : General considerations, specific aspects of perfusion, monitoring other concomitants which may affect its adequacy.
5. Oxygenation – general considerations, bubble &memberance (including assessment and comparison of oxygenator function).
6. Heat exchangers - Principles, function of heat exchange & their Management.
7. Priming of fluids and hemodilution : Crystalloids, 5% Dextrose, Balanced salt 50m, Mannitol, Colloidal osmoter, pressure, plasma expander, plasma preparation, dexatramos, gelatins hetastarchHemodilution : Historical perspective , advantages, - physiological effects, complications during bypass, safety during cardiopulmonary bypass, bypass safety, organizational aspects, accidents & its management (perfusion relative), cogulopathies, mechanical and electrical failure, perfusion management, perfusion systems, safety and performoist surgical teams.
8. Blood conservation hemofiltration& dialysis during cardiopulmonary Bypass including modified ultra filtration reverse autologous priming and other methods.
9. Micro emboli gaseous and particulate, filters used in cardiopulmonary bypass circuit.
10. Micro pore filtration during cardiopulmonary bypass.

IV Semester

PAPER 3: PTBS20

Theory 30 Hours

APPLIED PERFUSION TECHNOLOGY II

1. Pulsatile perfusion : Introduction, theory & Physiology of pulsatile flow, haemodynamic, metabolic effects, clinical use, hematological effects.
2. Cannulation technique during cardiopulmonary bypass: Venous cannulation, Principles of venous drainage, types and size of cannula, connection to the patient, the venous drainage. Arterial cannulation, cannulas, connection to a patient. Cardioplegiacannulae, sets.
3. Termination of cardiopulmonary bypass - Preparation of separation, Separation technique, Separation problems – situation, vasodilation, hypotension, principles and methodology.
4. Myocardial protection and cardioplegia- pretreatment of the myocardium, cardioplegia, hypothermia controlled reperfusion, myocardial protection for specific clinical problems, Complications of cardioplegia. Non cardioplegic methods during cardiac surgery on cardiopulmonary bypass.
5. Blood cell trauma – analysis of forces of fluid motion, effects of physical forces on blood cells, clinical effect. Complications of blood transfusion.
6. Anticoagulation on bypass, its monitoring, its reversal and complications. Heparinless bypass. Platelet aggregation and platelet dysfunction. Coagulopathies due to cardiopulmonary bypass and its management.
7. Perfusion problems during radio pulmonary bypass, high arterial line Press, air and arterial line poor venous return, air lock in a venous line Inflammatory responses to cardiopulmonary bypass & its clinical effects. Methods to minimize the same. Immune response, neuroendocrine renal metabolic splanchnic response, pulmonary response and electrolyte response to cardiopulmonary bypass.
8. Counter pulsation techniques and assist devices.
9. Perfusion techniques for pediatric cardiac surgery:
Perfusate composition, Cannulation techniques, aspects of perfusion practice in pediatric cardiac surgery, myocardial protection, removal of sugs, pressure monitoring, heparin dosage reversal.
10. ECMO – Special perfusion techniques for special cardiac surgery, invasive cardiology and outside the operation suite.
11. Perfusion as a method of cardiopulmonary bypass.
12. Minimally invasive surgery and the perfusionist.
13. Recent advances in perfusion techniques.
14. Experimental Perfusion.

IV Semester (Practical)

PRACTICAL 1: PTBS21

Practicals: 50 Hours

APPLIED PERFUOISN TECHNOLOGY - I

1. Calculation of PCV on CPB and amount of blood to be added to bring the PCV on CPB to particular level.
2. Interpretation and correction of a given arterial blood gas.
3. Interpretation and correction of a given electrolyte abnormally.

PRACTICAL 2: PTBS22

APPLIED PERFUOISN TECHNOLOGY - II

1. Calculation of body surface area.
2. Performing an ACT estimation and interpretation of results.
3. Setting of a dummy CPB circuit.

Compulsory Course AECC02

Theory: 30 Hours

LAW - INDIAN CONSTITUTION

I. GOAL :

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :

A) KNOWLEDGE :

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.

- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS

Theory:

- Unit I** a) Meaning of term Constitution.
 b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
 c) Salient Features of the Constitution.
 d) Preamble of the Constitution.
- Unit II** The democratic institutions created by the Constitution.
 Bicameral System of Legislature at the Centre and in the States.
 Devolution of Powers to Panchayat Raj Institutions.
- Unit III** Fundamental Rights and Duties - Their content and significance
- Unit IV** Directive Principles of State policies - The need to balance Fundamental Rights with
 Directive Principles.
- Unit V** Special rights created in the constitution for Dalits, Backward class, Women and Children,
 and the Religious and Linguistic Minorities
- Unit VI** Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in
 India.
- Unit VII** The Election Commission and State Public Service Commissions.
- Unit VIII** Method of amending the Constitution.
- Unit IX** Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.
- Unit X** Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constitution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04

Theory: 30 Hours

Research Methodology & Bioethics

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.
10. Health Education Methods and Media
 - **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
 - Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
 - Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
 - Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	PTBS23	Advanced Perfusion Technology Paper I	03			03
2	PTBS24	Advanced Perfusion Technology Paper II	02			02
3	PTBS25	Medicine Relevant to Perfusion Technology	03			03
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	PTBS26	Advanced Perfusion Technology I		03	02	05
7	PTBS27	Advanced Perfusion Technology II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA + Viva Voce	Total
1	PTBS23	Paper 1	Advanced Perfusion Technology I	60 + 20 + 20	100
2	PTBS24	Paper 2	Advanced Perfusion Technology II	60 + 20 + 20	100
3	PTBS25	Paper 3	Medicine Relevant to Perfusion Technology	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject (Hospital Administration/ Disaster Management)	80+20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	PTBS26	Practical 1	Advanced Perfusion Technology I	120 + 30	150
6	PTBS27	Practical 2	Advanced Perfusion Technology II	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT**1. Scheme of Practical Examination for Fifth Semester**

Sr. no		Practical	IA	Grand Total
1	Advanced Perfusion Technology I	120	30	150
2	Advanced Perfusion Technology II	120	30	150

Semester v

PAPER 1: PTBS23

Theory 30 Hours

ADVANCED PERFUSION TECHNOLOGY I

Contents

1. Pulsatile perfusion : Introduction, theory & Physiology of pulsatile flow, haemodynamic, metabolic effects, clinical use, hematological effects.
2. Cannulation technique during cardiopulmonary bypass: Venous cannulation, Principles of venous drainage, types and size of cannula, connection to the patient, the venous drainage. Arterial cannulation, cannulas, connection to a patient. Cardioplegiacannuale, serts.
3. Termination of cardiopulmonary bypass - Preparation of separation, Separation technique, Separation problems – situation, vasodilation, hypotension, principles and methodology.
4. Myocardial protection and cardioplegia- pretreatment of the myocardium, cardioplegia, hypothermia controlled reperfusion, myocardial protection for specific clinical problems, Complications of cardioplegia. Non cardioplegic methods during cardiac surgery on cardiopulmonary bypass.
5. Blood cell trauma – analysis of forces of fluid motion, effects of physical forces on blood cells, clinical effect. Complications of blood transfusion.
6. Anticoagulation on bypass, its monitoring, its reversal and complications. Heparinless bypass. Platelet aggregation and platelet dysfunction. Coagulopathies due to cardiopulmonary bypass and its management.
7. Perfusion problems during radio pulmonary bypass, high arterial line Press, air and arterial line poor venous return, air lock in a venous line Inflammatory responses to cardiopulmonary bypass & its clinical effects. Methods to minimize the same. Immune response, neuroendocrine renal metabolic splanchnic response, pulmonary response and electrolyte response to cardiopulmonary bypass.

V Semester

PAPER 2: PTBS24

Theory : 30 Hours

ADVANCED PERFUSION TECHNOLOGY II

1. Counter pulsation techniques and assist devices.
2. Perfusion techniques for pediatric cardiac surgery:
Perfusate composition, Cannulation techniques, aspects of perfusion practice in pediatric cardiac surgery, myocardial protection, removal of sugi, pressure monitoring, heparin dosage reversal.
3. ECMO – Special perfusion techniques for special cardiac surgery, invasivecardiology and outside the operation suite.
4. Perfusion as a method of cardiopulmonary bypass.
5. Minimally invasive surgery and the perfusionist.
6. Recent advances in perfusion techniques.
7. Experimental Perfusion.

V Semester (Theory)

PAPER 3: PTBS25

Theory 40 Hours

MEDICINE RELEVANT TO TECHNOLOGY

- a. **Vascular System.** (6 hrs)
 - a. Atherosclerosis- Definition, risk factors, briefly pathogenesis & morphology, clinical significance and prevention
 - b. Hypertension-definition, types and briefly pathogenesis and effects of hypertension
 - c. Aneurysms- definition, classification Pathology and complication.
- b. **Cardiac system-Congenital** (6 hrs)
 - a. Congenital heart diseases-basic defect and effects of important types of congenital heart diseases.
 - b. Pathophysiology of heart failure
- c. **Cardiac system-Acquired** (6 hrs)

- a. Cardiac hypertrophy causes, pathophysiology & progression to heart failure.
- b. Ischemic heart diseases-definition, types. Briefly pathophysiology, pathology & complications of various types of IHD
- c. Valvular heart diseases-causes pathology & complications. Complications of artificial valves.
- d. Cardiomyopathy-definition, types, causes and significance
- e. Pericardial effusion-causes, effects and diagnosis.

d. Haematology (6 hrs)

- a. Anaemia-definition, morphological types and diagnosis of anemia.
- b. Brief concept about hemolytic anemia and polycythaemia.
- c. Leukocyte disorders-briefly leukemia, leukocytosis, agranulocytosis etc.
- d. Bleeding disorders-definition, classification, causes & effects of important types of bleeding disorders. Briefly various laboratory tests used to diagnose bleeding disorders.

e. Respiratory System (6 hrs)

- a. chronic obstructive airway diseases- definition and types briefly causes, pathology and complications of each type of COPD
- b. Briefly concept about obstructive versus restrictive pulmonary disease pneumoconiosis-definition, types, pathology and effects in brief.
- c. pulmonary congestion and edema
- d. pleural effusion – causes, effects and diagnosis.

f. Renal System (6 hrs)

- a. Clinical manifestations of renal diseases.
- b. Briefly causes, mechanism effects and laboratory diagnosis of ARF & CRF. Briefly glomerulonephritis and pyelonephritis.
- c. End stage renal disease-definition, causes, effects and role of dialysis and renal transplantation in its management.

g. Cerebral system:

Cerebral circulation, intra-cranial pressure, cerebral edema, Cerebral aneurysms-Carotid stenosis-stroke. (6 hrs)

h. Miscellaneous:

Hyperthermia-cold reactive protein-sickle cell anaemia-methhaemoglobinuria-G6 PD deficiency- (6 hrs)

I. BIOMATERIALS

a. **Synthetic Polymers:** Polymers in biomedical use, polyethylene and polypropylene, perfluorinated polymers, acrylic polymers, hydrogels, polyurethanes, polyamides, biodegradable synthetic polymers, silicone rubber, plasma polymerization, micro-organisms in polymeric implants, polymer sterilization. (5 hrs)

b. **Biocompatibility:**

Definition, Wound healing process-bone healing, tendon healing. Material response: Function and Degradation of materials in vivo. Host response: Tissue response to biomaterials , Effects of wear particles. Testing of implants: Methods of test for biological performance- In vitro implant tests, In vivo implant test methods. Qualification of implant materials. (10 hrs)

c. **Biopolymers:**

Polymers as biomaterials, microstructure, mechanical properties – effects of environment on elastic moduli, yield strength and fracture strengths, sterilization and disinfections of polymeric materials. Biocompatibility of polymers, polymers as biomaterials, heparin and heparin-like polysaccharides, proteoglycans, structure and biological activities of native sulfated glycosaminoglycans, chemically modified glycosaminoglycans, heparin like substances from nonglycosaminoglycan polysaccharides and microbial glycosaminoglycan, surface immobilized heparins. (10 hrs)

Text book / Reference Books:

1. Textbook of pathology: Harsh Mohan. 6th edition
2. Robbins Basics Pathology: Kumar, Abbas, Fausto, Mitchell. 8th edition

V Semester

PRACTICAL 1: PTBS26

Practical 45 Hours

ADVANCED PERFUSION TECHNOLOGY I

Contents

1. Assembling a CBP circuit and priming.
2. Managing accidents on CPB.
3. Identification of various CPB circuit components and their uses, method of sterilization and complications related to them.

PRACTICAL 2: PTBS27

ADVANCED PERFUSION TECHNOLOGY II

1. Identification of drugs and their pharmacology
2. Calculating vascular resistance on CPB and management of increased perfusion pressure on bypass.
3. Setting up heart lung machine for levels sensor and line pressures.

ELS05

Theory: 30 Hours

Disaster & Emergency Management

A. Introduction to Disaster management

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management

C. Modern disaster management – disaster cycle

D. Hazards

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
-stages

-Basic elements

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	PTBS28	Recent Advances in Perfusion	04			04
2	PTBS29	Clinical Perfusion Technology	04			04
3	ELS06	Elective Subject : Basics of Biomedical Engineering // Basics of Electricity and Electronics	02			02
4	PTBS30	Clinical Perfusion – I		03	02	05
5	PTBS31	Clinical Perfusion - II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA	Grand Total
1	PTBS28	Paper 1	Recent Advances in Perfusion	60 + 20 + 20	100
2	PTBS29	Paper 2	Clinical Perfusion Technology	60 + 20+ 20	100
3	ELS06	Paper 3	Elective subject: Basic of Biomedical Engineering / Basics of Electricity and Electronics	80+20	100
Grand Total					300

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
4	PTBS30	Practical 1	Clinical Perfusion – I	160 + 40	200
5	PTBS31	Practical 2	Clinical Perfusion - II	160 + 40	200
Grand Total					400

Type of questions and distribution of marks for Theory examination

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT**2. Scheme of Practical Examination for Sixth Semester**

Sr. no	Subject	Practical	IA	Grand Total
1	Clinical Perfusion – I	160	40	200
2	Clinical Perfusion - II	160	40	200

VI Semester

PAPER 1: PTBS28

Theory 45 hours

RECENT ADVANCES IN PERFUSION – I

<u>Contents:</u>	No. of Hours
1. Perfusion techniques for paediatric cardiac surgery.	3 hrs.
2. ECMO : Management of VV and VA ECMO clinical assessment and pre ECMO patient evaluation. Different cannulation techniques and selection criteria for cannulation (VV/VA).	3 hrs.
3. Management of LVAD and impellar in patients as bridge to transplant.	3 hrs.
4. Heart / Lung transplantation / organ procurement preservation techniques and role of Perfusionist.	3 hrs.
5. Perfusion for non-cardiac surgery Invasive cardiology and outside the operation theater.	3 hrs.
6. Complications and safety during CPB.	7 hrs.
7. Minimally invasive surgery and the Perfusionist.	3 hrs.
8. Experimental perfusion.	3 hrs.

VI Semester

PAPER 2: PTBS29

Theory 50 Hours

CLINICAL PERFUSION TECHNOLOGY

- ❖ Cardiovascular System
 - Ischaemic heart diseases
 - Rheumatic heart disease
 - Congenital heart disease
 - Hypertension
 - Aortic Aneurysms
 - Cardiomyopathy
 - Peripheral vascular disease
 - Pulmonary edema and LV failure
- ❖ Hematology
 - Anaemia
 - Bleeding disorders
 - Laboratory tests used to diagnose bleeding disorders (in brief)
- ❖ Respiratory System
 - Chronic obstructive airway diseases (COPD)
 - Concept of obstructive versus restrictive pulmonary disease
 - PFT and its interpretation
- ❖ Renal System
 - ARF & CRF
 - End stage renal disease
 - Role of dialysis and renal transplantation in its management
- ❖ CNS
 - Automatic nervous system
 - (Sympathetic & Parasympathetic system)
 - Brief mention of CNS disorders & their etiology
- ❖ Others
 - DM
 - Obesity
 - Pregnancy
 - Paediatric Patient (neonate/Infant)
 - Elderly patient

VI Semester

PRACTICAL 1: PTBS30 CLINICAL PERFUSION - I

Contents:

1. Setting up of heart lung machine for a given case.
2. Managing oxygenator failure during emergency.
3. Arterial blood gas management and electrolytes correction.

PRACTICAL 2: PTBS31 CLINICAL PERFUSION - II

Contents:

1. Setting up of ECMO circuit and priming.
2. Occlusion setting methodology.
3. Settings of pulsatile perfusion.

Basics of Biomedical Engineering**Topics**

- Insulators and conductors
- Units of measurements
- Electrical power transmission
- Resistors, capacitors and inductors
- Regulated power supply
- Voltage stabilizers
- Uninterrupted power supply systems
- Amplifiers – AC and DC
- Differential amplifiers
- Input impedance
- Output impedance
- Gain and amplification
- Noise
- Common Mode Rejection Ratio (CMRR)
- Filters - Principles
 - High frequency filters
 - Low frequency filters
 - Band Pass filters
- Analog to digital converter (ADC) and Digital Analog converter (DAC)
- Sensitivity & Gain
- Averaging principles

ELS06

Theory: 30 Hours

Fundamentals of Electricity and Electronics:

Resistance: Symbol, units, colour coding equivalent resistance with 'connection in series and parallel.

Capacitance: Symbol, units, series and parallel connection

Inductance and transformers

Parameters of electricity power - voltage, current frequency, power.

Differences between AC and DC - .

AC and DC power supplies, Phase, neutral and earth - conventional colour coding

Ohms law and Kirchoff's law Electrical Circuits.

Earth and grounding - Symbol, importance in patient care.

AC and DC power supplies- Phase, neutral and earth - conventional colour coding

Classification of medical equipment

1. According to type of protection: B C F etc
2. According to mode of protection: Class I -III

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in al the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.
- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can

appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass

- a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
- b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
- d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA):**

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA / No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the first year subjects shall have postgraduate degree in the respective subject with 3 years of teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Anaesthesia Technology Degree Course (Semester System) Syllabus/Curriculum 2023-24



Accredited '**A+**' Grade by NAAC (3rd Cycle)
Placed in '**A**' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research (Deemed-to-be-University)

[Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Government of India Notification
No. F.9 -19/2000-U.3 (A)]

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth.
- To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

CONTENTS

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Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Applied Pharmacology	80 + 20	Practical I	120+30
		Introduction to Anaesthesia Technology	60 + 20 + 20	Practical II	120+30
		Applied Technology in Anaesthesia	60 + 20 + 20		
4.	4th Semester	Applied Pharmacology	80 + 20	Practical I	120+30
		Applied Anaesthesia Technology I	60 + 20 + 20	Practical II	120+30
		Applied Anaesthesia Technology II	60 + 20 + 20		

Third Year					
5.	5th Semester	Applied Anaesthesia Technology I	60 + 20 + 20	Practical I	120+30
		Applied Anaesthesia Technology II	60 + 20 + 20	Practical II	120+30
		Applied Anaesthesia Technology III	60 + 20 + 20		
6.	6th Semester	Applied Anaesthesia Technology I	60 + 20 + 20	Practical I	120+30
		Applied Anaesthesia Technology II	60 + 20 + 20	Practical II	120+30
		Applied Anaesthesia Technology III	60 + 20 + 20		
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Cardiac Anaesthesia	
		2. Intensive Care Unit	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
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40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits} \times \text{grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: **Total No. of SGPA /No. of Semester**

B.Sc. ANAESTHESIA TECHNOLOGY

PREAMBLE

The B.Sc. Anaesthesia Technology Course is of **3 years (6 semesters) and 1 Year internship** duration program aimed at training students in the technological aspects of Anaesthesia care with a good scientific foundation. These students will be in a position to competently assist the Anaesthesiologists especially in high tech Anaesthesia techniques in surgical theatre. They will be in much demand both within the country and abroad as Anaesthesia Technologists. With advanced training in the latest technologies in Anaesthesia Specialty, these graduates will play an important role in determining the quality of healthcare provided.

OBJECTIVE

The objective is to impart the basic Anaesthesia knowledge, technical skills which its application in the healthcare delivery system.

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – Anaesthesia technology shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

II. DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory rotatory internship.

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BATS01	Human Anatomy	02		02
2	BATS02(A)	Human Physiology	02		02
	BATS02(B)	Basics of Biochemistry	02		02
3	BATS03(A)	Pathology : Basic Hematology	02		02
	BATS03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	BATS04	Human Anatomy		02	02
6	BATS05 (A)	Human Physiology		02	02
	BATS05(B)	Basics of Biochemistry		02	02
7	BATS06(A)	Pathology : Basic Hematology		02	02
	BATS06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BATS01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BATS02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	BATS03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BATS04	Practical 1	Human Anatomy	80 + 20	100
6	BATS05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BATS06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief

Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: BATS01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: BATS04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of **different parts of Brain & Spinal Cord**

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BATS04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: BATS02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions
Classification of Body fluid compartments & composition, Homeostasis
Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis
Neuron and Neuroglia
Classification and Properties of Nerve fibers
Classification of Muscles
Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction
Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.
Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood
Plasma proteins: types & functions
Red Blood Cells: Morphology & functions, Erythropoiesis
Hemoglobin: structure, types, functions & fate of Hb
Definition and Classification of Anaemia & Jaundice
White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification
Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders
Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System
Functional organization of CNS, Structure of Spinal Cord
Autonomic Nervous System - Divisions & their Functions
Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of

Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - BATS05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry
- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups

- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: BATS02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: BATS05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks	40 Marks
IA Marks:	10 Marks
Grand Total	50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

Semester I

PAPER 3 - BATS03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: BATS06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- BATS03

Theory 30 Hours

Section B – Microbiology

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.
 - **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methodsAntiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
 - **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo

2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: BATS06
Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes
- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology

Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur
- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BATS07	Anatomy	02		02
2	BATS08(A)	Physiology	02		02
	BATS08(B)	Biochemistry	02		02
3	BATS09(A)	Hematology & Clinical Pathology	02		02
	BATS09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	BATS10	Human Anatomy		02	02
6	BATS11(A)	Human Physiology		02	02
	BATS11(B)	Basics of Biochemistry		02	02
7	BATS12 (A)	Hematology & Clinical Pathology		02	02
	BATS12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BATS07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BATS08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	BATS09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BATS10	Practical 1	Human Anatomy	80 + 20	100
6	BATS11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BATS12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy

Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - BATS10
Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
 Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi

2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – BATS08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – BATS11 Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: BATS08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: BATS11

Practical : 30 Hours

Basics of Biochemistry II

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata- 700009 (India)

PAPER 3: BATS09

Theory : 30 Hours

Section A - Haematology & Clinical Pathology

Hematology

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)

3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Traveller Bookseller, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: BATS12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid

10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: BATS09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr. C.P. Baveja.

PRACTICAL 3: BATS12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

25 marks

• Biomedical waste management	10 marks
• Serological tests/Inoculation techniques	15 marks
Minor :	15 marks
• Spotters	15 marks
IA	10 marks
	Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
- a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices),
Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
- b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
- c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.

- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. *Introduction to installation of different software and introduction about different software related to MLS.***

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal

- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
- Youth development programmes at the National level, State level and voluntary sector

Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV**UNIT 1: Youth Health and Yoga**

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking
- Self Confidence and Self esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BATS13	Applied Pharmacology	02			02
2	BATS14	Introduction to Anaesthesia Technology	02			02
3	BATS 15	Applied Technology in Anaesthesia	02			02
4	AECC01	AECC: Environmental Studies	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	BATS 16	Practical I		03	02	05
7	BATS17	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER
Scheme of Examination:

Sl. No.	Subject Code	Examination	Subjects	Max. + IA + Viva	Grand Total
1	BATS13	Paper 1	Applied Pharmacology	80+20	100
2	BATS14	Paper 2	Introduction to Anaesthesia Technology	60 + 20 + 20	100
3	BATS15	Paper 3	Applied Technology in Anaesthesia	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	BATS16	Practical 1	Practical I	120 + 30	150
7	BATS17	Practical 2	Practical II	120 + 30	150
Grand Total					300

SCHEME OF EXAMINATION FOR THEORY:**Type of questions and distribution of marks for Theory examination in each subject**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT**1. Scheme of Practical Examination for fourth Semester**

Sr. no		Practical	IA	Grand Total
1	Practical paper	120	30	150

SEMESTER III

PAPER 1: BATS13 APPLIED PHARMACOLOGY

PHARMACOLOGY

THEORY

30 hours

This course introduces the students to basic pharmacology of common drugs used and their importance in different treatments.

Units	Contents	30 Hours
1	General Pharmacology: Principles of drug administration and routes of administration, absorption distribution, metabolism and excretion of drugs and Mechanisms of drug action (various ways in which they act) Factors influencing drug action. Adverse drug reactions	08
Enumeration of drugs, uses and adverse effects of the following drugs:		
2	Drugs acting on autonomic nervous system: Cholinergics, anticholinergics, adrenergics and antiadrenergics	05
3.	Skeletal Muscle Relaxants: Drugs acting at neuromuscular junction and other muscle relaxants.	01
3	Analgesics NSAIDs and opioid analgesics.	02
4.	Drugs acting on renal system: Diuretics	01
5.	Drugs acting on the Cardiovascular System Drugs acting on renin angiotensin system Antianginal drugs Drugs used in heart failure Antihypertensives Antiarrhythmic drugs	05
7.	Chemotherapy of infections: Introduction to antimicrobials Sulfonamides, penicillins, cephalosporins, fluoroquinolones, aminoglycosides, macrolides, antitubercular drugs and anti HIV drugs.	08

Scheme of Examination:

Sl.No.	Questions	Questions asked	Questions to attempt	Marks	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2x10	20	100
2	Short Essay Questions	7	6	6x5		
3	Short Answer Questions	10	10	10x3		

Duration: 3 Hours

No Practical Examination

Recommended Text Books (Latest Edition)

Sl. no	Author	Name of the text	Publication
1.	K.D. Tripathi	Essentials of Medical Pharmacology	Jaypee brothers medical publishers pvt. Ltd
2	R.S. Satoskar, S.D. Bhandarkar, Nirmala N. Rege	Pharmacology and Pharmacotherapeutics	Popular Prakashan
3	Laurence and Bennett	Clinical Pharmacology	Churchill Livingstone
4	Bertram G. Katzung	Basic and Clinical Pharmacology	McGraw hill
5	Goodman & Gilman's	The Pharmacological Basis of Therapeutics	McGraw Hill publications
6	Rang H P & Dale M M	Pharmacology	Churchill Livingstone

PAPER 2: BATS14**Theory 45 Hours****INTRODUCTION TO ANAESTHESIA TECHNOLOGY**

- A. History of Anaesthesia
- B. Introduction to Anaesthesia
- C. Anesthesia Machine –High Pressure, Intermediate Pressure, Low pressure.
 - Boyles machine and work station - basic working principle

- Hanger and yoke system
- Cylinder pressure gauge
- Pressure regulator
- Flow meter assembly
- Vaporizers- types, hazards, filling, draining, maintenance
- Machine: Checking the machine (Cockpit drill), breathing circuits, CO₂absorbents, vaporizers

D. Medical Gas supply

- Compressed Gas cylinders
- Color coding and Different Sizes of Cylinders
- Cylinder valves, Pin index
- Storage of Cylinders
- Recommendations for piping system
- Alarms and safety devices

E. Breathing Circuits

- Classification of breathing system
- Mapleson system -A B C D E F
- Jackson Rees system, Bain circuit
- Non rebreathing valves -AMBU valves
- The components of circle system, Soda lime, indicators

F. Face Masks, Airway, Endotracheal tubes, Laryngoscopes

- Types, sizes
- Cuff system
- Checking tube position
- Types of laryngoscopes- Macintosh, Millers, C-MAC
- Videolaryngoscope
- Fiberoptic bronchoscope

G. LMA

- Classification,
- Insertion technique,
- Indication, Contraindication

PAPER 3: BATS15

45Hours

APPLIED TECHNOGY IN ANAESTHESIA

A. Oxygen therapy

- Definition of hypoxemia, causes, clinical signs, treatment
- Goals of oxygen therapy
- Evaluation of patients receiving oxygen therapy
- Hazards of oxygen therapy

B. Humidification and Nebulization:

Types, Importance, Advantages

C. Manual Resuscitators

- AMBU BAG
- Indications
- Methods of increasing oxygen delivery while using oxygen with resuscitator bags

D. Sterilization of anaesthesia equipment

- Cleaning and Disinfecting of anaesthesia equipment- Circuits
- Methods of autoclaving, boiling, pasteurization, gamma radiation, chemical sterilization

- Sterilization of syringes, needles, spinal and epidural sets, airways, Magill forceps, laryngoscope etc.

E. General Anaesthesia

- Premedication
- Induction agent
- Muscle relaxant
- Reversal agent

F. Basic Monitoring

- Electrocardiogram
- Pulse Oximetry
- Non Invasive Blood Pressure Monitoring
- Temperature
- End Tidal carbon dioxide monitoring

PRACTICAL 1 : BATS16

PRACTICAL 2: BATS17

- Arrangement of monitors and anaesthesia machine before starting of any cases for anaesthesia.
- Arrangement of anaesthesia trolley for general anaesthesia
- Arrangement of anaesthesia breathing circuits
- Nasopharyngeal airways, Endotracheal tubes and Laryngeal mask airways etc.
- Sterilization of anaesthesia machine & circuits
- Filling of soda lime canister of close circuits
- Arrangement of Simple oxygen administration devices
- Airway gadgets arrangements during anaesthesia procedures
- Anaesthesia Vaporizer's to be filled and make arrangements for inhalational anaesthesia

Compulsory Course AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and

overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-

- a. Air pollution
- b. Water pollution
- c. Soil pollution
- d. Marine pollution
- e. Noise pollution
- f. Thermal pollution
- g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets
river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

B. Field Work: 20 Marks

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
- Uses and application of bio-statistics in public health research and medical sciences.
- Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
- Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
- Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
- Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
- Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.

Basic Probability : Concept of probability, its terminology and different types of definition

Laws of probability: addition law, multiplication law and conditional probability.

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BATS18	Applied Pharmacology	02			02
2	BATS19	Applied Anaesthesia Technology I	02			02
3	BATS20	Applied Anaesthesia Technology II	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject: (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	BATS21	Practical I		03	02	05
7	BATS22	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks = 1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Examination	Subjects	Theory Max. + IA + Viva Voce	Grand Total
1	BATS18	Paper 1	Applied Pharmacology	80+20	100
2	BATS19	Paper 2	Applied Anaesthesia Technology I	60 + 20 + 20	100
3	BATS20	Paper 3	Applied Anaesthesia Technology II	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	BATS21	Practical 1	Practical I	120 + 30	150
7	BATS22	Practical 2	Practical II	120 + 30	150
Grand Total					300

SCHEME OF EXAMINATION FOR THEORY:

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

2. Scheme of Practical Examination for fourth Semester

Sr. no		Practical	IA	Grand Total
1	Practical paper	120	30	150

SEMESTER IV

PAPER 1: BATS18 APPLIED PHARMACOLOGY

PHARMACOLOGY

THEORY

30 hours

This course introduces the students to basic pharmacology of common drugs used and their importance in different treatments.

Units	Contents	30 Hours
Enumeration of drugs, uses and adverse effects of the following drugs:		
1	Antihistaminics	01
2	Pharmacotherapy of respiratory disorders: a. Drugs used in bronchial asthma - Bronchodilators, corticosteroids, mast cell stabilizers and leukotriene antagonists. b. Drugs used in cough – Expectorants, mucolytics and cough centre suppressants	03
3	Drugs acting on blood: Drugs used in treatment of anaemia: iron, vitamin B12 and folic acid Drugs used in haemostasis – coagulants, anticoagulants, antiplatelet drugs, fibrinolytics (thrombolytics) and antifibrinolytic drugs. Drugs used in the treatment of shock	05
4	Drugs acting on CNS: Alcohol, sedatives, hypnotics, antiepileptic drugs and antianxiety drugs.	04
5	Anaesthetic agents Inhalational anaesthetics and intravenous anaesthetics – Advantages and disadvantages of individual agents. Adjuvants to general anaesthesia and preanaesthetic medication Local anaesthetics	03
6.	Endocrine Pharmacology Thyroid hormones and Antithyroid Drugs Corticosteroids Insulin and oral hypoglycaemic agents	06
7.	Drugs acting on GIT: Drugs for treatment of peptic ulcer disease Antiemetics Drugs used in treatment of diarrhoea Drugs used in treatment of constipation	04

8.	Antiseptics and Disinfectants	02
9.	Miscellaneous IV fluids- various preparations and their usage b. Overview and classification of common vaccines	02

Scheme of Examination:

Sl.No.	Questions	Questions asked	Questions to attempt	Marks	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2x10		
2	Short Essay Questions	7	6	6x5		
3	Short Answer Questions	10	10	10x3	20	100

Duration: 3 Hours

No Practical Examination

Recommended Text Books (Latest Edition)

Sl. no	Author	Name of the text	Publication
1.	K.D. Tripathi	Essentials of Medical Pharmacology	Jaypee brothers medical publishers pvt. Ltd
2.	R.S. Satoskar, S.D. Bhandarkar, Nirmala N. Rege	Pharmacology and Pharmacotherapeutics	Popular Prakashan
3	Laurence and Bennett	Clinical Pharmacology	Churchill Livingstone
4	Bertram G. Katzung	Basic and Clinical Pharmacology	McGraw hill
5	Goodman & Gilman's	The Pharmacological Basis of Therapeutics	McGraw Hill publications
6	Rang H P & Dale M M	Pharmacology	Churchill Livingstone

Semester IV

PAPER 2: BATS 19 APPLIED ANAESTHESIA TECHNOLOGY I

Theory 45 Hours

A CENTRAL NEURAXIAL BLOCK

1. Spinal Anaesthesia

- Applied Anatomy
- Structures Encountered during Spinal Anaesthesia
- CSF
- Systemic effects
- Factors affecting the block
- Advantages, disadvantages
- Indication, Contraindication, Complication
- Technique
- Drugs,
- Spinal needle

2. Epidural Anaesthesia

- Applied anatomy
- Structures Encountered during epidural Anaesthesia
- Systemic effect
- Advantages, Disadvantages
- Indication, Contraindication
- Epidural Needle
- Drugs
- Technique
- Complication

3. Combined Spinal Epidural

- Advantages, Disadvantages

- Indication, Contraindication
- Technique
- Complication

B. CAUDAL BLOCK

- Applied Anatomy
- Method
- Drugs
- Technique
- Indication, Contraindication

C. LOCAL ANAESTHESIA

- Classification of Local Anaesthetic drugs
- Mechanism of Action of Local Anaesthetic drugs
- Pharmacokinetics and Pharmacodynamic of Local Anaesthetic drugs

PAPER 3: BATS20

Theory 45 Hours

APPLIED ANAESTHESIA TECHNOLOGY II

NERVE BLOCKS

A. GENERAL

- Introduction, techniques for nerve location-
- Peripheral nerve stimulator, Ultrasoundguided block & Anatomical landmark
- Indication, Contraindication
- Complications-Local anesthesia systemic toxicity& Block specific complications

B. UPPER LIMB BLOCKS

1. Brachial Plexus Block

- Approaches, Technique, Drugs, Indication, Contraindication, Complication

2. Wrist block
 - Approach, Technique, Drugs, Indication, Contraindication, Complication
3. Digit blocks
 - Approach, Technique, Drugs, Indication, Contraindication, Complication

C. LOWER LIMB BLOCKS

1. Femoral Nerve block
Technique, Drugs, Indication, Contraindication, Complication
2. Sciatic nerve block
Technique, Drugs, Indication, Contraindication, Complication
3. Popliteal block
Technique, Drugs, Indication, Contraindication, Complication
4. Ankle block
Technique, Drugs, Indication, Contraindication, Complication

D. DRUGS USED

1. Local Anaesthetics- Lignocaine, Bupivacaine, Ropivacaine (all preparations)
2. Adjuvants used in regional Anaesthesia- Clonidine, Dexmedetomidine, Dexamethasone, Sodium bicarbonate, Fentanyl Etc.,
3. Local Anaesthesia Toxicity

E. Management of Patient with Fluid

F. Electrolyte disturbance

G. Blood and Blood Products

PRACTICAL 1 : BATS21

PRACTICAL 2: BATS22

- Preparation of Spinal set
- Preparation of Epidural set
- Preparation of Caudal set
- Preparation for Upper limb and Lower limb blocks

- Drugs and instruments for regional anaesthesia
- Spotters

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- Unit I** a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution.
- Unit II** The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions.
- Unit III** Fundamental Rights and Duties - Their content and significance
- Unit IV** Directive Principles of State policies - The need to balance Fundamental Rights with
Directive Principles.
- Unit V** Special rights created in the constitution for Dalits, Backward class, Women and

Children, and the Religious and Linguistic Minorities

Unit VI Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.

Unit VII The Election Commission and State Public Service Commissions.

Unit VIII Method of amending the Constitution.

Unit IX Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.

Unit X Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/mpi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constitution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04
Research Methodology & Bioethics

Theory: 30 Hours

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

ELS04

Theory: 30 Hours

Fundamentals of Health Education & Communication

Introduction to Health Education and health promotion

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.

10. Health Education Methods and Media

- **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
- Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
- Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
- Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BATS23	Applied Anaesthesia Technology I	03			03
2	BATS24	Applied Anaesthesia Technology II	03			03
3	BATS25	Applied Anaesthesia Technology III	02			02
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	BATS26	Practical I		03	02	05
7	BATS27	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA + Viva Voce	Total
1	BATS23	Paper 1	Applied Anaesthesia Technology I	60 + 20 + 20	100
2	BATS24	Paper 2	Applied Anaesthesia Technology II	60 + 20 + 20	100
3	BATS25	Paper 3	Applied Anaesthesia Technology III	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject (Hospital Administration/ Disaster Management)	80+20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BATS26	Practical 1	Practical I	120 + 30	150
6	BATS27	Practical 2	Practical II	120 + 30	150
Grand Total					300

SCHEME OF EXAMINATION FOR THEORY:

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

3. Scheme of Practical Examination for Fifth Semester

Sr. no		Practical	IA	Grand Total
1	Practical paper	120	30	150

SEMESTER V

PAPER 1: BATS23

Theory 45 Hours

APPLIED ANAESTHESIA TECHNOLOGY I

A. Anaesthesia for Laparoscopic surgeries

- Preanaesthetic evaluation
- Preoperative preparation
- Planning for anaesthesia techniques
- Pre anaesthetic medication
- Intra operative anaesthetic management Special considerations
- Recovery
- Post-operative care

Anaesthesia for obstetrics and Gynaecology

B. Anaesthesia for Obstetrics and Gynaecology

C. Major GI surgeries

- Preanaesthetic evaluation
- Preoperative preparation
- Planning for anaesthesia techniques
- Pre anaesthetic medication
- Intra operative anaesthetic management Special considerations
- Recovery
- Post - operative care

D. Anaesthesia for Geriatrics

E. Anaesthesia for Trauma

F. Anaesthesia for Burns - including management of Difficult Airway

G. Anaesthesia for Endocrine disease - including Diabetes Mellitus, Hypertension, Pheochromocytoma.

APPLIED ANAESTHESIA TECHNOLOGY II

A. Orthopaedic surgery including replacements & arthroscopies

- Preanaesthetic evaluation
- Preoperative preparation
- Planning for anaesthesia techniques
- Pre anaesthetic medication
- Intra operative anaesthetic management Special considerations
- Recovery
- Post-operative care

B. Ophthalmic surgery including phacoemulsification & retinal surgeries

- Preanaesthetic evaluation
- Preoperative preparation
- Planning for anaesthesia techniques
- Pre anaesthetic medication
- Intra operative anaesthetic management Special considerations
- Recovery
- Post-operative care

C. ENT surgeries including microsurgeries & laser surgeries

- Preoperative preparation
- Planning for anaesthesia techniques
- Pre anaesthetic medication
- Intra operative anaesthetic management
- Special considerations
- Recovery
- Post-operative care

D. Day Care Anaesthesia

E. Remote Location Anaesthesia

F. Mechanical Ventilation

APPLIED ANAESTHESIA TECHNOLOGY III

A. Anaesthetic implications in medical conditions

- Anaesthesia for Renal diseases
- Anaesthesia for Respiratory diseases
- Anaesthesia for Patient with Cardiovascular diseases (including hypertension)
- Anaesthesia for Liver diseases
- Anaesthesia and Obesity

PRACTICAL 1 : BATS26

PRACTICAL 2 : BATS27

- Preparation & loading of common anaesthesia drugs
- Preparation & loading of emergency drugs including infusions
- Dosage of common anaesthesia & emergency drugs
- Setting of emergency drug trolley
- Setting of airway management equipments
- Setting difficult airway equipments including difficult airway cart & Fiberoptic bronchoscope
- Checking of anaesthesia machine & drill (check list)
- Checking of breathing circuits, vaporisers, ventilators, defibrillators & suction machine
- Positioning for different surgical procedures
- Fluids
- Positioning for spinal, epidural anaesthesia and general anaesthesia
- Care of anaesthetized patient
- Assisting the anaesthesiologists in anaesthesia management of different specialized surgical procedures

Disaster & Emergency Management**A. Introduction to Disaster management**

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management**C. Modern disaster management – disaster cycle****D. Hazards**

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
 - stages
 - Basic elements

ELS05

30 Hours

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BATS28	Applied Anaesthesia Technology I	03			03
2	BATS29	Applied Anaesthesia Technology II	02			02
	BATS30	Applied Anaesthesia Technology III	03			03
3	ELS06	Elective Subject : <ul style="list-style-type: none"> • Cardiac Anaesthesia • Intensive Care Unit 	02			02
4	BATS31	Practical I		03	02	05
5	BATS32	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA + Viva Voce	Total
1	BATS28	Paper 1	Applied Anaesthesia Technology I	60 + 20 + 20	100
2	BATS29	Paper 2	Applied Anaesthesia Technology II	60 + 20 + 20	100
3	BATS30	Paper 3	Applied Anaesthesia Technology III	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject : <ul style="list-style-type: none"> • Cardiac Anaesthesia • Intensive Care Unit 	80+20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BATS31	Practical 1	Practical I	120 + 30	150
6	BATS32	Practical 2	Practical II	120 + 30	150
Grand Total					300

SCHEME OF EXAMINATION FOR THEORY:

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

4. Scheme of Practical Examination for Sixth Semester

Sr. no		Practical	IA	Grand Total
1	Practical paper	120	30	150

SIXTH SEMESTER

PAPER 1: BATS28 45 Hours

APPLIED ANAESTHESIA TECHNOLOGY I

A. MONITORING

- Arterial pressure monitoring
 - Invasive
 - Non invasive
- End tidal carbon dioxide monitoring
- Monitoring anaesthetic gases
- Airway pressure monitoring
- Monitoring oxygen saturation

B. Neuromuscular monitoring

- Equipment
- Electrodes
- Choice of monitoring site

C. Temperature monitoring

- Basic physiology of thermoregulation
- Sites of temperature monitoring
- Care of probes
- Complications
- External warming devices

D. Arterial blood gas monitoring

- Collection of sample
- Storage of sample before transport

E. Basics of Thrombo elastography

F. Glucose monitoring and its significance

G. Central venous pressure monitoring

H. Cardiac output monitoring

- Entering data in cardiac output monitor
- Continuous cardiac output
- Intermittent bolus technique
- Non-invasive cardiac output monitoring

I. Basics of Monitoring Depth of Anaesthesia

PAPER 2:BATS29

30 Hours

APPLIED ANAESTHESIA TECHNOLOGY II

A. Post Anaesthesia care unit (PACU)

- Concept
- Positioning
- Monitoring
- Common complications

B. Procedures in Anaesthesiology

- Venous Cannulation
 - o Peripheral
 - o Central
- PA catheter insertion
- Arterial Cannulation

- Emergency cricothyroidotomy
- Fiberoptic bronchoscopy
- Transesophageal echocardiography

C. Electrical Safety in Operating Room

- Fire triangle
- Ignition Sources
- Fuels
- Oxidizers

D. Environmental Safety in Operating Room

E. Basic Life Support

PAPER 3:BATS30

45 Hours

APPLIED ANAESTHESIA TECHNOLOGY III

B. Anaesthesia for various specialty

- Cardiac Anaesthesia (including drugs)
- Neuro Anaesthesia
- Paediatric Anaesthesia
- Thoracic and vascular Anaesthesia
- Genitourinary Surgery
- Organ Transplantation

C. Complications during Anaesthesia

- Cardiovascular
- Respiratory
- Nervous system
- Temperature
- Adverse drug effects

D. Critical Care

E. Adult Cardiac Life Support

PRACTICAL 1 : BATS31

PRACTICAL 2 : BATS32

- Preparation for Central Venous Cannulation, Invasive blood pressure cannulation.
- Preparation for Emergency cricothyroidotomy, Fiberoptic bronchoscopy, Transesophageal echocardiography
- Preparation of various cardiac drugs, infusion pumps, infusion sets.
- Preparation of Anaesthesia trolley for difficult airway.
- Preparation for Fiber optic intubation, Emergency cricothyroidotomy
- Trans esophageal echocardiography, PA catheter insertion.

ELS06 Elective Subject: Cardiac Anaesthesia**30 Hours**

Sl.NO	Topics	Hours
01.	Cardiac Physiology	2
02.	Cardiac Drugs	2
03.	ECG	2
04.	Ischemic Heart Disease And Valvular Heart Disease	2
05.	Preoperative Evaluation And Preparation	2
06.	Intraoperative Monitoring	2
07.	Cardiopulmonary Bypass	2
08.	On Pump CABG, Ventilatory Settings.	2
09.	Cardioplegia	2
10.	Defibrillation	2
11.	IABP	2
12.	ECMO	2
13.	Pacemaker,ICD.	2
14.	Heart Transplantation	2
15.	Post-Operative Complications And Management	2

ELS06 Elective Subject : Intensive Care Unit**30 Hours**

Sl No	Topics	Hours
1	Briefing on ICU setup	2 Hours
2	Basic Monitoring	2 Hours
3	Advance Monitoring	2 Hours
4	Arterial blood gas analysis	2 Hours
5	Non Invasive Ventilation	2 Hours
6	Basics of Invasive Ventilation	2 Hours
7	Various modes of Ventilation	2 Hours
8	Newer Ventilation	2 Hours
9	Weaning	2 Hours
10	Total par enteral nutrition	2 Hours
11	Inotropes	2 Hours
12	Glasgow coma scale	2 Hours
13	Electrolytes	2 Hours
14	Blood & Blood products	2 Hours
15	Emergency Medications	2 Hours

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in all the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.
- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass
 - a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
 - b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
 - c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
 - d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits} \times \text{grade points}}{\text{Total Credits}}$$

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the First year subjects shall have Postgraduate degree in the respective subject with 3 years teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Neuroscience Technology Degree Course (Semester System) Syllabus/Curriculum 2023-24



Accredited 'A+' Grade by NAAC (3rd Cycle) Placed
in 'A' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research

(Deemed-to-be-University)

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No. F.9 -19/2000-U.3 (A)]

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth. To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

CONTENTS

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B.Sc. Neuroscience Technology

PREAMBLE

The B.Sc. Neuroscience Technology Course is of **3 years (6 semesters) and 1 Year internship** degree course aimed at training the students in the technological aspects of medical care with a good scientific foundation. These students will be in a position to competently assist the Neurologist, especially in high tech Neurological procedures. They will be in demand both within the country and outside as Allied Healthcare personnel. With advanced training in the latest technologies in Neurology specialty, these graduates will play an important role in determining the quality of health care provided

I. TITLE OF THE COURSE

The course shall be called Bachelor of Science in Neuroscience Technology.

II. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – **Neuroscience Technology** Course shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

III. DURATION OF COURSE

The duration of the Course shall be for **period of three years and one year compulsory rotatory internship.**

IV. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

V. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

VI. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Basic Neurosciences - I	60 + 20 + 20		
		Applied Technology – I Basic Principles of Clinical Neurophysiology	60 + 20 + 20	Applied Technology Part I	120 + 30
		Applied Technology – II Basic Principles of Electroencephalography	60 + 20 + 20	Applied Technology Part II	120 + 30
4.	4th Semester	Basic Neurosciences II	60 + 20 + 20		
		Applied Technology III Nerve Conduction Studies (Basic)	60 + 20 + 20	Applied Technology III (Nerve conductions)	120 + 30
		Applied Technology IV: Electromyography & Evoked Potentials (Basic)	60 + 20 + 20	Applied Technology IV (Evoked Potentials)	120 + 30

Third Year					
5.	5th Semester	Applied Neurology - I	60 + 20 + 20		
		Applied Technology – V Electroencephalography	60 + 20 + 20	Applied Technology – V Practical Electroencephalography	120 + 30
		Applied Technology – VI Electroneuromyography (ENMG)	60 + 20 + 20	Applied Technology – VI Practical Electroneuromyography (ENMG)	120 + 30
6.	6th Semester	Applied Neurology – II	60 + 20 + 20	Applied Technology – VIIA Electroneuromyography (ENMG)	160 + 40
		Applied Technology – VII Electroneuromyography (ENMG) and evoked potentials (EP)	60 + 20 + 20	Applied Technology – VIIB Evoked potentials (EP)	160 + 40
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basic of Biomedical Engineering	
		2. Fundamentals of Electricity and Electronics	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: **Total No. of SGPA /No. of Semester**

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BNST01	Human Anatomy	02		02
2	BNST02(A)	Human Physiology	02		02
	BNST02(B)	Basics of Biochemistry	02		02
3	BNST03(A)	Pathology : Basic Hematology	02		02
	BNST03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	BNST04	Human Anatomy		02	02
6	BNST05 (A)	Human Physiology		02	02
	BNST05(B)	Basics of Biochemistry		02	02
7	BNST06(A)	Pathology : Basic Hematology		02	02
	BNST06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BNST01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BNST02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	BNST03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BNST04	Practical 1	Human Anatomy	80 + 20	100
6	BNST05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BNST06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester I

PAPER 1: BNST01 Human Anatomy

Theory 30 Hours

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: BNST01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: BNST04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of **different parts of Brain & Spinal Cord**

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BNST04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: BNST02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions

Classification of Body fluid compartments & composition, Homeostasis

Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis

Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - BNST05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: BNST02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: BNST05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks

40 Marks

IA Marks:

10 Marks

Grand Total

50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata- 700009 (India)

Semester I

PAPER 3 - BNST03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: BNST06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- BNST03 Section B – Microbiology

Theory 30 Hours

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.

- **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration.
 - Efficiency testing to various sterilizers.
 - (b) Chemical methods
 - Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
 - **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: BNST06
Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes

- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
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1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education

- 15) Halebidu and Belur
- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BNST07	Anatomy	02		02
2	BNST08(A)	Physiology	02		02
	BNST08(B)	Biochemistry	02		02
3	BNST09(A)	Hematology & Clinical Pathology	02		02
	BNST09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	BNST10	Human Anatomy		02	02
6	BNST11(A)	Human Physiology		02	02
	BNST11(B)	Basics of Biochemistry		02	02
7	BNST12 (A)	Hematology & Clinical Pathology		02	02
	BNST12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BNST07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BNST08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	BNST09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BNST10	Practical 1	Human Anatomy	80 + 20	100
6	BNST11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BNST12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - BNST07 **Human Anatomy**

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy

Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			

3.	Short Answers	5	5	5 x 3	15			
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Practical 1: - BNST10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – BNST08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – BNST11
Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: BNST08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: BNST11

Practical : 30 Hours

Basics of Biochemistry II

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.

6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)
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PAPER 3: BNST09**Theory : 30 Hours****Section A - Haematology & Clinical Pathology****Hematology**

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:**Reference books (Latest Edition)**

Sl · N o.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10 ·	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: BNST12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test

13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: BNST09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr.C.P.Baveja.

PRACTICAL 3: BNST12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
 - Youth development programmes at the National level, State level and voluntary sector
- Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking
- Self Confidence and Self esteem

- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BNST13	Basic Neurosciences - I	02			02
2	BNST14	Applied Technology – I Basic Principles of Clinical Neurophysiology	02			02
3	BNST15	Applied Technology – II Basic Principles of Electroencephalography	02			02
4	AECC01	AECC: Environmental Studies	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	BNST16	Applied Technology Part I Practical		03	02	05
7	BNST17	Applied Technology Part II Practical		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER
Scheme of Examination:

Sl. No.	Subject Code	Examination	Subjects	Max. + IA + Viva	Grand Total
1	BNST13	Paper 1	Basic Neurosciences - I	60 + 20 + 20	100
2	BNST14	Paper 2	Applied Technology – I Basic Principles of Clinical Neurophysiology	60 + 20 + 20	100
3	BNST15	Paper 3	Applied Technology – II Basic Principles of Electroencephalography	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	BNST16	Practical 1	Applied Technology Part I	120 + 30	150
7	BNST17	Practical 2	Applied Technology Part II	120 + 30	150
Grand Total					300

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL EXAMINATION

Scheme of Practical Examination for Third Semester

Sr. no	Examination	Practical	IA	Grand Total
1	Practical paper	120	30	150

Semester III

**PAPER 1: BNST13
BASIC NEUROSCIENCES - I**

Theory 30 Hours

Paper I:

- Anatomy of brain
- Cerebral lobes – anatomy and function
 - Frontal lobe
 - Parietal lobe
 - Temporal lobe
 - Occipital lobe
- Blood supply of brain
- Basal Ganglia
- Thalamus
- Cerebellum
- Brain Stem
 - Midbrain
 - Pons
 - Medulla oblongata
- Motor pathway
- Consciousness
- Sleep
 - Physiology of sleep

- Staging of sleep
- Resting Membrane Potential
- Ion channels
- End plate potential
- Miniature end plate potential
- Excitatory and inhibitory post-synaptic potentials
- Action potential
- Neurotransmitters
 - Dopamine
 - Acetylcholine
 - Gamma-amino butyric acid (GABA)
 - Histamine
- Autonomic nervous system

PAPER 2: BNST14
Applied Technology – I

Theory 30 Hours

Basic Principles of Clinical Neurophysiology

1. Patient preparation
2. Basic Principles
3. Electrical Safety
4. Electrical Ground and its maintenance
5. Electrodes
6. Amplifiers
7. Signal processing
8. Analog to digital conversion
9. Sampling rate
10. High Frequency filter
11. Low frequency
12. Band pass filter
13. 50 Hz filter
14. Time Constant
15. Data acquisition & Storage
16. Impedance
17. Averaging
18. Calibration
19. Common Mode Rejection Ratio
20. Triggering – Principles and applications

PAPER 3: BNST15
Applied Technology – II

Theory 30 Hours

Basic Principles of Electroencephalography

Neural Generators of Electroencephalography

- Principles of EEG Recording
- Principles of analog EEG recording
- Principles of digital EEG recording
- Electrode placements

- 10 – 20 system
- 10 – 10 system
- IFCN Guidelines for EEG Electrode placement
- T1 and T2 Electrodes
- Sphenoidal electrodes
- Optimal use of reference electrodes
 - Ear lobe reference
 - Vertex reference
 - Common average reference
- Electroencephalography Montage
 - Bipolar montages
 - Referential montages
 - Laplacian montage
- EEG rhythms
 - Alpha activity
 - Beta activity
 - Theta activity
 - Delta activity
 - Mu Rhythm
- Normal Awake EEG
- EEG during sleep
- Breech rhythm
- Benign Physiological variants in EEG
- Artifacts in EEG Recording
 - Biological artefacts
 - Equipment related artefacts
 - Environmental artefacts
- Video EEG

PRACTICAL 1: BNST16
Applied Technology Part I

Practicals: 75 Hours

1. Electrode Identification
2. Electrode Application
3. Care of Electrodes
4. Maintenance of Electrode
5. Maintenance of ENMG machinery

Practical Examinations

120 marks

Spotter identifications	60 Marks
Electrode Application	60 Marks
Internal Assessment Practical	30 Marks

Total

150 Marks

PRACTICAL 2: BNST17
Applied Technology Part II

Practicals 75 Hours

1. EEG Recording
2. Normal EEG
 - Awake EEG recording
 - EEG recording in sleep
3. EEG artefacts
 - Recognition
 - Methods to reduce artefacts

Practical Examination

120 marks

- EEG Recording 60
- EEG Interpretation
 - Awake EEG 20
 - Activation procedure 20
 - Artefacts 20
- Internal Assessment

30 Marks

Total 150 Marks

Compulsory Course AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management

- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
 - Uses and application of bio-statistics in public health research and medical sciences.
 - Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
 - Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
 - Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
 - Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
 - Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.
- Basic Probability : Concept of probability, its terminology and different types of definition Laws of probability: addition law, multiplication law and conditional probability.

Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BNST18	Basic Neurosciences II	02			02
2	BNST19	Applied Technology III : Nerve Conduction Studies (Basic)	02			02
3	BNST20	Applied Technology IV: Electromyography & Evoked Potentials (Basic)	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject: (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	BNST21	Applied Technology III Practical exam (Nerve conductions)		03	02	05
7	BNST22	Applied Technology IV Practical Exam (evoked potentials)		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Theory Max. + IA + Viva Voce	Grand Total
1	BNST18	Paper 1	Basic Neurosciences II	60 + 20 + 20	100
2	BNST19	Paper 2	Applied Technology III : Nerve Conduction Studies (Basic)	60 + 20 + 20	100
3	BNST20	Paper 3	Applied Technology IV: Electromyography & Evoked Potentials (Basic)	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
6	BNST21	Practical 1	Applied Technology III Practical exam (Nerve conductions)	120 + 30	150
7	BNST22	Practical 2	Applied Technology IV Practical Exam (evoked potentials)	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

Scheme of Practical Examination for Fourth Semester

Sl. no		Practical	IA	Grand Total
1	Applied Technology III	120	30	150
2	Applied Technology IV	120	30	150

Semester IV

**PAPER 1: BNST18
Basic Neurosciences II**

Theory 30 Hours

- Spinal Cord: Structure, Tracts, Blood Supply
- Spinal roots and peripheral nerves
- Anatomy of Individual Nerves
 - Median nerve
 - Ulnar nerve
 - Anatomical variations in median and ulnar nerves
 - Martin Gruber anastomosis
 - Richie – Cannieu anastomosis
 - Radial nerve
 - Musculocutaneous nerve
 - Axillary nerve
 - Suprascapular nerve
 - Thoracodorsal nerve

- Medial cutaneous nerve of forearm
- Lateral cutaneous nerve of forearm
- Phrenic nerve
- Femoral nerve
- Sciatic nerve
- Saphaneous nerve
- Common Peroneal nerve
- Deep peroneal nerve
- Superficial peronial nerve
- Posterior Tibial nerve
- Medial and lateral plantar nerves
- Sural nerve
- Obturator nerve
- Brachial plexus
- Lumbosacral Plexus
- Muscles
 - Facial muscles
 - Upper limb muscles
 - Lower limb muscles
- Neuromuscular Junction
 - Anatomy of neuromuscular junction
 - Physiology of neuromuscular transmission
- Visual pathway
- Auditory pathway
- Somatosensory pathways
- Motor unit
- Muscle stretch reflex
- Muscle contraction

PAPER 2: BNST19
Applied Technology III

Theory 30 Hours

Nerve Conduction Studies (Basic)

1. Principles of sensory Nerve Conductions
2. Principles of motor nerve conductions
3. Motor nerve conductions
 - a. Median nerve
 - b. Ulnar nerve
 - c. Radial nerve
 - d. Axillary nerve
 - e. Musculocutaneous nerve
 - f. Suprascapular nerve
 - g. Femoral nerve
 - h. Axillary nerve
 - i. Supramuscular nerve
 - j. Phrenic nerve
 - k. Common peroneal (Fibular) nerve
 - l. Deep peroneal nerve
 - m. Posterior tibial nerve
 - n. Medial plantar nerve
 - o. Lateral plantar nerve

4. Sensory nerve conductions
 - a. Median nerve
 - b. Ulnar nerve
 - c. Radial nerve
 - d. Lateral cutaneous nerve of forearm
 - e. Medial cutaneous nerve of forearm
 - f. Sural nerve
 - g. Superficial peroneal nerve
 - h. Saphenous nerve
5. Late Responses
 - a. H – reflex
 - b. F – response
6. Repetitive Nerve Stimulation
7. Facial nerve conductions
 - a. Facial nerve motor conductions
 - b. Blink reflex

PAPER 3: BNST20
Applied Technology IV

Theory 30 Hours

Electromyography & Evoked Potentials (Basic)

1. Principles of electromyography
2. Electrodes used for electromyography
3. Qualitative electromyography
4. Spontaneous EMG activity
 - a. Fibrillation
 - b. Positive sharp wave
 - c. End plate noise
 - d. End plate spikes
 - e. Fasciculation
 - f. Myotonic discharges
 - g. Complete repetitive discharges
 - h. Neuromyotonia discharges
 - i. Myokymic discharges
5. Motor unit potential
6. Interference pattern
7. Electrocardiogram
8. Heart rate variability
9. Sympathetic skin response
10. Principles of evoked potentials
11. Averaging
12. Visual evoked potentials
13. Auditory evoked potentials
14. Somatosensory evoked potentials (SSEP)
 - a. Median nerve SSEP
 - b. Ulnar nerve SSEP
 - c. Posterior tibial SSEP
 - d. Common peroneal nerve SSEP
 - e. Dermatome SSEP

PRACTICAL 1: BNST21
Applied Technology III

Practicals 75 Hours

Practical exam (Nerve conduction)

1) Recording of Nerve conduction

- Motor nerve conduction of upper and lower limb nerves
- Sensory nerve conduction of upper and lower limb nerves
- H – reflex
- F – response in upper and lower limb nerves

2) Measurement of nerve conduction data in motor and sensory conduction

- Latency
- Amplitude
- Duration
- Conduction velocity

1) Evaluation of vital signs

- Pulse

- Blood pressure
- Respiration
- Evaluation of conscious state, Glasgow coma score

Practical Examination		120 marks
Motor nerve conductions	30	
Sensory nerve conduction	30	
F – response	15	
H – reflex	15	
Interpretation of nerve conduction	30	
Internal Assessment (Practical)		30 Marks
Total		150 Marks

**PRACTICAL 2: BNST22
Applied Technology IV**

Practicals 75 Hours

Practical Exam (evoked potentials)

1) Recording of Evoked Potentials

- Auditory evoked potentials
- Visual evoked potentials
 - Pattern reversal
 - LED flash
- Somatosensory evoked potentials
 - Median nerve
 - Ulnar nerve
 - Posterior tibial nerve

Practical Examination		120 marks
Recording Evoked Potentials	60	
Interpretation of evoked potentials	60	
Internal Assessment (Practical)		30 marks
Total		150 Marks

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- | | |
|-----------------|---|
| Unit I | a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution. |
| Unit II | The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions. |
| Unit III | Fundamental Rights and Duties - Their content and significance |
| Unit IV | Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles. |
| Unit V | Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities |
| Unit VI | Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India. |
| Unit VII | The Election Commission and State Public Service Commissions. |

Unit VIII Method of amending the Constitution.

Unit IX Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.

Unit X Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constitution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04

Theory: 30 Hours

Research Methodology & Bioethics

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.

10. Health Education Methods and Media

- **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
- Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
- Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
- Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BNST23	Applied Neurology - IV	03			03
2	BNST24	Applied Technology – V Electroencephalography	02			02
3	BNST25	Applied Technology – VI Electroneuromyography (ENMG)	03			03
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	BNST26	Applied Technology – V Practical Electroencephalography		03	02	05
7	BNST27	Applied Technology – VI Practical Electroneuromyography (ENMG)		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA + Viva Voce	Total
1	BNST23	Paper 1	Applied Neurology - IV	60 + 20 + 20	100
2	BNST24	Paper 2	Applied Technology – V Electroencephalography	60 + 20 + 20	100
3	BNST25	Paper 3	Applied Technology – VI Electroneuromyography (ENMG)	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject (Hospital Administration/ Disaster Management)	80+20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BNST26	Practical 1	Applied Technology – V Practical Electroencephalography	120 + 30	150
6	BNST27	Practical 2	Applied Technology – VI Practical Electroneuromyography (ENMG)	120 + 30	150
Grand Total					300

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2.	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT

1. Scheme of Practical Examination for Fifth Semester

Sr. no		Practical	IA	Grand Total
1	Practical paper	120	30	150

Semester V

**PAPER 1: BNST23
Applied Neurology – IV**

Theory 45 Hours

- Classification of epilepsies
- **Semiology of epilepsies**
- Primary generalized tonic clonic epilepsy
- Absence epilepsy
- Myoclonic epilepsies
- West syndrome
- Lennox Gastaut syndrome
- Focal epilepsies
 - **Frontal lobe epilepsies**
 - **Temporal lobe epilepsies**
 - **Parietal lobe epilepsies**
 - **Occipital lobe epilepsies**
- Status epilepticus (**Definition, management and evaluation**)
- **Convulsive status epilepticus**
- **Non convulsive status epilepticus**
- **Super refractory and refractory status epilepticus**
- Antiepileptic drugs
 - a. **Phenobarbitone**
 - b. **Phenytoin**

- c. Cabamazepine
- d. Valproate
- e. Leveteracitam
- f. Lacosomide
- g. Benzodiazepine
- h. Newer antiepileptic drugs

- Sedatives
- Neostigmine, Pyridostigmine
- Myasthenia Gravis
- Coma
- Cerebrovascular disorders
- Pyogenic meningitis
- Tubercular meningitis
- Viral encephalitis
- Immune – mediated encephalitis
- Brain death
- Brain tumors
- Motor Neuron Disease
- Spinal muscular atrophy
- Sleep disorders

PAPER 2: BNST24
Applied Technology – V

Theory 30 Hours

Electroencephalography

1. Normal awake EEG
2. Normal Sleep EEG
3. Benign physiological variants of EEG
4. EEG in children
5. Maturation of EEG in neonates, infancy and childhood
6. EEG in generalized epilepsies
7. EEG in absence epilepsy
8. EEG in focal epilepsies
9. EEG in status epilepticus
10. EEG in metabolic disease of brain
11. EEG changes in CNS infections
12. EEG in Brain Death
13. EEG in head trauma
14. EEG in cerebrovascular diseases
15. EEG in brain tumor
16. EEG changes due to medications
17. Video EEG
18. Long term EEG monitoring
19. Quantitative EEG analysis
20. Spike detection
21. Brain mapping

22. Polysomnography
23. Intra – operative EEG monitoring
24. Magnetoencephalography

PAPER 3: BNST25
Applied Technology – VI

Theory 45Hours

Electroneuromyography (ENMG)

1. Principles of Nerve conduction studies
2. Physiological variables affecting nerve conduction
3. Nerve conduction in Demyelinating neuropathies
4. Nerve conduction in axonopathies
5. Nerve conduction studies in entrapment neuropathies
6. Evaluation of Brachial plexus
7. Evaluation of lumbosacral plexus
8. Evaluation of radiculopathies
9. Repetitive nerve stimulation
10. H – reflex
11. F – response
12. Masseter reflex
13. Pain evoked sensory potentials
14. Event related potentials
15. Electronystagmography (ENG)
16. Magnetic stimulation of brain
17. Magnetic stimulation of peripheral nerves

PRACTICAL 1: BNST26
Applied Technology – V

Practical: 75 Hours

Electroencephalography

1. Recording of EEG in laboratory
2. Point of care EEG recording
3. Factual reporting of normal EEG
4. Factual reporting of abnormal EEG

Practical Examination

EEG Reporting		120 marks
a. Generalised abnormalities	60	
b. Focal abnormalities	60	
Internal Assessment (Practicals)		30 Marks
Total		150 Marks

PRACTICAL 2: BNST27
Applied Technology – VI

Practical: 75 Hours

Electroneuromyography (ENMG)

1. Factual reporting of motor conductions
2. Factual reporting of sensory conductions
3. Late responses and blink reflex

Practical Examination 120 marks

Recording of nerve conductions 60 marks

Interpretation of nerve conduction studies 60 marks

Internal Assessment (Practicals) 30 marks

Total 150 marks

ELS05

Theory: 30 Hours

Disaster & Emergency Management

A. Introduction to Disaster management

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management

C. Modern disaster management – disaster cycle

D. Hazards

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
-stages

-Basic elements

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BNST28	Applied Neurology – II	04			04
2	BNST29	Applied Technology – VII Electroneuromyography (ENMG) and evoked potentials (EP)	04			04
3	ELS06	Elective Subject : Basics of Biomedical Engineering // Fundamentals of Electricity and Electronics	02			02
4	BNST30	Applied Technology – VIIA Electroneuromyography (ENMG)		03	02	05
5	BNST31	Applied Technology – VIIB Evoked potentials (EP)		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER
Scheme of Examination

Sl. No.	Subject Code	Theory	Subjects	Marks Max. + IA	Grand Total
1	BNST28	Paper 1	Applied Neurology – II	60 + 20 + 20	100
2	BNST29	Paper 2	Applied Technology – VII Electroneuromyography (ENMG) and evoked potentials (EP)	60 + 20+ 20	100
3	ELS06	Paper 3	Elective subject: Basics of Biomedical Engineering / Fundamentals of Electricity and Electronics	80+20	100
Grand Total					300

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
4	BNST30	Practical 1	Applied Technology – VIIA Electroneuromyography (ENMG)	160 + 40	200
5	BNST31	Practical 2	Applied Technology – VIIB Evoked potentials (EP)	160 + 40	200
Grand Total					400

Type of questions and distribution of marks for Theory examination

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESSMENT

2. Scheme of Practical Examination for Sixth Semester

Sr. no		Practical	IA	Grand Total
1	Practical I	160	40	200
2	Practical II	160	40	200

PAPER 1: BNST28 Applied Neurology – II

Theory 30 Hours

1. Peripheral neuropathies – clinical approach
2. Axonal neuropathies
3. Demyelinating neuropathies
4. Guillain Barre syndrome
5. Chronic inflammatory demyelinating polyneuropathy
6. Amyotrophic lateral sclerosis and motor neuron disease
7. Diabetic neuropathy
8. Uremic neuropathy
9. Hereditary motor sensory neuropathies
10. Hansen's disease
11. Mononeuritis multiplex
12. Traumatic neuropathies
13. Entrapment neuropathies
14. Compressive myelopathies
15. Non – compressive myelopathies
16. Multiple sclerosis
17. NMO spectrum disorders
18. Polymyositis and dermatomyositis
19. Muscular Dystrophies
20. Myotonic disorders
 - a. Myotonia congenita
 - b. Myotonic dystrophy
21. Myopathies

- a. Congenital myopathies
- b. Acquired myopathies
- 22. Parkinson's disease
- 23. Tremors (Definition, classification)
- 24. Different types of tremors and their treatment
- 25. Chorea
- 26. Dystonia
- 27. Periodic paralysis (hypokalemic, hyperkalemic, normokalemic)
- 28. Optic neuritis

PAPER 2: BNST29
Applied Technology – VII

Theory 30 Hours

Electroneuromyography and evoked potentials

- 1. Electromyography in myopathic disorders
- 2. Electromyography in neuropathic disorders
- 3. Electromyography in anterior horn cell disease (motor neuron diseases)
- 4. Electrophysiological evaluation of entrapment neuropathies
 - a. Carpal tunnel syndrome
 - b. Ulnar nerve entrapments
 - c. Suprascapular entrapment
 - d. Tarsal tunnel syndrome
 - e. Common peroneal nerve entrapment
- 5. Quantitative Electromyography
- 6. Single fiber Electromyography
 - a. Jitter analysis
 - b. Fiber density
- 7. EMG Interference analysis and Turns amplitude ratio
- 8. Evoked potentials in Disorders of the central nervous system disorders
- 9. Evoked potentials in Disorders of the peripheral nervous system disorders
- 10. Surface recording of EMG in movement disorders
 - a. Tremors
 - b. Myoclonus
- 11. Intraoperative monitoring using nerve conductions
- 12. Intraoperative monitoring with electromyography
- 13. Intraoperative monitoring with Evoked potentials
- 14. Vestibular evoked myogenic potentials

PRACTICAL 1: BNST30
Applied Technology – VIIA

Practical: 90 hours

Electroneuromyography (ENMG)

1. Motor nerve conduction study of upper limb nerves
2. Motor nerve conduction study of lower limb nerves
3. Sensory nerve conduction study
4. Late responses and reflexes
 - a. F wave
 - b. H reflex
 - c. Blink reflex
5. Evaluation of brachial plexopathy
6. Repetitive Nerve stimulation

Practical Examination

a. Recording Nerve conduction	60
b. Repetitive nerve stimulation	40
c. Interpretation of ENMG data	60

Internal Assessment (Practicals) 40 Marks

Total 200 Marks

PRACTICAL 2: BNST31
Applied Technology – VIIB

Practical: 90 hours

Evoked potentials (EP)

1. Somatosensory evoked potentials
2. Auditory Evoked Potentials
3. Visual evoked potentials
4. Vestibular evoked myogenic potentials

Practical Examination

a. Interpretation of evoked potentials	120 (40 x 3)
b. Recording evoked potentials	40

Internal Assessment (Practicals) 40 Marks

Total 200 Marks

**List of Reference Books for Basic Neurosciences and Applied Technology
(Latest Edition)**

Sl. No	Name of the Text Book	Author / Editor
1	Clinical Neuroanatomy	Snell R
2	Adams and Victor's Principles of Neurology	Ropper AH, Samuels MA, Klein JP
3	Electroencephalography	Niedermeyer E Fernando Lopes De Silva
4	Current Practice of Clinical Electroencephalography	Ebersole JS, Pedley TA
5	Clinical Electroencephalography	UK Mishra, J Kalita
6	Clinical Neurophysiology: Nerve Conduction Study, Electromyography and Evoked Potentials	UK Mishra, J Kalita
7	Clinical EMG and Nerve Conductions	Shin J Oh
8	Electromyography and Neuromuscular Disorders	David Preston, Barbara Shapiro
9	Electrodiagnosis in Clinical Neurology	Aminoff MJ.
10	Davidson's Principles of Internal Medicine	Penman ID, RalstonSH, Stachan MWJ, Hobson RP
11	Essentials of MEDICAL PHYSIOLOGY	K.Sembulingam, Prema Sembulingam
12	Ganong's Review of Medical Physiology	Barrett K, Barman SM, Brooks HL, Yuan J
13	Human Anatomy – Upper Limb Thorax	B. D. Chaurasia
14	Human Anatomy - Brain – Neuroanatomy	B. D. Chaurasia

Basics of Biomedical Engineering**Topics**

- Insulators and conductors
- Units of measurements
- Electrical power transmission
- Resistors, capacitors and inductors
- Regulated power supply
- Voltage stabilizers
- Uninterrupted power supply systems
- Amplifiers – AC and DC
- Differential amplifiers
- Input impedance
- Output impedance
- Gain and amplification
- Noise
- Common Mode Rejection Ratio (CMRR)
- Filters - Principles
 - High frequency filters
 - Low frequency filters
 - Band Pass filters
- Analog to digital converter (ADC) and Digital Analog converter (DAC)
- Sensitivity & Gain
- Averaging principles

ELS06

Theory: 30 Hours

Fundamentals of Electricity and Electronics:

Resistance: Symbol, units, colour coding equivalent resistance with 'connection in series and parallel.

Capacitance: Symbol, units, series and parallel connection

Inductance and transformers

Parameters of electricity power - voltage, current frequency, power.

Differences between AC and DC - .

AC and DC power supplies, Phase, neutral and earth - conventional colour coding

Ohms law and Kirchoff's law Electrical Circuits.

Earth and grounding - Symbol, importance in patient care.

AC and DC power supplies- Phase, neutral and earth - conventional colour coding

Classification of medical equipment

1. According to type of protection: B C F etc
2. According to mode of protection: Class I -III

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in al the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.
- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass
 - a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
 - b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
 - c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
 - d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to Semester Grade Point Average (SGPA):

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA / No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the First year subjects shall have Postgraduate degree in the respective subject with 3 years teaching experience or M.Sc. (Medical) with 5 years teaching experience.

- Examiners for the Basic Neurosciences (Part 1 and 2), Applied Neurology (Parts 1 and 2), and all the Applied Technology Theory and / or Practical examinations shall have DM degree in Neurology. Teaching experience is preferred.

Ordinance Governing B.Sc. Renal Dialysis Technology Degree Course

(Semester System)

Syllabus/Curriculum

2023-24



KLE
ACADEMY OF HIGHER
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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth. To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of lifelong learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

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B.Sc. RENAL DIALYSIS TECHNOLOGY

PREAMBLE

The B.Sc. Renal Dialysis Technology Course is of **3 years (6 semesters) and 1 Year internship** duration aimed at training the young graduates in the technological aspects of dialysis care with a good scientific foundation. These students will be in a position to competently carry out hemodialysis and will also be trained in peritoneal dialysis, so as teach family members of ESRD patients how carry out peritoneal dialysis in their own home. They will be in demand both within the country and outside as Allied Healthcare personnel. With advanced training in the dialysis like SLED, CRRT and PD, these graduates will play an important role in determining the quality of health care provided.

OBJECTIVE

The objective is to impart the basic knowledge & technical skills of Dialysis and its application in the health care delivery system.

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – **Renal Dialysis Technology** Course shall have passed:

Those who have completed GNM Course (3 years or 3 year six months course)

Or

The two year Pre-University examination or equivalent as recognized university with Physics, Chemistry and Biology as principal subjects of study.

Or

Those who has completed diploma dialysis course from a recognized university

II. DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory rotatory internship

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Concepts of Renal Disease & its Management	60 + 20 + 20	Concepts of Renal Disease & its Management	80 + 20
		Basics in Renal Dialysis Technology	60 + 20 + 20	Basics in Renal Dialysis Technology	80 + 20
		Basics of Nephrology	60 + 20 + 20	Basics of Nephrology	80 + 20
4.	4th Semester	Applied Anatomy & Physiology Related To Dialysis Technology	60 + 20 + 20	Applied Anatomy & Physiology Related To Dialysis Technology	80 + 20
		Pharmacology Related To Dialysis Technology	60 + 20 + 20	Pharmacology Related To Dialysis Technology	80 + 20
		Applied Dialysis Technology 1	60 + 20 + 20	Applied Dialysis Technology 1	80 + 20

Third Year					
5.	5th Semester	Applied Dialysis Technology 2	60 + 20 + 20	Applied Dialysis Technology 2	80 + 20
		Applied Dialysis Technology 3	60 + 20 + 20	Applied Dialysis Technology 3	80 + 20
		Clinical Procedures And Instruments In Dialysis Services	60 + 20 + 20	Clinical Procedures And Instruments In Dialysis Services	80 + 20
6.	6th Semester	Renal Dialysis Technology - Advanced	60 + 20 + 20	Renal Dialysis Technology - Advanced	80 + 20
		CSSD PROCEDURES	60 + 20 + 20	CSSD PROCEDURES	80 + 20
		Procedural Skills in Renal Dialysis	60 + 20 + 20	Procedural Skills in Renal Dialysis	80 + 20
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basic of Biomedical Engineering	
		2. Fundamentals of Electricity and Electronics	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits} \times \text{grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: **Total No. of SGPA /No. of Semester**

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	RDT01	Human Anatomy	02		02
2	RDT02(A)	Human Physiology	02		02
	RDT02(B)	Basics of Biochemistry	02		02
3	RDT03(A)	Pathology : Basic Hematology	02		02
	RDT03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	RDT04	Human Anatomy		02	02
6	RDT05 (A)	Human Physiology		02	02
	RDT05(B)	Basics of Biochemistry		02	02
7	RDT06(A)	Pathology : Basic Hematology		02	02
	RDT06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	RDT01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	RDT02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	RDT03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	RDT04	Practical 1	Human Anatomy	80 + 20	100
6	RDT05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	RDT06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester I

PAPER 1: RDT01 Human Anatomy

Theory 30 Hours

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief

Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

Type of questions and distribution of marks for Theory examination in each subject in First Semester for Subject Codes: RDT01

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: RDT04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of **different parts of Brain & Spinal Cord**

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code RDT04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: RDT02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions

Classification of Body fluid compartments & composition, Homeostasis

Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis

Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - RDT05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: RDT02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: RDT05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks

40 Marks

IA Marks:

10 Marks

Grand Total

50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

Semester I

PAPER 3 - RDT03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: RDT06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- RDT03

Theory 30 Hours

Section B – Microbiology

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.

- **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methods
- Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
- **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: RDT06 Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes

- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman

2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur

- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	RDT07	Anatomy	02		02
2	RDT08(A)	Physiology	02		02
	RDT08(B)	Biochemistry	02		02
3	RDT09(A)	Hematology & Clinical Pathology	02		02
	RDT09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	RDT10	Human Anatomy		02	02
6	RDT11(A)	Human Physiology		02	02
	RDT11(B)	Basics of Biochemistry		02	02
7	RDT12 (A)	Hematology & Clinical Pathology		02	02
	RDT12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	RDT07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	RDT08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	RDT09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	RDT10	Practical 1	Human Anatomy	80 + 20	100
6	RDT11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	RDT12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - RDT07 Human Anatomy

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - RDT10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code RDT11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – RDT08 **Section A - Physiology**

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – RDT11
Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: RDT08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: RDT11 Basics of Biochemistry II

Practical : 30 Hours

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New

			Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: RDT09

Theory : 30 Hours

Section A - Haematology & Clinical Pathology

Hematology

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:**Reference books (Latest Edition)**

Sl · N o.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10 ·	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: RDT12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid

10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: RDT09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr.C.P.Baveja.

PRACTICAL 3: RDT12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices),
Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
 - Youth development programmes at the National level, State level and voluntary sector
- Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking
- Self Confidence and Self esteem

- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	RDT13	Concepts of Renal Disease & its Management	02			02
2	RDT14	Basics in Renal Dialysis Technology	02			02
3	RDT15	Basics of Nephrology	02			02
4	AECC01	AECC: Environmental Studies	02			02
5	ELS03	Elective Subject (Communication Skills / Basic Statistics)	02			02
6	RDT16	Concepts of Renal Disease & its Management		02	02	04
7	RDT17	Basics in Renal Dialysis Technology		02	02	04
8	RDT18	Basics of Nephrology		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER

S. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	RDT13	Paper 1	Concepts of Renal Disease & its Management	60 + 20 + 20	100
2	RDT14	Paper 2	Basics In Renal Dialysis Technology	60 + 20 + 20	100
3	RDT15	Paper 3	Basics of Nephrology	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Basic Statistics)	80 + 20	100
Grand Total					500

S. No.	Practical	Subjects	Practical + IA	Total
6	RDT16	Concepts of Renal Disease & its Management	80 + 20	100
7	RDT17	Basics in Renal Dialysis Technology	80 + 20	100
8	RDT18	Basics of Nephrology	80 + 20	100
Grand Total				300

SEMESTER III

Paper 1: RDT13 **Concepts of renal disease & its management**

Theory 30 Hours

1. Acute renal failure
2. Nephrotic syndrome - primary & secondary
3. Nephritic syndrome
4. UTI - urinary tract infections
5. Asymptomatic urinary abnormalities
6. Chronic renal failure
7. Renal stone diseases
8. Obstructive uropathies
9. Tumors of kidney

Books

1. Primer in Kidney Disease by Scott Gilbert
2. Kidney Disease – Guide for Living by Walter A Hunt

SCHEME OF EXAMINATION – Semester III

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

Practical 1: RDT16

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Nephrotic syndrome - primary & secondary• Nephritic syndrome• UTI - urinary tract infections	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Chronic renal failure• Renal stone disease• Obstructive uropathies	4	4X10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Books

1. Primer in Kidney Disease by Scott Gilbert
2. Kidney Disease – Guide for Living by Walter A Hunt

Paper 2: RDT14
Basics in Renal Dialysis Technology:

Theory 30 Hours

1. Indications of dialysis
2. Types of dialysis
3. Principles of dialysis - definition
4. Haemodialysis apparatus - types of dialyser & membrane
5. Types of vascular access for haemodialysis
6. Introduction to haemodialysis machine
7. Priming of dialysis apparatus
8. Dialyser reuse
9. Common complications of haemodialysis
10. Monitoring of patients during dialysis
11. Vaccination in dialysis patients and staffs.

Books

1. Handbook of Dialysis Therapy by Allen R. Nissenson

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2.	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

PRACTICAL 2: RDT17

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Indications of dialysis• Types of dialysis• Principles of dialysis – definition• Haemodialysis apparatus• Types of dialyser & membrane	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Priming of dialysis apparatus• Dialyser reuse	4	4x 10	40 Marks

Practical 80Marks
I A Marks 20Marks
Grand Total 100 Marks

Books

1. Handbook of Dialysis Therapy by Allen R. Nissension

Paper 3: RDT15
BASICS OF NEPHROLOGY

Theory 30 Hours

1. Pregnancy and renal diseases
 - Renal Physiology in Normal Pregnancy
 - Pregnancy with Preexisting Kidney Diseases
 - Renal Complications in Normal Pregnancy
1. Renal vascular disorders & hypertension associated renal diseases
 - Nonpharmacologic Prevention and Treatment of Hypertension
 - Pharmacologic Treatment of Hypertension
2. Hereditary and Congenital Diseases of the Kidney
 - Autosomal Dominant Polycystic Kidney Disease
 - Alport syndrome
 - Other Cystic Kidney Diseases
3. Diabetic nephropathy

SCHEME OF EXAMINATION –
Semester III

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

PRACTICAL 3: RDT18

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Renal Physiology in Normal Pregnancy• Pregnancy with Preexisting Kidney Diseases• Diabetic nephropathy	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Renal vascular disorders & hypertension associated renal diseases• Autosomal Dominant Polycystic Kidney Disease	4	4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Compulsory Course AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.

- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy

- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets
river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
 - Uses and application of bio-statistics in public health research and medical sciences.
 - Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
 - Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
 - Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
 - Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
 - Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.
- Basic Probability : Concept of probability, its terminology and different types of definition
Laws of probability: addition law, multiplication law and conditional probability.

Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	RDT19	Applied Anatomy & Physiology Related To Dialysis Technology	02			02
2	RDT20	Pharmacology Related To Dialysis Technology	02			02
3	RDT21	Applied Dialysis Technology 1	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	RDT22	Applied Anatomy & Physiology Related To Dialysis Technology		02	02	04
7	RDT23	Pharmacology Related To Dialysis Technology		02	02	04
8	RDT24	Applied Dialysis Technology 1		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks = 1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	RDT19	Paper 1	Applied Anatomy & Physiology Related To Dialysis Technology	60 + 20 + 20	100
2	RDT20	Paper 2	Pharmacology Related To Dialysis Technology	60 + 20 + 20	100
3	RDT21	Paper 3	Applied Dialysis Technology 1	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Practical	Subjects	Practical + IA	Total
5	RDT22	Applied Anatomy & Physiology Related To Dialysis Technology	80 + 20	100
6	RDT23	Pharmacology Related To Dialysis Technology	80 + 20	100
7	RDT24	Applied Dialysis Technology 1	80 + 20	100
Grand Total				300

PAPER 1 - RDT19

Theory 30 Hours

Applied anatomy & physiology related to dialysis technology

Applied Anatomy

1. Basic Anatomy Of Urinary System - Structural Anatomy Of Kidney, Bladder, Uretr, Urethra, Prostate
2. Histology Of Kidney
3. Blood Supply Of Kidney
4. Development Of Kidney In Brief
5. Anatomy Of Peritoneum Including Concept Of Abdominal Hernias
6. Anatomy Of Vascular System
 - Upper Limb Vessels - Course, Distribution, Branches, Origin & Abnormalities
 - Neck Vessels - Course, Distribution, Branches, Origin & Abnormalities
 - Femoral Vessels - Course, Distribution, Branches, Origin & Abnormalities

Physiology

1. Mechanism Of Urine Formation
2. Glomerular Filtration Rate (GFR)
3. Clearance Studies
4. Physiological Values - Urea, Creatinine, Electrolytes, Calcium, Phosphorous, Uric Acid, Magnesium, Glucose 24 Hours Urinary Indices - Urea, Creatinine, Electrolytes, Calcium, Magnesium
5. Physiology Of Renal Circulation
 - Factors Contributing & Modifying Renal Circulation
 - Autoregulation
6. Hormones Produced By Kidney & Physiologic Alterations In Pregnancy
7. Haemostasis - Coagulation Cascade, Coagulation Factors, Auto Regulation, BT, CT, PT, PTT, Thrombin Time
8. Acid Base Balance - Basic Principles & Common Abnormalities Like Hypokalemia, Hyponatremia, Hyperkalemia, Hypernatremia, Hypocalcemia, Hypercalcemia, PH, Etc.
9. Basic Nutrition In Renal Diseases

Semester IV**Theory Total- 100 Marks****Duration: 3 Hour**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1– RDT22

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Basic Anatomy Of Urinary System - Structural Anatomy Of Kidney, Bladder, Uretr, Urethra, Prostate• Histology Of Kidney• Blood Supply Of Kidney	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Hypokalemia, Hyponatremia, Hyperkalemia, Hypernatremia, Hypocalcemia	4	4 x 10	40 Marks

Practical
I A Marks
Grand Total 80 Marks
20Marks
100 Marks

PAPER 2-RDT20**Theory 30 Hours****Pharmacology related to dialysis technology**

1. IV fluid therapy with special emphasis in renal diseases
2. Diuretics - classification, actions, dosage, side effects & contraindications
3. Antihypertensives - classification, actions, dosage, side effects & contraindications, special reference during dialysis , vasopressors, drugs used in hypotension
4. Drugs & dialysis - dose & duration of administration of drugs
5. Dialysable drugs - phenobarbitone, lithium, methanol etc.
6. Vitamin D & its analogues, phosphate binders, iron, folic acid & other vitamins of therapeutic value
7. Erythropoietin in detail
8. Heparin including low molecular weight heparin
9. Protamine sulphate
10. Formalin, sodium hypochlorite, hydrogen peroxide - role as disinfectants & adverse effects of residual particles applicable to formalin
11. Haemodialysis concentrates - composition & dilution (acetate & bicarbonates)
12. Peritoneal dialysis fluid in particular hypertonic solutions - composition
13. Potassium exchange resins with special emphasis on mode of administration
14. Drugs used in treatment of covid 19
15. Renal dose modification of drugs used in management of covid 19.

SCHEME OF EXAMINATION – Semester IV**Theory Total- 100 Marks****Duration: 3 Hour**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	75X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 2 – RDT23

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Diuretics Antihypertensives Heparin including low molecular weight heparin Protamine sulphate	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Disinfectants Erythropoietin	4	4x 10	40 Marks

Practical
I A Marks
Grand Total 80 Marks
20Marks
100 Marks

PAPER 3-RDT21
APPLIED DIALYSIS TECHNOLOGY 1

Theory 30 Hours

COURSE CONTENT

1. Indications of dialysis
2. History & types of dialysis
3. Theory of haemodialysis - diffusion, osmosis, ultrafiltration & solvent drag
4. Haemodialysis apparatus - types of dialyser & membrane, dialysate
5. Physiology of peritoneal dialysis
6. Vascular access for haemodialysis & associated complications
7. Peritoneal access devices - types of catheter, insertion techniques & associated complications
8. Dialysis machines - mechanism of functioning & management
 - o Haemodialysis machine
 - o Peritoneal dialysis machine
9. Complications of dialysis
 - o Haemodialysis - acute & long term complications
 - o Peritoneal dialysis - mechanical & metabolic complications
10. Biochemical investigations required for renal dialysis
11. Adequacy of dialysis
 - o Haemodialysis
 - o Peritoneal dialysis
 - o Peritoneal equilibration test (PET)
12. Anti coagulation
13. Peritonitis & exit site infection
14. Withdrawal of dialysis criteria
 - o Acute dialysis
 - o Chronic dialysis

SCHEME OF EXAMINATION –
SemesterIV

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 3 – RDT24

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Haemodialysis apparatus• Peritoneal access devices• Dialysis machines	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Complications of dialysis Adequacy of dialysis	4	4x 10	40 Marks

Practical 80 Marks
I A Marks 20Marks
Grand Total 100 Marks

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- Unit I**
- a) Meaning of term Constitution.
 - b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
 - c) Salient Features of the Constitution.
 - d) Preamble of the Constitution.
- Unit II** The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions.
- Unit III** Fundamental Rights and Duties - Their content and significance
- Unit IV** Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.
- Unit V** Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities
- Unit VI** Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their

functions in India.

Unit VII The Election Commission and State Public Service Commissions.

Unit VIII Method of amending the Constitution.

Unit IX Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.

Unit X Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04

Theory: 30 Hours

Research Methodology & Bioethics

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.
10. Health Education Methods and Media
 - **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
 - Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
 - Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
 - Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	RDT25	Applied Dialysis Technology 2	02			02
2	RDT26	Applied Dialysis Technology 3	02			02
3	RDT27	Clinical Procedures And Instruments In Dialysis Services	02			02
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	RDT28	Applied Dialysis Technology 2		02	02	04
7	RDT29	Applied Dialysis Technology 3		02	02	04
8	RDT30	Clinical Procedures And Instruments In Dialysis Services		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	RDT25	Paper 1	Applied Dialysis Technology 2	60 + 20 + 20	100
2	RDT26	Paper 2	Applied Dialysis Technology 3	60 + 20 + 20	100
3	RDT27	Paper 3	Clinical Procedures And Instruments In Dialysis Services	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject : (Hospital Administration/ Disaster Management)	80 + 20	100
Grand Total					400

Sr. No.	Practical	Subjects	Practical + IA	Total
5	RDT28	Applied Dialysis Technology 2	80 + 20	100
6	RDT29	Applied Dialysis Technology 3	80 + 20	100
7	RDT30	Clinical Procedures And Instruments In Dialysis Services	80 + 20	100
Grand Total				300

FIFTH SEMESTER

PAPER 1: RDT25 APPLIED DIALYSIS TECHNOLOGY 2

Theory 30 Hours

1. Dialysis in special situations
 - Patients with congestive cardiac failure
 - Advanced liver disease
 - Patients positive for HIV, HBsAg & HCV
 - Failed transplant
 - Poisoning cases
 - Pregnancy
 - Covid infection
2. Dialysis in infants & children
3. Dialyser reuse
4. Special dialysis procedures
 - Continuous therapies in haemodialysis
 - Different modalities of peritoneal dialysis
 - Haemodiafiltration
 - Haemoperfusion
 - SLED
 - MARS
5. Prevention and control measures in covid 19.

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1 – RDT28

Practical Examination-Semester v

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Dialysis in special situations Dialysis in infants & children	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<ul style="list-style-type: none">• Continuous therapies in haemodialysis• Different modalities of peritoneal dialysis • Haemodiafiltration• Haemoperfusion• SLED• MARS	4	4 x 10	40 Marks

Practical
I A Marks
Grand Total

80 Marks
20Marks
100 Marks

APPLIED DIALYSIS TECHNOLOGY 3

1. Plasmapheresis
2. Special problems in dialysis patients
 - Psychology & rehabilitation
 - Diabetes
 - Hypertension
 - Infections
 - Bone diseases
 - Sleep disorder
3. Recent advances in haemodialysis
 - Nocturnal dialysis
 - Online dialysis
 - Daily dialysis
4. Telemedicine in dialysis practice
5. Water treatment system
6. Renal anaemia management in Chronic dialysis

Theory Total- 100 Marks**Duration: 3 Hour**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2.	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 2 – RDT29

Practical Examination-Semester VI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Plasmapheresis Recent advances in haemodialysis	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Telemedicine in dialysis practice Water treatment system Renal anaemia management in Chronic dialysis	4	4 x 10	40 Marks

Practical 80 Marks
I A Marks 20Marks
Grand Total 100 Marks

Paper 3- RDT27

CLINICAL PROCEDURES AND INSTRUMENTS IN DIALYSIS SERVICES

1. Setting up dialysis machine for dialysis
2. AV cannulation
3. AV fistula/ AV graft cannulation
4. Initiation of dialysis through central venous catheters like internal jugular, femoral & subclavian vein
5. Packing & sterilization of dialysis trays
6. Closing of dialysis
7. Preparation of concentrates depending on the situations
8. Reuse of dialysis apparatus
9. Isolated ultrafiltration
10. Performance of peritoneal dialysis exchange manually
11. Setting up of automated peritoneal dialysis equipment
12. First assistant in minor procedures
13. Skin suturing
14. CPR demonstrations
15. Setting up of SLED machine for initiation of dialysis

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 3 – RDT30

Practical Examination-Semester v

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
AV cannulation AV fistula/ AV graft cannulation Initiation of dialysis through central venous catheters Closing of dialysis Performance of peritoneal dialysis exchange manually	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Preparation of concentrates depending on the situations Reuse of dialysis apparatus Isolated ultrafiltration	4	4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Disaster & Emergency Management**A. Introduction to Disaster management**

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management**C. Modern disaster management – disaster cycle****D. Hazards**

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
 - stages

-Basic elements

ELS05

30 HOURS

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	RDT31	Renal Dialysis Technology - Advanced	02			02
2	RDT32	CSSD PROCEDURES	02			02
3	RDT33	Procedural Skills In Renal Dialysis	02			02
5	ELS06	Elective Subject Basic of Biomedical Engineering / Basics of Electricity and Electronics	02			02
6	RDT34	Renal Dialysis Technology - Advanced		02	02	04
7	RDT35	CSSD PROCEDURES		02	02	04
8	RDT36	Procedural Skills In Renal Dialysis		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER
Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	RDT31	Paper 1	Renal Dialysis Technology - Advanced	60 + 20 + 20	100
2	RDT32	Paper 2	CSSD PROCEDURES	60 + 20 + 20	100
3	RDT33	Paper 3	Procedural Skills in Renal Dialysis	60 + 20 + 20	100
4	ELS06	Paper 4 Subsidiary	Elective subject: Basic of Biomedical Engineering / Basics of Electricity and Electronics	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	RDT34	Practical 1	Renal Dialysis Technology - Advanced	80 + 20	100
6	RDT35	Practical 2	CSSD PROCEDURES	80 + 20	100
7	RDT36	Practical 3	Procedural Skills In Renal Dialysis	80 + 20	100
Grand Total					300

Paper 1 - RDT31

RENAL DIALYSIS TECHNOLOGY - ADVANCED

Hemodialysis in prospective renal transplant recipient

Hemodialysis in Delayed Graft Function

Hemodialysis allograft dysfunction

Plasmapheresis in Antibody mediated rejection

CONCEPTS IN ADVANCED LIFE SUPPORT

- Drugs

- Defibrillator

PROLONGED LIFE SUPPORT

CARE OF THE UNCONSCIOUS PATIENT

- Skin integrity assessment and care
- Physiotherapy - Chest & Limbs
- Nutritional needs and supply, Various routes of administration
- Basic care of surgical wounds and fractures
- Psychological assessment and support in an ICU.

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1 – RDT34

Practical Examination-Semester vI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
ACLS Defibrillation	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Bedsore Assessment and Prevention, Prevention of Aspiration In Unconscious Patient, Nutritional Assessment and Support	4	4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
2. ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

**PAPER 2: RDT32
CSSD PROCEDURES**

Theory: 30 Hours

1. Waste disposal collection of used items from user area, reception protective clothing and disinfections sage gaurds,
2. use of disinfectants sorting and classification of equipment for cleaning purposes, sharps, blunt lighted etc. contaminated high risk baby care - delicate instruments or hot care instruments,
3. cleaning process - use of detergents. Mechanical cleaning apparatus, cleaning instruments, cleaning jars, receivers bowels etc. trays, basins and similar hand ware utensils. Cleaning of catheters and tubings, cleaning glass ware, cleaning syringes and needles.
4. Materials used for wrapping and packing assembling pack contents. Types of packs prepared. Inclusion of trays ahd galliparts in packs. Method of wrapping and making use of indications to show that a pack of container has been through a sterilization process date stamping.
5. General observations principles of sterlization. Moist heat sterlization. Dry heat sterlization. ETO gas sterlization. H2O2 gas plasma vapo sterlization.

13. EQUIPMENT MAINTEN0NCE & BASIC TROUBLESHOOTING:

Pumps - Infusion, Syringe

Monitors - Standalone & multiparameter

ECG Machine

ABG Machine

Defibrillator

SCHEME OF EXAM FOR THEORY

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 2 – RDT35

Practical Examination-Semester III

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Cleaning And Decontamination of Instruments after Procedure, Procedure Tray Preparation	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Types of Sterlization: Moist Heat Sterlization, Dry Heat Sterlization, Ethylene Oxide Sterlization	4	4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

PAPER 3: RDT33
PROCEDURAL SKILLS IN RENAL DIALYSIS

Theory: 30 Hours

EMERGENCY LIFE SUPPORT:

Basic Life Support - Keeping Airway open, Use of Ambu bag and mask ventilation,

Advanced Cardiac Life Support

Use of Defibrillator

Maintenance of urinary catheters

Management peritoneal dialysis

Management CVVHD

Assistance:

IJV HD catheter insertion

Femoral HD catheter insertion

Tunnel catheter insertion

SCHEME OF EXAM FOR THEORY

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2.	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 3 – RDT36

Practical Examination-Semester VI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
ACLS Defibrillation, Central Venous Catheterization, Hemodialysis Catheterization	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Hemodialysis Catheterization TUNNEL CATHETER INSERTION	4	4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Basics of Biomedical Engineering

Topics

- Insulators and conductors
- Units of measurements
- Electrical power transmission
- Resistors, capacitors and inductors
- Regulated power supply
- Voltage stabilizers
- Uninterrupted power supply systems
- Amplifiers – AC and DC
- Differential amplifiers
- Input impedance
- Output impedance
- Gain and amplification
- Noise
- Common Mode Rejection Ratio (CMRR)
- Filters - Principles
 - High frequency filters
 - Low frequency filters
 - Band Pass filters
- Analog to digital converter (ADC) and Digital Analog converter (DAC)
- Sensitivity & Gain
- Averaging principles

ELS06

Theory: 30 Hours

Fundamentals of Electricity and Electronics:

Resistance: Symbol, units, colour coding equivalent resistance with 'connection in series and parallel.

Capacitance: Symbol, units, series and parallel connection

Inductance and transformers

Parameters of electricity power - voltage, current frequency, power.

Differences between AC and DC - .

AC and DC power supplies, Phase, neutral and earth - conventional colour coding

Ohms law and Kirchoff's law Electrical Circuits.

Earth and grounding - Symbol, importance in patient care.

AC and DC power supplies- Phase, neutral and earth - conventional colour coding

Classification of medical equipment

1. According to type of protection: B C F etc
2. According to mode of protection: Class I -III

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in al the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.

- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass

- a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
- b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
- d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA):**

SGPA= Credits X grade points/ Total Credits

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the first year subjects shall have postgraduate degree in the respective subject with 3 years of teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Optometry Degree Course (Semester System) Syllabus/Curriculum 2023 - 24



Accredited 'A+' Grade by NAAC (3rd Cycle)
Placed in 'A' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research (Deemed-to-be-University)

Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Government of India
Notification No. F.9 -19/2000-U.3 (A)]

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry/organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth.
- To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of lifelong learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.



INSIGNIA

The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the SevenStars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

Ref. No. KAHER/AC/22 – 23/D-28112249

Dated: 10th November 2022

NOTIFICATION

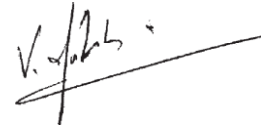
**Sub : Ordinance governing the syllabus/curriculum for
B.Sc. Optometry Course (Semester System)**

**Ref : Minutes of the meeting of the Academic Council of the
University held on 18th October 2022**

In exercise of the powers conferred under Rule A-04(i) of the Memorandum of Association of the KAHER, the Academic Council of the KAHER in its Meeting held on **18th October 2022** has approved the Ordinance governing the the revision of Curriculum for B.Sc. Optometry Course.

The Ordinance shall be effective for the students admitted to B.Sc. Optometry Course under the Faculty of Medicine in the constituent college of the KAHER viz. Jawaharlal Nehru Medical College, Belagavi from the academic session 2022-23 onwards.

By Order



REGISTRAR

To
The Dean
Faculty of Science,
J.N. Medical College, Belagavi.

CC to:

1. The PA to Hon. Chancellor, KAHER, Belagavi.
2. The Special Officer to Hon. Vice- Chancellor, KAHER, Belagavi.
3. The Principal, J N Medical College, Belagavi.
4. The Controller of Examinations, KAHER, Belagavi.
5. The Director, Academic Affairs, KAHER, Belagavi.
6. The Principal, School of Allied Health Sciences, KAHER, Belagavi.
7. The Secretary, University Grants Commission, New Delhi,

CONTENTS

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B.Sc. Optometry Course

PREAMBLE

The B.Sc. Optometry course is a semester course of three years and one year Internship degree program, focusing on ocular disorder primary eye care and medical treatment.

An optometrist will be qualified to examine refractive errors, prescribe spectacles, contact lenses, low vision aids and to detect ocular diseases and give primary eye care to the patients.

An Optometrist will assist the ophthalmologist for comprehensive eye care and also assist in the operation theatre. The candidate will also be trained in advanced technology in eye care and also be able to work in the institute.

OBJECTIVE

Optometry course is an independent specialty course focusing on ocular disorders, vision care and medical treatment.

An optometrist is qualified and institutionally trained, to examine refractive errors and ocular diseases and to manage primary eye care. They can prescribe spectacles, contact lens, low vision aids and detect ocular diseases. They are also involved in vision therapy exercises and rehabilitation of various conditions related to vision. They can council the patients with partial sight and hereditary vision defects.

According to the **World Council of Optometry**, the supreme governing body, "Optometry is a healthcare profession that is autonomous, educated, and regulated (licensed/registered), and optometrists are the primary healthcare practitioners of the eye and visual system who provide comprehensive eye and vision care, which includes refraction and dispensing, detection/diagnosis and management of disease in the eye, and the rehabilitation of conditions of the visual system."

The curriculum has been designed after a detailed evaluation of the pattern followed by different schools of optometry and considering the current eye care needs of India.

GOALS OF THE PROGRAM

The institution's mission of excellence in health care has been incorporated into the optometry syllabus .This concentrates on primary eye care, scholarly activity and development of leaders for the profession and community at large.

By successful completion of the optometry Bachelors program students will be able to:

- Correct refractive errors and prescribe glasses
- Design and dispense contact lenses
- Assess subjects with low vision and dispense appropriate aids
- Perform comprehensive evaluation of the health status of eye and visual system and detect ocular, associated systematic and neurological disorders and referral of patients to the specialists at appropriate stage

- Utilize the latest technology in the diagnosis of ocular anomalies including visual field devices, imaging technology including ultrasound and retinal imaging techniques, corneal topography, electrophysiology, etc.
- Diagnosis and orthoptic treatment of heterophoria and strabismus
- Practices of public health and community optometry in schools, colleges, urban and rural areas
- Do optometric counseling to the patients with hereditary visual defects
- Perform continuing professional education and uphold legal and ethical behavior in his/her career

I. ELIGIBILITY FOR ADMISSION

A Candidate seeking admission to the Bachelor of Science – B.Sc. Optometry course shall have passed.

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree course from a Recognized University (two years after 10 years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

OR

- 4) Pre University vocational course from an approved board with Optometry as a vocational subject.

OR

5) LATERAL ENTRY:

- a) Candidates with three years Diploma in ophthalmic Technique (DOT) after 10 years of schooling.

OR

- b) Candidates with 2 years Diploma in ophthalmic Technique (DOT) after the second year of Pre-University Examination with Physics, Chemistry and Biology as principal subjects.

- c) DOT should be obtained from a recognized Government Board.

II. DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory Rotatory Internship

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Ocular Anatomy and Visual Optics	60 + 20 + 20	Practical I	120 + 30
		Physical optics and Geometric optics	60 + 20 + 20	Practical II	120 + 30
		Optometry and dispensing of optics	60 + 20 + 20		
4.	4th Semester	Ocular Physiology and ocular biochemistry	60 + 20 + 20	Practical I	120 + 30
		Ocular Pharmacology and Nutrition & Hospital Procedure	60 + 20 + 20	Practical II	120 + 30
		Optometric instrument and Clinical examination of visual system	60 + 20 + 20		

Third Year					
5.	5th Semester	Contacts lens squint & binocular Vision	60 + 20 + 20	Practical I	120 + 30
		Ocular Diseases + Eye and Systemic Diseases	60 + 20 + 20	Practical II	120 + 30
		Ocular Pathology and Ocular Microbiology	60 + 20 + 20		
6.	6th Semester	Low vision aids Geriatric Optometry & Pediatric Optometry	60 + 20 + 20	Practical I	160 + 40
		Community Optometry			
		Occupational Optometry Research Methodology and Statistic	60 + 20 + 20	Practical II	160 + 40
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basic of Biomedical Engineering	
		2. Basics of Psychology	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA)** of all six semesters will be calculated as: **Total No. of SGPA /No. of Semester**

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BOPT01	Human Anatomy	02		02
2	BOPT02(A)	Human Physiology	02		02
	BOPT02(B)	Basics of Biochemistry	02		02
3	BOPT03(A)	Pathology : Basic Hematology	02		02
	BOPT03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	BOPT04	Human Anatomy		02	02
6	BOPT05 (A)	Human Physiology		02	02
	BOPT05(B)	Basics of Biochemistry		02	02
7	BOPT06(A)	Pathology : Basic Hematology		02	02
	BOPT06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BOPT01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BOPT02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	BOPT03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BOPT04	Practical 1	Human Anatomy	80 + 20	100
6	BOPT05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BOPT06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief

Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: BOPT04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of **different parts of Brain & Spinal Cord**

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BOPT04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks**Suggested Readings:**

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: BOPT02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions

Classification of Body fluid compartments & composition, Homeostasis

Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis

Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - BOPT05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry
- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting

- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: BOPT02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

- a. Definition, Classification and biological importance.
- b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

- a. Definition, Classification and biological importance.
- b. Simple lipids: Triacylglycerol and waxes-composition and functions.
- c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.
- d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

- a. Amino acids: Classification, properties, side chains of amino acids.
- b. Protein: Definitions, Classifications and functions.
- c. Peptides: Biologically active peptides
- d. Overview of Structural organization of proteins.
- e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

- b) DNA Structure and function
- c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: BOPT05

Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and	Total
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		Marks	
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks	40 Marks
IA Marks:	10 Marks
Grand Total	50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

Semester I

PAPER 3 - BOPT03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Bookseller, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: BOPT06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count

9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergrens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrobes Tube
7	Westergrens Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- BOPT03 Section B – Microbiology

Theory 30 Hours

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.
- **Microscopy:** - Introduction and history - Types of microscopes
(a) Light microscope

- (b) Dark ground Microscope
- (c) Fluorescent Microscope
- (d) Phase contrast Microscope
- (e) Electron microscope:

-Principles and operational mechanisms of various types of microscopes

- **Classification and Morphology of Bacteria.**
- **Physiology of Bacteria**
- **Sterilization:** - Definition -- Types and principle of sterilization methods.

(a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration.

Efficiency testing to various sterilizers.

(b) Chemical methods

Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.

- **Antibiotics and drug resistance**
- **Bacterial genetics and mechanisms of Bacterial gene transfer.**
- **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: BOPT06 Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes
- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram

Stain=15Marks

ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur
- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	BOPT07	Anatomy	02		02
2	BOPT08(A)	Physiology	02		02
	BOPT08(B)	Biochemistry	02		02
3	BOPT09(A)	Hematology & Clinical Pathology	02		02
	BOPT09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	BOPT10	Human Anatomy		02	02
6	BOPT11(A)	Human Physiology		02	02
	BOPT11(B)	Basics of Biochemistry		02	02
7	BOPT12 (A)	Hematology & Clinical Pathology		02	02
	BOPT12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BOPT07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	BOPT08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	BOPT09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	BOPT10	Practical 1	Human Anatomy	80 + 20	100
6	BOPT11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	BOPT12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - BOPT10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BOPT11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standing	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – BOPT08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – BOPT11 Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: BOPT08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism
Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle
Protein Metabolism- General Reactions of amino acids and Urea cycle
Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: BOPT11 Basics of Biochemistry II

Practical : 30 Hours

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of	1	1 x 20	20 Marks

Glucose/Urea/ creatinine /Estimation of urine creatinine			
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Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical 40 Marks
 IA Marks: 10 Marks
Grand Total 50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: BOPT09**Theory : 30 Hours****Section A - Haematology & Clinical Pathology****Hematology**

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No .	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:**Reference books (Latest Edition)**

Sl · N o.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10 ·	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: BOPT12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine
11	Sickling test

12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: BOPT09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr. C.P. Baveja.

PRACTICAL 3: BOPT12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices), Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
- Youth development programmes at the National level, State level and voluntary sector

Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking

- Self Confidence and Self esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

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THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BOPT13	Ocular Anatomy and Visual Optics	02			02
2	BOPT14	Physical optics and Geometric optics	02			02
3	BOPT15	Optometry and dispensing of optics	02			02
4	AECC01	AECC: Environmental Studies	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	BOPT16	Practical I		03	02	05
7	BOPT17	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BOPT13	Paper 1	Ocular Anatomy and Visual Optics	60+20+20	100
2	BOPT14	Paper 2	Physical optics and Geometric optics	60+20+20	100
3	BOPT15	Paper 3	Optometry and dispensing of optics	60+20+20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Practical + IA	Total
6	BOPT16	Practical I	120 + 30	150
7	BOPT17	Practical II	120 + 30	150
Grand Total				300

THIRD SEMESTER
1. PHYSICAL OPTICS (THEORY)

SL. NO.	TOPICS
1.	<p>Nature of light – An overview: Corpuscular Theory, Wave Theory, quantum theory and dual nature</p> <p>Review – SHM, combination of two SHMs (along a line and at right angles), energy of SHM, mathematical representation of wave, wave fronts, path and phase difference</p> <p>Interference of light – Superposition of two coherent waves, constructive and destructive interference, reflection phase shifts, condition for sustained interference, practical methods of producing coherent waves, theory of interference pattern and application to measurement of wavelength</p> <p>Interference in thin films: Films of uniform thickness, variable thickness (air wedge, Newton’s rings, Michelson’s interferometer), their applications to antireflection coatings, optical flatness of reflecting surfaces, determination of wavelength refractive index, thickness of thin films, radius of curvature</p>
2.	<p>Diffraction – classes of diffraction. Fresnel theory of half period zones, explanation of rectilinear propagation of light, Zone plate, comparison with a lens. Fresnel diffraction at a circular aperture.</p> <p>Fraunhofer diffraction at a single slit (quantitative), multiple slits and diffraction grating. General equation of grating – special cases of normal incidence and minimum deviation positions. Resolving and dispersive powers of gratings</p>
3.	<p>Polarization –</p> <p>Review of light as a transverse wave. Polarization phenomenon due to reflection, refraction and scattering Brewster’s and Malus’ laws. Polaroids. Double refraction, retardation plates, Nicol prism as a device to produce polarized light, dichroism, equation to polarization ellipse, elliptical, circular and linear polarizations, their production and detection</p> <p>Optical activity. Lorentz half shade polarimeter, determination of specific rotation</p>
4.	<p>Radiometry and Photometry – Terms and units</p> <p>Lummer – Brodhun photometer, comparison of luminous pointances (luminous intensities), determination of reflection and transmission coefficients</p>
5.	<p>Scattering of light</p> <p>Rayleigh scattering, Mie scattering, Raman scattering, Numericals</p>

PHYSICAL OPTICS – PRACTICAL

Sl.No.	TOPICS
1.	EXPERIMENTS <ol style="list-style-type: none">1. Air wedge2. Newton's rings3. Biprism4. Michelson's interferometer5. Refractive index of a liquid using a hollow prism6. Refractive indices of an anisotropic crystal7. Variation of refractive index with wavelength8. Diffraction grating- minimum deviation method9. Diffraction grating – normal indication method10. Resolving power of a telescope11. Polarimeter12. Verification of inverse square law of radiation using a photometer13. Photometer – determination of transmission coefficient14. Photo diode characteristics15. Ultrasonic interferometer
2.	DEMONSTRATION EXPERIMENTS <ol style="list-style-type: none">1. Single slit diffraction2. Lassajous figures

RECOMMENDED BOOKS

1. Fundamentals of Optics – 4th edition – Francis A. Jenkins and Harvey E. White
2. A textbook of Optics-N.Subrahmanyam and Brij Lal
3. Optics – 4th edition – Eugene Hecht
4. Introduction to classical and modern optics – 2nd edition – Jurgen R. Meyer – Arendt
5. Introduction to optics – Frank L. Pedrotti and Leno S. Pedrotti.
6. Optics – 11th edition – M.H. Freeman, C.C. Hull

2. GEOMETRICAL OPTICS - THEORY

SL.NO.	TOPICS
1.	Introduction- classification of optics based on the nature and properties of light
2.	Review of geometrical optics – ray, beam, rectilinear propagation of light, umbra, penumbra, pinhole camera, Fermat’s principle and Laws of reflection and refraction image, principal of reversibility, Conjugate points, path length, vergence, total internal reflection
3.	Prisms – Reflection through prism, dispersion, dispersing prisms, dispersion without deviation, deviation without dispersion, ophthalmic prisms, reflecting prisms.
4.	refraction at a spherical surface – focal points, focal lengths, vergence and refractive power, sign convention. image formation: predictable rays, graphical methods (both parallel and oblique ray methods) Gauss formula and surface power equations
5.	Thin lenses – meaning, focal lengths and power, image formation (both parallel ray and oblique ray methods), lateral axial and angular magnifications lens equations: Guess : Newton’s and lensmaker’s formula. Lenses in combination (with contact and without Contact), Determination focal length – for convex lens. uv method, Bassel’s method and using lensometer Determination focal length- for convex lens: uv method, Bassel’s method and using lensometer. Determination of focal length for concave lens using a convex lens (with contact and without contact) Determination of radius of curvature of lenses. Gradient index lenses
6.	Thick lenses – Meaning, focal points and principal points, image formation (both parallel and oblique ray methods). Equivalent power, front and back vertex power, nodal points and optical centre, Matrix theory
7.	Spherical mirrors – focal points, focal lengths, image formation, mirrors and vergence, reflection matrix, aspheric mirrors
8.	Aberrations – Monochromatic: spherical, coma, astigmatism (both oblique and axial) curvature of field and distortion. Chromatic aberration
9.	Aperture and stops – Aperture stop, depth of focus and field, field stop, field of view, pupils stop between two lenses, two lenses with no stop

10.	Optical system – Camera lenses. The eyes and its refractive anomalies, microscopes, telescopes, eyepieces, catoptric and catadioptric system
11	Quantum optics – Photoelectric effect, sources of light, spectrum (both emission and absorption
12	Optical fibres - types, ray propagation, losses, applications and brief introduction to integrated optics
13	Lasers – basic principles and working. Ruby, He-Ne, Argon ion, carbon dioxide, excimer and semiconductor lasers
14	Optics of transformations – Fourier transforms spectroscopy, transfer functions and optical data processing.

GEOMETRICAL OPTICS – PRACTICAL

SL NO	TOPICS
1.	<ol style="list-style-type: none">1. Law of reflection2. Law of refraction3. Critical angle of glass4. Angle of minimum deviation using I-d curve5. F & u of convex lens6. F & u of concave lens7. F & f convex mirror8. F of concave mirror9. U of solid10. U of liquid11. Angle of the prism – using spectrometer12. Determination of Cauchy's constant13. U of the material of the crown and flint glasses for Na light14. Dispersive power of a prism15. Planck's constant
2	Demonstration equipment: <ol style="list-style-type: none">1. Magnification of a compound microscope2. Reflecting prisms

RECOMMENDED BOOKS

1. Fundamentals of Optics – 4th edition – Francis A Jenkins and Harvery & White
2. A textbook of Optics – N Subrahmanyam and Brij Lal
3. Optics – 4th edition – Eugene Hecht
4. Introduction to classical and modern optics – 2nd edition – Jurgen R Meyer – Arendt
5. Introduction to optics – Frank L. Pedrotti and Leno S. Pedrotti
6. Optics – 11th edition – M. H. Freeman, C.C Hull

3. OCULAR ANATOMY

SL NO	TOPICS
1	Eye 1.1 Lids 1.2 Conjunctiva 1.3 Sclera 1.4 Cornea 1.5 Anterior chamber 1.6 Iris 1.7 Ciliary body 1.8 Choroid 1.9 Retina 1.10 Extra ocular muscles 1.11 Orbit and Para Nasal sinuses 1.12 Development of Eye
2	Refractory media 1.1 Aqueous humor 1.2 Lens 1.3 Vitreous body
3	Demonstration 3.1 Practical dissection of Bull's eye 3.2 Practical demonstration of orbital structures

RECOMMENDED BOOKS

1. Human anatomy B.D.Chourasia
2. Human anatomy A.K.Dutta
3. Text book of Human anatomy H Gray
4. Anatomy and Physiology of the eye A.K. Khurana, Indu Khurana
5. Clinical anatomy of the eye S.Snell, A Lemp

4. OPTOMETRIC OPTICS (THEORY)

Sl. No	TOPICS
1	<p>Spectacle Lenses – I</p> <ul style="list-style-type: none">1.1 Introduction to spectacle lenses1.2 Forms of lenses, spectacle tools1.3 Spherical, Cylindrical and sphero cylindrical lenses1.4 Properties of crossed cylinders1.5 Transposition of Spherocylindrical lenses1.6 Toric lenses, Toric transposition1.7 Astigmatic lenses, Methods of writing prescriptions1.8 Axis Direction of astigmatic lenses1.9 Obliquely crossed cylinders1.10 Sag Formulae, Lens measure1.11 Vertex distance and vertex power1.12 Tilt induced power1.13 Aberrations in ophthalmic lenses
2	<p>Spectacle Lenses – II</p> <ul style="list-style-type: none">1.1 Manufacture of glass1.2 Lens surfacing1.3 Principle of surface generation and glass cements1.4 Lens quality1.5 Faults in lens material1.6 Faults on lens surface1.7 Inspecting the quality of lenses
3	<p>OPHTHALMIC PRISMS</p> <ul style="list-style-type: none">1.1 Definition of prisms, Units of prism power1.2 Thickness difference and Base apex notations1.3 Dividing, Compounding and Resolving prisms1.4 Rotary prisms and effective prism power in near vision1.5 Prismatic effect, decentration, Prentice Rule1.6 Prismatic effect of spherical lenses, spherocylinders and plano

	<p>cylinders</p> <p>1.7 Differential prismatic effects</p>
4	<p>SPECTACLE FRAMES</p> <p>4.1 Types and parts</p> <p>4.2 classification of spectacle frames-material, weight, temple position, Coloration</p> <p>4.3 Frame construction, frame measurements and markings</p> <p>4.4 Frame selection, ordering, verification and dispensing</p> <p>4.5 Size, shape, mounting and field of view of ophthalmic lenses</p>
5	<p>TINTED & PROTECTIVE LENSES</p> <p>5.1 Characteristics of tinted lenses</p> <p>5.2 Absorptive Glasses</p> <p>5.3 Polarizing Filters</p> <p>5.4 Photochromic Filters</p> <p>5.5 Reflecting filters</p> <p>5.6 Safety lenses – Toughened lenses, Laminated Lenses, CR 39, Polycarbonate lenses</p>
6	<p>MULTIFICAL LENSES – Introduction, history and development, types, identification and dispensing.</p> <p>6.1 Bifocal lenses</p> <p>6.2 Trifocal lenses</p> <p>6.3 Progressive addition lenses</p>
7	<p>Lenticular lenses and aspherical lenses</p>
8	<p>MISCELLANEOUS SPECTACLE LENSES</p> <p>8.1 Iseikonic Lenses, Spectacle Magnifiers</p> <p>8.2 Recumbent prisms</p> <p>8.3 Fresnel prism and lenses</p>
9	<p>REFLECTION FROM SPECTACLE LENSE SURFACES & LENS COATINGS</p> <p>9.1 Reflection from spectacle lenses – ghost images – Reflections in bifocals at the dividing line</p> <p>9.2 Antireflection coating, Mirror coating, Hard Coating</p>

	[HMC], Hydrophobic coating

DISPENSING OPTICS (PRACTICAL)

Sl. No	TOPICS
1	<p>DISPENSING OPTICS</p> <ol style="list-style-type: none"> 1. Surfacing and polishing glass lenses 2. Glazing 3. Frame manipulation and repair 4. Facial measurement and frame choice 5. Power and dimension measurements of complete pair of spectacles 6. Lens faults inspections 7. Measurements of assorted faces for spectacle 8. Making and edging of bifocal lenses 9. Edging of lenses for plastic, metal and rimless frames 10. Complete dispensing for subjects-single vision, bifocals and progressive Addition lenses 11. Special lenses – examination of specimens

RECOMMENDED BOOKS

- | | |
|---|---|
| 1. Principles of Ophthalmic lenses | M.O. Jalie – 2 nd edition |
| 2. System for ophthalmic dispensing
Borish | Clifford.W. Brooks, Irwin M. |
| 3. Clinical Optics
edition | Troy Fannin, Theodore Grosvenor 2 nd |
| 4. Ophthalmic lenses & dispensing | M.O. Jalie – 2 nd edition |
| 5. Practical aspects of ophthalmic optics | Margeret dowaliby – 4 th edition |

5. VISUAL OPTICS (THEORY)

Sl. No	TOPICS
1	1. REVIEW OF GEOMETRICS OPTICS 1.1 Vergence ad powder 1.2 Conjugacy, Objective space and image space 1.3 Sign convention 1.4 Spherical refracting surface 1.5 Spherical Mirror, catoptric power 1.6 Cardinal points 1.7 Magnification
2	OPTICS OF OCULAR STRUCTURES 2.1 Cornea and aqueous 2.2 Crystalline lens 2.3 Vitreous 2.4 Schematic and reduced eye
3	MEASUREMENTS OF OPTICAL CONSTANTS OF EYE 3.1 Corneal curvature and thickness 3.2 Keratometry 3.3 Curvature & thickness of the lens
4	REFRACTIVE ANOMALIES AND THEIR CAUSES 4.1 Etiology of refractive anomalies 4.2 contributing variabilities and their ranges 4.3 Populating distributions of anomalies 4.4 Optical component measurement 4.5 Growth of eye in relation to refractive errors
5	VISUAL ACUITY 5.1 Definition, specification, Conversion, measurement & Recording (Distance & Near)

	<p>5.2 Test types (Distance & Near)</p> <p>5.3 Contrast sensitivity</p> <p>5.4 Trial set & Trial frame</p>
6	<p>REFRACTIVE CONDITIONS</p> <p>Aetiology, optical condition types, clinical features and management</p> <p>1.1 Emmetropia / Ametropia</p> <p>1.2 Myopia</p> <p>1.3 Hyperopia</p> <p>1.4 Astigmatism</p> <p>1.5 Anisometropia and Aniseikonia</p> <p>1.6 Presbyopia</p> <p>1.7 Aphakia and pseudophakia, Biometry</p> <p>1.8 Axial Vs Refractive Ametropia</p>
7	<p>ACCOMMODATION</p> <p>7.1 Mechanism</p> <p>7.2 Range & Amplitudes of accommodation</p> <p>7.3 Anomalies of accommodation</p>
8	<p>CONVERGENCE</p> <p>8.1 Types, measurement & Anomalies</p> <p>8.2 Relation between accommodation & convergence</p>
9	<p>Retinoscopy (Static & Dynamic)</p> <p>9.1 Principle, instrumentation & types</p> <p>9.2 Procedure & interpretation of findings – Transposition & Spherical equivalent</p> <p>9.3 Dynamic retinoscopy – various methods</p> <p>9.4 Radical retinoscopy & Mohindra's near retinoscopy</p> <p>9.5 Subjective refraction – Principle, astigmatic chart, binocular balancing & binocular refraction</p> <p>9.6 Cycloplegic refraction</p>
10	<p>EFFECTIVE POWER & MAGNIFICATION</p> <p>10.1 Ocular refraction Vs Spectacle refraction</p> <p>10.2 Ocular accommodation Vs Spectacle accommodation</p>

	10.3 Spectacle magnification & Relative spectacle magnification 10.4 Retinal image blur – Depth of focus & Depth of field
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VISUAL OPTICS (PRACTICAL)

Sl. No	TOPICS
Part I	<p>2. Study of purkinje images I & II, III & IV</p> <p>3. Mathematical model of the eye – Emmetropia, Hyperopia & Myopia</p> <p>4. Effect of trial lenses & accessories in front of the eye</p>
Part II	<p>1. Visual acuity</p> <ul style="list-style-type: none"> ✓ Measurement & recording (Distance & Near) <p>2. Retinoscopy – Practice of retinoscopy (Dry & Wet) in</p> <ul style="list-style-type: none"> ✓ Emmetropia, Myopia, Hypermetropia, Astigmatism, Anisometropia, Presbyopia, Aphakia, Pseudophakia, media opacities, strabismus & eccentric fixation ✓ Interpretation of retinoscopic findings ✓ Subjective verification ✓ Prescription writing ✓ Methods of differentiating axial Vs Refractive ametropia ✓ Dynamic retinoscopy – Methods <p>3. Accommodation & Convergence</p> <ul style="list-style-type: none"> ✓ Measurement of range & Amplitude of accommodation ✓ Measurement of Near point of Convergence

RECOMMENDED BOOKS

- | | |
|--|--|
| 1. Duke Elder's practice of refraction | David Abrams – 10 th edition |
| 2. Clinical refraction | Irwin. M. boorish |
| 3. Primary care optometry | Theodore Grosvenor – 4 th edition |

PATTERN OF EXAMINATION**DISTRIBUTION OF QUESTIONS**

S. No.	Questions	No. of Questions	No. of Questions to be attempted	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2 x 10	20	60	20	20	100
2	Short Essay Questions	6	5	5 x 5	25				
3	Short Answers	5	5	5 x 3	15				

PRACTICAL EXAMINATION

Particulars	Practical Marks	Internal Assessment	Total
Practical I	120	30	150
Practical II	120	30	150

Compulsory Course AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.

- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial

wastes.

- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
 - Uses and application of bio-statistics in public health research and medical sciences.
 - Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
 - Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
 - Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
 - Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
 - Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.
- Basic Probability : Concept of probability, its terminology and different types of definition
- Laws of probability: addition law, multiplication law and conditional probability.

Communication Skills**Unit-I:**

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BOPT18	Ocular Physiology and ocular biochemistry	02			02
2	BOPT19	Ocular Pharmacology and Nutrition & Hospital Procedure	02			02
3	BOPT20	Optometric instrument and Clinical examination of visual system	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject: (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	BOPT21	Practical I		03	02	05
7	BOPT22	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks = 1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BOPT18	Paper 1	Ocular Physiology and ocular biochemistry	60+20+20	100
2	BOPT19	Paper 2	Ocular Pharmacology and Nutrition & Hospital Procedure	60+20+20	100
3	BOPT20	Paper 3	Optometric instrument and Clinical examination of visual system	60+20+20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Subject Code	Practical	Practical + IA	Total
6	BOPT21	Practical I	120 + 30	150
7	BOPT22	Practical II	120 + 30	150
Grand Total				300

FOURTH SEMESTER

1. OCULAR PHYSIOLOGY

SL.NO.	TOPICS
1	<ol style="list-style-type: none">1. Protective mechanism in the eye. Eyelid and lacrimation, descriptive of the globe.2. Extrinsic ocular muscles, their action and control of their movements.3. Coats of the eyeball4. Cornea5. Aqueous humour and vitreous6. Intra ocular pressure7. Iris and pupil8. Crystalline lens and accommodation- Presbyopia9. Retina structure & function10. Vision – general aspects of sensation11. Pigments of the eye and photo chemistry12. The visual stimulus, refractive errors13. Visual acuity14. Visual perception-binocular vision, stereoscopic vision, optical illusion15. Visual pathway, central & cerebral connections, lesions of pathways & effects16. Colour vision and colour vision defects

RECOMMENDED BOOKS

- | | |
|------------------------------------|-------------------------------------|
| 1. Text book of medical physiology | Guyton |
| 2. Human physiology | Choudhary |
| 3. Human physiology | Chatterjee |
| 4. Adler's physiology of the eye | Robert A. Moses, William M Hart. Jr |

2. OCULAR BIOCHEMISTRY

SL.NO.	TOPICS
1.	Importance of ocular biochemistry in clinical optometric practice
2.	Tear film ✓ Composition –Lipid layer-Aqueous layer-Mucoid layer-Functions & dysfunction – Diagnostic tests – Tear substitutes – Recent development
3.	Cornea ✓ Biochemical composition of epithelium-bowman’s layer-stroma-Descemet’s layer-endothelium-functions-corneal metabolism-nutrient uptake-energy transparency-barrier mechanism-pump action-irrigating solutions-aging and other anomalies-recent development
4.	Lens ✓ Composition-metabolism-glucose utilization-sorbitol pathways-Glutathione and ascorbic acid transport-transparency-cataract formation-aging photo oxidation-sugar cataract-cataract and ascorbic acid-medical therapy-recent development
5.	Aqueous humour ✓ Composition-function-Ciliary body-aqueous humour production-IOP-Glaucoma
6.	Vitreous humour ✓ Structure-composition functions-viterous biochemical pathology-Intraocular gets-recent developments
7.	Retina ✓ Pigment epithelium-structure-composition-photoreceptor cells-rhodopsin-lipids renewal-inner segment-Pigment epithelium-choroid – metabolism and function-phagocytosis – vitamin A-retinal function and metabolism. Retina neuropeptides. Biochemical correlates of retinal diseases

RECOMMENDED BOOKS

- | | |
|------------------------------|--------------------|
| 1. Text book of biochemistry | Sitaram Acharya |
| 2. Text book of biochemistry | A.C.Deb |
| 3. Biochemistry | S.K.Dasgupta |
| 4. Biochemistry of the eye | David R. whikehart |

3. OCULAR PHARMACOLOGY

SL NO	TOPICS
1	OCULAR PHARMACIOLOGY 3.1 Ocular preparations, formulations and requirements of an ideal agents 3.2 Ocular pharmacokinetics-Methods of drug administration -Special drug delivery systems 3.3 Ocular toxicology
2	DIAGNOSTIC AND THERAPUTIC APPLICATIONS OF DRUGS IN OPHTHALMOLOGY 4.1. Agents used to aid diagnosis 4.2. Drugs and biological agents used in ocular surgery 4.3. Anesthetics used in ophthalmic procedures 4.4. Drug treatment of glaucoma, accommodative esotropia and ocular myasthenia 4.5. Pharmacotherapy of ocular infections-Bacterial, Viral, Fungal, Chlamydial 4.6. Drugs used in allergic conditions of the eye 4.7. Drugs used in inflammatory disorders of the eye

RECOMMENDED BOOKS

- | | |
|---|--|
| 1. Essentials of medical pharmacology | Tripathi |
| 2. Optometric Pharmacology | Julie Griebrok Jose, Kenneth.A.Poise, Emily Holden |
| 3. Ocular drug consult | Milton.M.Hom |
| 4. Anterior eye diseases & Therapeutics | A. S. Bruce, M. S. Loughnan |
| 5. Clinical Ocular Pharmacology | Jimmy. D. Bartlett, Siret. D. Jaanus - 4 th edition |

4. NUTRITION AND HOSPITAL PROCEDURE

SL.NO.	TOPICS
1.	Introduction <ul style="list-style-type: none"> ✓ History of nutrition-Nutrition as science-Food groups – RDA – Balanced diet – diet planning – Assessment of nutritional status
2.	Energy <ul style="list-style-type: none"> ✓ Units of energy – Measurement and energy value of food – Energy expenditure- Total energy/Calorie – requirement for different age groups and diseases – Satiety value- energy imbalance – Obesity – starvation-Limitations of daily food guide
3	Proteins <ul style="list-style-type: none"> ✓ Sources and functions – Essential and nonessential aminoacids – Incomplete and complete proteins- Supplementary foods – PEM and the eye – Nitrogen balance- Changes in the protein requirement
4.	Fats <ul style="list-style-type: none"> ✓ Functions and sources- Essential fatty acids – Excess and deficiency – Lipids and the eye- Hyperlipidemia – Heart diseases - Atherosclerosis
5	Minerals <ul style="list-style-type: none"> ✓ General functions and sources – Macro and micro minerals associated with the eye –Deficiencies and excess – ophthalmic complications – Example: iron calcium, iodine, etc.
6.	Vitamins <ul style="list-style-type: none"> ✓ General functions – Food sources – Vitamin deficiencies and associated eye disorders with particular emphasis on Vitamin A – Promoting sound habits in pregnancy, lactation and infancy – Nutrients with antioxidant Properties
7.	Miscellaneous <ul style="list-style-type: none"> ✓ Measles and associated eye disorders, low birth weight.

HOSPITAL PROCEDURE

SL.NO.	TOPICS
	<ol style="list-style-type: none"> 1. General idea about the role, importance and procedures of the following within the hospital set up 2. Medical records 3. Medical photography 4. Computer networking system 5. Laboratory technology

5. OPTOMETRIC OPTICS (THEORY)

Sl. No	TOPICS
1	<p>Spectacle Lenses - I</p> <ul style="list-style-type: none">1.14 Introduction to spectacle lenses1.15 Forms of lenses, spectacle tools1.16 Spherical, Cylindrical and sphero cylindrical lenses1.17 Properties of crossed cylinders1.18 Transposition of Spherocylindrical lenses1.19 Toric lenses, Toric transposition1.20 Astigmatic lenses, Methods of writing prescriptions1.21 Axis Direction of astigmatic lenses1.22 Obliquely crossed cylinders1.23 Sag Formulae, Lens measure1.24 Vertex distance and vertex power1.25 Tilt induced power1.26 Aberrations in ophthalmic lenses
2	<p>Spectacle Lenses - II</p> <ul style="list-style-type: none">4.1 Manufacture of glass4.2 Lens surfacing4.3 Principle of surface generation and glass cements4.4 Lens quality4.5 Faults in lens material4.6 Faults on lens surface4.7 Inspecting the quality of lenses
3	<p>OPHTHALMIC PRISMS</p> <ul style="list-style-type: none">1.8 Definition of prisms, Units of prism power1.9 Thickness difference and Base apex notations1.10 Dividing, Compounding and Resolving prisms1.11 Rotary prisms and effective prism power in near vision1.12 Prismatic effect, decentration, Prentice Rule1.13 Prismatic effect of spherical lenses, spherocylinders and plano cylinders1.14 Differential prismatic effects

4	<p>SPECTACLE FRAMES</p> <p>4.1 Types and parts</p> <p>4.2 classification of spectacle frames-material, weight, temple position, Coloration</p> <p>4.3 Frame construction, frame measurements and markings</p> <p>4.4 Frame selection, ordering, verification and dispensing</p> <p>4.5 Size, shape, mounting and field of view of ophthalmic lenses</p>
5	<p>TINTED & PROTECTIVE LENSES</p> <p>5.1 Characteristics of tinted lenses</p> <p>5.2 Absorptive Glasses</p> <p>5.3 Polarizing Filters</p> <p>5.4 Photochromic Filters</p> <p>5.5 Reflecting filters</p> <p>5.6 Safety lenses – Toughened lenses, Laminated Lenses, CR 39, Polycarbonate lenses</p>
6	<p>MULTIFOCAL LENSES – Introduction, history and development, types, identification and dispensing.</p> <p>6.1 Bifocal lenses</p> <p>6.2 Trifocal lenses</p> <p>6.3 Progressive addition lenses</p>
7	Lenticular lenses and aspherical lenses
8	<p>MISCELLANEOUS SPECTACLE LENSES</p> <p>8.1 Iseikonic Lenses, Spectacle Magnifiers</p> <p>8.2 Recumbent prisms</p> <p>8.3 Fresnel prism and lenses</p>
9	<p>REFLECTION FROM SPECTACLE LENSE SURFACES & LENS COATINGS</p> <p>9.1 Reflection from spectacle lenses – ghost images – Reflections in bifocals at the dividing line</p> <p>9.2 Antireflection coating Mirror coating, Hard Coating [HMC], Hydrophobic coating</p>

OPTOMETRIC INSTRUMENTS (PRACTICALS)

SL. NO	TOPICS
1	Pre examination history
2	1.1. Visual acuity charts – Construction & Standards 1.2. Illumination of the consultation room 1.3. Trial case lenses – best form lenses 1.4. Trial frame design – Phoropter – Advantages & Difficulties 1.5. Retinoscope – Optics, types & adjustments 1.6. Projection Charts
3	Keratometer 2.1. Keratometric principle 2.2. Types – Bausch & Lomb, Javal-Schiotz models 2.3. Measurement, Documentation & Interpretation of data
4	Lens checking instruments 3.1. Optometer principle 3.2. Badal & non badal principle – Advantage & disadvantages 3.3. Lens gauger or clock 3.4. Hand neutralization
5	Slit Lamp 4.1. Slit-lamp systems 4.2. Mechanical design 4.3. Illumination techniques 4.4. Accessories 4.5. Scanning laser devices
6	Autorefractometer 5.1. Scheiner's principle 5.2. Advantages & disadvantages 5.3. Newer developments
7	Corneal topography 6.1. Placido's disc 6.2. Photokeratoscope 6.3. Topography Modelling System
8	Tonometer 7.1. Types, principle & standardization (Schiotz, Applanation & NCT) 7.2. Measurement, documentation & interpretation of results
9	Color vision testing devices 8.1. Color vision theories 8.2. Common color vision defects 8.3. Pseudoisochromatic test plates 8.4. Color arrangements tests

	8.5. Interpretation & clinical significance of findings
10	Fields of vision & Screening devices 9.1. Introduction – Visual fields & boundaries of visual fields 9.2. Visual field screening devices – Central & Peripheral 9.3. Quantitative perimetry – Manual & Automated 9.4. Results & Analysis of visual field examination
11	Ophthalmoscopes 10.1. Optical principle & Types 10.2. Direct ophthalmoscope – Instrumentation, Characteristics & Uses 10.3. Indirect ophthalmoscope- Instrumentation, Characteristics & Uses 10.4. Direct ophthalmoscope Vs Indirect ophthalmoscope
12	Fundus biomicroscope 11.1. Direct fundus biomicroscopy – Principle & Instrumentation (with examples) 11.2. Indirect fundus biomicroscopy – Principle & Instrumentation (with examples)
13	Gonioscope 12.1. Principle & Instrumentation 12.2. Direct Gonioscope 12.3. Indirect Gonioscope
14	Ophthalmic Ultrasonography 14.1. Physics of Ultrasonography 14.2. A-scan – Procedure & clinical uses 14.3. B-Scan – Procedure & Clinical uses
15	Electrophysiology – ERG, VEP & EOG
16	Fundus camera & Fluorescein angiography

CLINICAL EXAMINATION OF VISUAL SYSTEM (PRACTICAL)

SL.NO	TOPICS
1	History of the ophthalmic subject 1.1. Ocular history 1.2. Medical history 1.3. Family history 1.4. Systemic history
2	Assessment of visual acuity 2.1. Distance & Near visual acuity 2.2. Colour vision & Contrast sensitivity
3	Examination of Extra Ocular Muscle balance
4	Assessment of accommodation & Convergence
5	Pupil evaluation & Measurement of Intra pupillary distance (IPD)
6	Slit Lamp examination 6.1. Examination of eye lids, conjunctiva & sclera 6.2. Examination of cornea & lens 6.3. Examination of iris, Ciliary body & pupil
7	Examination of Intra ocular pressure – Schiottz & Applanation
8	Assessment of angle of anterior chamber
9	Ophthalmoscopy – Direct & Indirect
10	Optic disc evaluation
11	Examination of Lacrimal system
12	Examination of orbit
13	Macular function tests
14	Visual field charting – Central & Peripheral

RECOMMENDATION BOOKS

- | | |
|--|--|
| 1. Optometric instrumentation | David B. Henson |
| 2. Clinical ophthalmology (VOL –I) | Thomas D. Duane |
| 3. Primary care Optometry | Theodors Grosvenor – 4 th edition |
| 4. Clinical Procedure in Optometry
Bartlet | J.Boyd Eskside, John. F. Amos, Jimmy. D. 1 st edition |
| 5. Automated state perimetry | Anderson & Patella – 2 ^{ns} edition |
| 6. Investigation techniques & Ocular examination | Sandip Doshi, William Harvey |
| 7. Diagnosis of defective color vision | Jennifer birch – 2 nd edition |

PATTERN OF EXAMINATION

DISTRIBUTION OF QUESTIONS

Sl. No.	Questions	No. of Questions	No. of Questions to be attempted	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2 x 10	20	60	20	20	100
2	Short Essay Questions	6	5	5 x 5	25				
3	Short Answers	5	5	5 x 3	15				

PRACTICAL EXAMINATION

Particulars	Practical Marks	Internal Assessment	Total
Practical I	120	30	150
Practical II	120	30	150

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- | | |
|-----------------|---|
| Unit I | a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution. |
| Unit II | The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions. |
| Unit III | Fundamental Rights and Duties - Their content and significance |
| Unit IV | Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles. |
| Unit V | Special rights created in the constitution for Dalits, Backward class, Women and Children, |

and the Religious and Linguistic Minorities

Unit VI Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.

Unit VII The Election Commission and State Public Service Commissions.

Unit VIII Method of amending the Constitution.

Unit IX Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.

Unit X Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constitution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04
Research Methodology & Bioethics

Theory: 30 Hours

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.

10. Health Education Methods and Media

- **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
- Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
- Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
- Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BOPT23	Contacts lens squint & binocular Vision	03			03
2	BOPT24	Ocular Diseases + Eye and Systemic Diseases	03			03
3	BOPT25	Ocular Pathology and Ocular Microbiology	02			02
5	ELS05	Elective Subject (Basics of Hospital Administration/ Disaster Management)	02			02
6	BOPT26	Practical I		03	02	05
7	BOPT27	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BOPT23	Paper 1	Contacts lens squint & binocular Vision	60+20+20	100
2	BOPT24	Paper 2	Ocular Diseases + Eye and Systemic Diseases	60+20+20	100
3	BOPT25	Paper 3	Ocular Pathology and Ocular Microbiology	60+20+20	100
4	ELS05	Paper 4	Elective Subject (Basics of Hospital Administration/ Disaster Management)	80+20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Practical + IA	Total
5	BOPT26	Practical I	120 + 30	150
6	BOPT27	Practical II	120 + 30	150
Grand Total				300

FIFTH SEMESTER

1. LENS (THEORY)

Sl. No	TOPICS
1	11. History of Contact Lens 1.2. Lacrimal apparatus - Anatomy & Physiology 1.3. Cornea - Anatomy & Physiology 1.4. Corneal physiology & Contact Lens 1.5. Slit-lamp biomicroscopy 1.6. Keratometry 1.7. Placido's disc 1.8. Topography 1.9. Preliminary measurements & Investigations
2	2.1. Contact Lens materials 2.2. Glossary of terms- Contact lenses 2.3. Optics of Contact lenses 2.4. Indications & Contraindications
3	3.1. RGP contact lens design 3.2. Soft Contact lens design 3.3. Fitting philosophies 3.4. Handling of contact lens
4	4.1. Fitting of spherical soft CL & Effect of parameter changes 4.2. Fitting of spherical RGP contact lenses - Low Dk & High Dk 4.3. Effect of RGP CL parameter changes on lens fitting 4.4. Fitting in astigmatism - Toric CL
5	5.1. Follow-up post fitting examination 5.2. Follow-up slit-lamp examination 5.3. Lens care and hygiene, instructions, compliance 5.4. Contact Lens solutions 5.5. Care of contact lenses
6	6.1. Fitting in Aphakia, Pseudophakia 6.2. Fitting in irregular astigmatism - Keratoconus/PMD etc 6.3. Bifocal contact lenses 6.4. Fitting contact lenses in children 6.5. CL fitting following ocular surgeries 6.6. Therapeutic contact lens - Bandage CL 6.7. Cosmetic contact lenses 6.8. Contact lenses for special purposes- Swimming, sports, occupational etc
7	7.1. Continuous wear & extended wear contact lenses

	7.2.Disposable contact lenses 7.3. Frequent replacement contact lenses
8	8.1.Modifications of finished CL 8.2.Inspection & Verification of finished contact lenses 8.3.Use of Specular microscopy & Pachymetry in CL practice
9	9.1.Contact lens deposits 9.2.Complications of contact lens wear
10	10.1.Recent developments in contact lenses 10.2.Review of Contact lenses & Solutions available in India 10.3. Current contact lens research.

CONTACT LENS PRACTICAL

Sl. No	TOPICS
1	1.1.Fitting & Dispensing of contact lenses in Myopia, Hyperopia, Astigmatism, Presbyopia, Anisometropia, Aphakia, Pseudophakia, Keratoconus, PMD etc 1.2.Paediatric contact lens fitting 1.3.CL fitting following ocular surgeries 1.4.Visit to factories manufacturing contact lenses

RECOMMENDED BOOKS

1. Contact Lenses Antony.J.Philips, Janet Stone
2. Textbook of Contact Lenses V.K.Dada 4th Edition
3. Contact Lens Practice Ruben & Guillon
4. Color Atlas of Contact Lens Montague Rubem
5. Contact Lens The CLAO guide Peter.R.Castle
6. IACLE Contact Lens modules International Association of Contact Lens Educators, Sydney, Australi
- 7.Manual of Contact Lens prescribing & Fitting Milton.M.Hom-3rd edition
8. Manual of Gas Permeable contact Lens Edward.S.Bennet, Milton.M.Hom-2nd edition
9. Clinical manual of specialized CL prescribing Terry.R.Scheid
10. Clinical Contact Lens Practice Edward.s.Bennet, Barry.A.weissman
11. Cosmetic Contact Lens & Artificial eyes Devendra Kumar & Gopal Krishnan
12. Common Contact Lens Complications lyndon. W.Jones, Deborah.A.Jones
13. Anterior segment Complication of CL wear Joel Silbert-2nd edition

2. SQUINT AND BINOCULAR VISION (THEORY)

Sl. No	TOPICS
1	1.1. Anatomy & Physiology of extra ocular muscles 1.2. Spatial sense 1.3. Binocular vision <ul style="list-style-type: none"> ✓ Definition ✓ Mechanism ✓ Development ✓ Grades & Test of BSV ✓ Binocular fusion, suppression, rivalry, Summation ✓ Visual direction & Corresponding points ✓ Visual distance & Monocular clues ✓ Panum's space ✓ Longitudinal Horopter ✓ Neural aspects of binocular vision
2	2.1 Visually guided behavior & Aniseikonia 2.2. ARC <ul style="list-style-type: none"> ✓ Mechanism ✓ Common tests 2.3. Stereopsis <ul style="list-style-type: none"> ✓ Definition & Tests 2.4. Synaptophore
3	3.1. Amblyopia <ul style="list-style-type: none"> ✓ Definition & Classification ✓ Clinical characteristics ✓ Diagnosis & Management 3.2. Eccentric Fixation 3.3. Pseudostrabismus
4	4.1. Qualitative & quantitative diagnosis of strabismus 4.2. Etiology, Classification, Clinical characteristics, Tests & Treatment of <ul style="list-style-type: none"> ✓ Esodeviations ✓ Exodeviations ✓ A-V phenomenon ✓ Cyclovertical squints ✓ Special forms of strabismus

5	Paralytic squint 5.1.Paralysis of individual extra ocular muscles 5.2.Clinical characteristics, diagnostic tests & management
6	Nystagmus ✓ Types, Etiology, Clinical characteristics & Treatment
7	Management of strabismus ✓ Non-surgical ✓ Surgical

SQUINT & BINOCULAR VISION PRACTICALS

Sl. No	TOPICS
1	Strabismus assessment ✓ Cover test, Krimsky, Synaptophore, Stereoaucuity test, Diplopia charting Examination procedures of different types of strabismus and its non-surgical management

RECOMMENDED BOOKS

- | | |
|--|--|
| 1. Binocular vision & Ocular motility | Von Noorden-6th edition |
| 2. Clinical management of binocular vision | M.Scheimann, Bruce Wick 2nd edition |
| 3. Binocular anomalies | John.R.Griffin, J.David Grisham -4th edition |
| 4. Practical binocular vision assessment | Frank Eperjesi, Michelle.M.Rundstorm |
| 5. Binocular vision & Orthoptics | Bruce Evans, Sandip Doshi |

3. OCULAR DISEASES

Sl. No	TOPICS
1	EYELIDS 1. Eye lid anatomy 1.2 Congenital and developmental anomalies of eyelids 1.3. Blepharospasm 1.4 Ectropion and Entropion 1.5 Trichiasis and symblepharon 1.6 Eyelid inflammations 1.7 Eyelid tumours 1.8 Ptosis 1.9 Eyelid retractions 1.10. Eyelid trauma
2	LACRIMAL SYSTEM 2.1. Lacrimal anatomy 2.1 Lacrimal pump 2.2 Methods of Lacrimal evaluation 2.3 Congenital and developmental anomalies of Lacrimal system 2.4. Lacrimal obstructions 2.5 Lacrimal sac tumours 2.6 Lacrimal trauma
3	SCLERA AND EPISCLERA 3.1. Ectasia and staphyloma 3.2. Scleritis and episcleritis
4	ORBIT 4.1. Orbital anatomy 4.2. Incidence of orbital abnormalities 4.3. Methods of orbital examinations 4.4. Congenital and developmental anomalies of orbit 4.5. Orbital tumours 4.6. Orbital inflammations 4.7 Sinus disorders affecting the orbit 4.8. Orbital trauma
5	CONJUNCTIVA & CORNEA 5.1. Inflammation 5.2. Therapeutic principles, specific inflammatory diseases 5.3. Tumours <ul style="list-style-type: none"> ✓ Tumours of epithelial origin ✓ Glandular and adenexal tumours ✓ Tumours of neuroectodermal origin ✓ Vascular tumours ✓ Xanthomatous lesions

	<ul style="list-style-type: none"> ✓ Inflammatory lesions ✓ Metastatic tumours <p>5.4. Degenerations & dystrophies</p> <ul style="list-style-type: none"> ✓ Definitions ✓ Degenerations & dystrophies <p>5.5. Miscellaneous conditions</p> <ul style="list-style-type: none"> ✓ Keratoconjunctivitis Sicca ✓ Tear function tests ✓ Steven Johnson Syndrome ✓ Ocular Rosacea ✓ Atopic eye disorders ✓ Benign Mucosal Pemphigoid- ocular pemphigoid ✓ Vitamin A deficiency ✓ Metabolic diseases associated with corneal changes
6	<p>LENS</p> <p>6.1. Anatomy and pathophysiology</p> <ul style="list-style-type: none"> ✓ Normal anatomy and aging process ✓ Developmental defects ✓ Acquired lenticular defects <p>6.2. Management of lenticular defects</p>
7	<p>IRIS, CILIARY BODY & PUPIL</p> <p>7.1 Congenital anomalies</p> <p>7.2 Primary and secondary diseases of iris and ciliary body</p> <p>7.3 Tumours</p> <p>7.4 Anomalies of pupillary reactions</p>
8	<p>CHOROID</p> <p>8.1 Congenital anomalies of choroid</p> <p>8.2 Diseases of choroid</p> <p>8.3 Tumours</p>
9	<p>VITREOUS</p> <p>9.1 Developmental abnormalities</p> <p>9.2 Hereditary hyaloidoretinopathies</p> <p>9.3 Juvenile retinoschisis</p> <p>9.4 Asteroid hyalosis</p> <p>9.5 Cholesterolosis</p> <p>9.6 Vitreous haemorrhage</p> <p>9.7 Blunt trauma and the vitreous</p> <p>9.8 Inflammation and vitreous</p> <p>9.9 Parasitic infestations</p> <p>9.10. Pigment granules in vitreous</p> <p>9.11. Vitreous complications in cataract surgery</p>

10	<p>RETINA</p> <p>10.1.Retinal vascular diseases</p> <p>10.2.Diseases of choroidal vasculature, Bruch's membrane and retinal pigment epithelium</p> <p>10.3.Retinal tumours</p> <ul style="list-style-type: none"> ✓ Retinoblastoma ✓ Retinal and optic nerve head astrocytomas ✓ Lymphoid tumours <p>10.4.Retinal vascular disorders</p> <p>10.5. Retinal inflammations</p> <p>10.6. Metabolic diseases affecting the retina</p> <p>10.7. Electromagnetic radiation effects on the retina</p> <p>10.8. Hereditary macular disorders [Including albinism</p> <p>10.9.Peripheral retinal Degeneration</p> <p>10.10.Retinal holes and detachments</p> <p>10.11.Intraocular foreign bodies</p> <p>10.12.Photocoagulation</p> <p>10.13.Miscellaneous disorders</p>
11	<p>NEURO OPHTHALMOLOGY</p> <p>11.1.Neuroophthalmic examination</p> <ul style="list-style-type: none"> ✓ History ✓ Visual function testing ✓ Technique of pupillary examination ✓ Ocular motility ✓ Checklist for testing <p>11.2. Visual sensory system</p> <ul style="list-style-type: none"> ✓ The retina ✓ The optic disc ✓ The optic nerve ✓ Optic chiasma ✓ Optic tracts ✓ Lateral geniculate body ✓ Optic radiations ✓ Visual cortex ✓ Visual field ✓ Blood supply of anterior and posterior visual systems ✓ Disorders of visual integration <p>11.3.Ocular motor system</p> <p>11.4.The facial nerve</p> <p>11.5.Pain and sensation from the eye</p> <p>11.6.Autonomic nervous system</p> <p>11.7.Selected systemic disorders with neuro ophthalmologic signs</p>

12	<p>GLAUCOMA</p> <p>12.1 An overview of glaucoma</p> <p>12.2 Aqueous humour dynamics- Gonioscopy</p> <p>12.3 Intraocular pressure and Tonometry</p> <p>12.4 Evaluation of optic nerve head</p> <p>12.5 Visual fields</p> <p>12.6 Glaucoma screening</p> <p>12.7 Classification of glaucoma</p> <p>12.8 Primary open angle glaucoma</p> <p>12.9 Primary angle closure glaucoma</p> <p>12.10 Primary congenital glaucoma</p> <p>12.11 Secondary glaucoma</p> <p>12.12 Principles of medical therapy</p> <p>12.13 Other modalities of glaucoma treatment</p>
13	<p>BLINDNESS</p> <p>13.1. Definitions</p> <p>13.2. Causes</p> <p>13.3. Social implications</p> <p>13.4. Rationale in therapy</p>

EYE AND SYSTEMIC DISEASES

Sl. No	TOPICS
1	<p>ARTERIAL HYPERTENSION</p> <p>1.1. Pathophysiology, classification, clinical examination, Diagnosis</p> <p>1.2. Complications, management</p> <p>1.3. Hypertension and the eye</p>
2	<p>DIABETES MELLITUS</p> <p>2.1. Pathology, classifications, clinical features</p> <p>2.2. Diagnosis, complications, management</p> <p>2.3. Diabetes mellitus and the eye</p>
3	<p>ACQUIRED HEART DISEASES- EMBOLISM</p> <p>3.1. Rheumatic fever- Pathophysiology, classifications, diagnosis complications and management</p> <p>3.2. embolism</p> <p>3.3. Subacute bacterial endocarditis</p>

4	<p>CANCER-INTRODUCTION</p> <p>4.1. Definition, nomenclature, characteristics of benign and malignant</p> <p>4.2. Grading of staging of cancer, diagnosis, principles of treatment</p> <p>4.3. Neoplasia and the eye</p>
5	<p>CONNECTIVE TISSUE DISEASES</p> <p>5.1. Anatomy and pathophysiology: arthritis</p> <p>5.2. Eye and connective tissue diseases</p>
6	<p>THYROID DISEASE</p> <p>6.1. Anatomy and physiology of thyroid gland</p> <p>6.2. Classification of thyroid disease</p> <p>6.3. Diagnosis, complications, clinical features, management</p> <p>6.4. Thyroid disease and the eye</p>
7	<p>TUBERCULOSIS</p> <p>7.1. Etiology, pathology, clinical features, pulmonary tuberculosis, diagnosis, complication, treatment</p> <p>7.2. Tuberculosis and the eye</p>
8	<p>HELMINTHIASIS</p> <p>8.1. Classification of helminthic diseases, - schistosomiasis,</p> <p>8.2. principles of diagnosis and management</p> <p>8.3. Helminthic disease and the eye [Taenia., echinococcus, larva migrans</p>
9	<p>COMMON TROPICAL MEDICAL AILMENTS</p> <p>9.1. Introduction to tropical diseases: malaria</p> <p>9.2. Tropical diseases and the eye- leprosy, toxoplasmosis, syphilis, Trachoma</p>
10	<p>MALNUTRITION</p> <p>10.1. Etiology & nutritional disorders of the eye</p>
11	<p>INTRODUCTION TO IMMUNOLOGY</p> <p>11.1. Introduction & components of immune system</p> <p>11.2. Principles of immunity in health</p> <p>11.3. Immunology in disease</p> <p>11.4. Immunology and the eye</p>
12	<p>GENETICS</p> <p>12.1. Introduction to genetics</p> <p>12.2. Organisation of the cell</p> <p>12.3. Chromosome structure and cell division</p> <p>12.4. Gene structure and basic principles of genetics</p>

	12.5.Genetic disorders and their diagnosis 12.6.Genes and the eye 12.7.Genetic counseling and genetic engineering

RECOMMENDED BOOKS

- | | |
|---------------------------------|--|
| 1. Clinical Ophthalmology | Jack J.Kanski-4th edition |
| 2. Textbook of Ophthalmology | A.K.Khurana |
| 3. Parson's diseases of the eye | Revised by Ramanjith Sihota & Radhika Tandon |
| 4. Glaucoma Handbook | Anthony.B.Litwak |

4. OCULAR PATHOLOGY

SL NO.	TOPICS
	1. Ophthalmic wound healing 2. Eyelid [normal and pathology including inflammations and tumours] 3. Cornea [Normal and pathology in degeneration and dystrophies] 4. Lens [normal and pathology of cataract] 5. Retina [normal and pathology hi inflammatory diseases, infections] 6. Intraocular tumours [Retinoblastoma and chorMdal melanoma] 14. Orbit [inflammation and neoplasia]

RECOMMENDED BOOKS

- | | |
|---------------------------|-------------|
| 1. General pathology | Harsh Mohan |
| 2. Text book of Pathology | N. C. Dey |
| 3. Basic Pathology | Robbins |

OCULAR MICROBIOLOGY

SL NO	TOPICS
	1. Common bacterial infections of the eye 2. Common fungal infections of the eye 3. Common viral infections of the eye 4. Common parasitic infections of the eye

RECOMMENDED BOOKS

1. Text book of microbiology

Ananth Narayan

PATTERN OF EXAMINATION

DISTRIBUTION OF QUESTIONS

S.No	Questions	No. of Questions	No. of Questions to be attempted	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2 x 10	20	60	20	20	100
2	Short Essay Questions	6	5	5 x 5	25				
3	Short Answers	5	5	5 x 3	15				

PRACTICAL EXAMINATION

Particulars	Practical Marks	Internal Assessment	Total
Practical II	120	30	150
Practical II	120	30	150

ELS05

Theory: 30 Hours

Disaster & Emergency Management

A. Introduction to Disaster management

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management

C. Modern disaster management – disaster cycle

D. Hazards

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
 - stages

-Basic elements

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	BOPT28	Low vision aids Geriatric Optometry & Pediatric Optometry Community Optometry	04			04
2	BOPT29	Occupational Optometry Research Methodology and Statistic	04			04
3	ELS06	Elective Subject : Basic of Biomedical Engineering / Basics of Psychology	02			02
4	BOPT30	Practical I		03	02	05
5	BOPT31	Practical II		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	BOPT28	Paper 1	Low vision aids Geriatric Optometry & Pediatric Optometry Community Optometry	60+20+20	100
2	BOPT29	Paper 2	Occupational Optometry Research Methodology and Statistic	60+20+20	100
3	ELS06	Paper 3	Elective subject: Basic of Biomedical Engineering / Basics of Psychology	80+20	100
Grand Total					300

Sr. No.	Subject Code	Practical	Practical + IA	Total
4	BOPT30	Practical I	160 + 40	200
5	BOPT31	Practical II	160 + 40	200
Grand Total				400

SIXTH SEMESTER

1. LOW VISION AIDS (THEORY)

Sl. No	TOPICS
1	Introduction 1.. Definition & Classification 1.2. Causes of Low Vision 1.3. Optometrist's role in Low Vision management
2	Examination of a Patient with Low vision 2.1.Case history 2.2.Visual acuity <ul style="list-style-type: none">✓ Distant vision- Charts, measurement & Documentation✓ Near vision Charts, measurement & Documentation✓ Refraction -Significance & Technique✓ Diagnostic procedures in low vision examination
3	Optics & Characteristics of Low vision aids 3.1. Magnification 3.2. Galilean telescope Vs Keplarian Telescopes 3.3.Spectacle magnifiers 3.4.Hand Magnifiers 3.5.Stand Magnifiers 3.6.CCTV 3.7.Bioptic telescopes 3.8.Accessory low vision aids
4	Selection of Low vision aids for distance, intermediate & Near
5	Guidelines & training to use various aids
6	Choices of tests &Aids in various pathological conditions 6.1.Conditions causes overall blurring of the visual field 6.2.Condions causes central field defects 6.3.Conditions causes peripheral fieid defects
7	Light, glare & Contrast in Low vision care & Rehabilitation
8	Children with low vision
9	Genetics
10	Rehabilitation of visually handicapped

LOW VISION AIDS PRACTICAL	
1	<p>Demonstration followed by evaluation of a low vision patient by students</p> <ul style="list-style-type: none">• Low vision case history• Visual acuity measurement & Documentation• Refraction• Needed diagnostic tests for each pathological condition• Selection, trial & dispensing of visual aids Rehabilitation methods

RECOMMENDED BOOKS

- | | |
|------------------------|-------------------------|
| 1. Low vision care | E.B.Mehr, Allen.N.Fried |
| 2. Clinical Low vision | Eleanor.E.Faye |

2. GERIATRIC OPTOMETRY

Sl. No	TOPICS
1	1.1.Introduction 1.2.structural & physiological changes in the eye associated with ageing <ul style="list-style-type: none"> ✓ Structural changes to lid & adnexa ✓ Physiological changes to cornea, lens & Uvea ✓ Degenerative & Physiological changes in vitreous, choroid & retina
2	2.1.Optical& refractive changes <ul style="list-style-type: none"> ✓ Refractive changes in cornea, lens & vitreous ✓ Refractive changes due to diabetes ✓ Refractive changes due to uveitis
3	Ocular diseases <ul style="list-style-type: none"> ✓ Cataract ✓ Glaucoma ✓ Macular disorders ✓ Vascular disorders
4	Optical correction of refractive conditions
5	Dispensing in geriatric age groups <ul style="list-style-type: none"> ✓ Spectacle ✓ Contact lenses

RECOMMENDED BOOKS

1 vision of the ageing patient

Hirsch Wick

2. Vision & Ageing- General & Clinical perspective

Alfred Rosenboom, Meredith. W.Morgan

PEDIATRIC OPTOMETRY

Sl. No	TOPICS
1	Introduction 1.1.Review of ocular anatomy & Physiology 12.Visual development
2	Pediatric case history 2.1.Genetic factors 2.2.Prenatal factors 2.3.Perinatal factors 2.4.Postnatal factors
3	Normal Appearance, pathology and structural anomalies of <ul style="list-style-type: none"> ✓ Orbit ✓ Eyelids ✓ Lacrimal system ✓ Conjunctiva ✓ Cornea ✓ Sclera ✓ Anterior chamber, Uveal tract, pupils ✓ Lens ✓ Vitreous, Fundus ✓ Oculomotor system
4	Ocular Examination 4.1.Measurement of visual acuity <ul style="list-style-type: none"> ✓ Various visual acuity charts for different age groups ✓ Teller acuity chart & VEP 4.2.Measurement of refractive status <ul style="list-style-type: none"> ✓ Dry & Cycloplegic refraction ✓ Interpretation of results 4.3. Assessment of binocular status 4.4.Measurement of sensory motor adaptability 4.5. Assessment of accommodation &Convergence
5	Post examination processes 5.1.Compensatory treatment & remedial therapy for <ul style="list-style-type: none"> ✓ Myopia ✓ Pseudomyopia ✓ Hyperopia ✓ Astigmatism ✓ Anisometropia

	<ul style="list-style-type: none"> ✓ Strabismus ✓ Nystagmus
6	Pediatric dispensing <ul style="list-style-type: none"> ✓ Spectacles ✓ Contact Lenses

RECOMMENDED BOOKS

- | | |
|---|------------------------------|
| 1. Principles & Practice of pediatric optometry | Alfred Rosenboom, M.W.Morgan |
| 2. Pediatric Optometry | Jerome Rosner |
| 3. Clinical pediatric optometry | Leonard.J.Press- 1st edition |

3. COMMUNITY OPTOMETRY

Sl. No	TOPICS
1	Community Optometry <ol style="list-style-type: none"> 1. Global medicine and evolution of public health in India 2. Public health of optometry- concepts and implementation 3. Health care delivery systems in India and determinants of health Levels of prevention - optometrist's role in community 5. Concepts of national health programme 6. Screening in population 7. Epidemiology of blindness- cataract, glaucoma, deficiency disorders 8. Scope of geriatric ophthalmology in preventive and rehabilitation care 9. Natural history of disease, transmission of disease 10. Basics in research methodology in populations 11. Demography and vital statistics 12. National and international agencies in health care 13. Fundamentals of health economics, health plan 14. Quality assessment in health delivery programmes, 15. Community outreach-camps and school screening programmes
	OCCUPATIONAL OPTOMETRY
1	1.1. Introduction to occupational health, hygiene and safety 1.2. International bodies like ILO, WHO, national bodies like labour institutes, National institutes of occupational health, national safety council, etc.
2	Acts and rules, <ol style="list-style-type: none"> 2.1. factories act and rules 2.2. workmen's compensation act, ESI act, etc.

3	Occupational diseases 3.1.occupation related diseases caused by <ul style="list-style-type: none"> ✓ Physical agents ✓ Chemical agents Biological agents
4	Occupational hygiene & ergonomics 4.1.environmental monitoring 4.2.Recognition, evaluation and control of hazards 4.3.1lumination- definition, measurements and standards
5	Occupational safety 5.1.causes of accidents 5.2. Accident analysis, accident prevention 5.2.vision, lighting, colour and their role 5.3.Problems of special occupational groups
6	Ocular and visual problems of occupation 6.1.Electromagnetic radiation <ul style="list-style-type: none"> ✓ Ionizing & Non ionizing ✓ Infrared ✓ Ultraviolet Microwave & laser
7	Prevention of occupational diseases <ul style="list-style-type: none"> ✓ Medical examination /medical monitoring Pre-employment/pre-placement examinations
8	Personal protective equipment <ul style="list-style-type: none"> ✓ Goggles, Face shields etc Selection, use & Testing for standards
9	9.1. Work with visual display units-Computer 9.2.Contact lens & work 9.3.Pesticides- General & Ocular defects 9.4Role of optometrist - promotion of general and visual health and safety of people at at Work 9.5. Industrial visits

RECOMMENDED BOOKS

- | | |
|---|-----------------------------------|
| 1. Public health and community Optometry | Robert.D.Newcomb, Jerry. L. Jolly |
| 2. Industrial & Occupational ophthalmology | Samuel.L.Fox |
| 3. Guide to occupational and other visual needs | Holmes |
| 4. Work and the eye | Raechel.V.North |
| 5. Diagnosing and treating computer related vision problems | Sheedy, Shaw-McMinn |

4. RESEARCH METHODOLOGY & STATISTICS

L	TOPICS
1	Introduction I: Biostatistics <ul style="list-style-type: none"> ✓ Definition
2	Introduction II: Research Methodology <ul style="list-style-type: none"> ✓ Research process ✓ Steps involved in research process
3	Variables and scales of measurements <ul style="list-style-type: none"> ✓ Definitions and examples of qualitative, quantitative, continuous discrete, dependent and independent variables. ✓ Definitions, properties and examples of nominal, ordinal, interval and ratio scales of
4	Sampling <ul style="list-style-type: none"> ✓ Population, sample, sampling, reasons for sampling, probability and non-probability sampling. ✓ Methods of probability sampling - simple random, stratified, systematic-procedure. ✓ Merits and demerits.
5	Organization of data <ul style="list-style-type: none"> ✓ Frequency table, histogram, frequency polygon, frequency curve, bar diagram, pie
6	Measures of location <ul style="list-style-type: none"> ✓ Arithmetic mean, median, mode, quartiles and percentiles-definition.
7	Measures of variation <ul style="list-style-type: none"> ✓ Range, inter-quartile range, variance, standard deviation, coefficient of variation-definition.
8	Normal distribution <ul style="list-style-type: none"> ✓ Concept, graphical form, properties, examples. ✓ Concept of Skewness and Kurtosis

9	Correlation <ul style="list-style-type: none"> ✓ Scatter diagram. ✓ concept and properties of correlation coefficient, examples [No computation]
10	Health Information System <ul style="list-style-type: none"> ✓ Definition, requirement, component and uses of health information system. ✓ Sources of health information system- Census, Registration of vital events, Sample registration system (SRS), Notification of diseases, Hospital records, Disease registries, Record linkage, Epidemiological surveillance. Population survey
11	Vital statistics and hospital statistics <ul style="list-style-type: none"> ✓ Rate, ratio, proportion, Incidence, Prevalence. Common morbidity, mortality and Fertility statistics - Definition and computation. ✓
12	Hypothesis <ul style="list-style-type: none"> ✓ What is hypothesis? ✓ Formulation of hypothesis. ✓ Characteristics of good hypothesis.
13	Epidemiology <ul style="list-style-type: none"> ✓ Concept of health and disease ✓ Definition and aims of Epidemiology,
14	Concept of reliability & validity

RECOMMENDED BOOKS

1. Methods in Biostatistics for medical students & Research workers Mahajan B.K.-6th edition
2. Research methodology – Methods & techniques Kothari C.R
3. Introduction to Biostatistics: A manual for students in health sciences Sundar Rao PSS, Richard J.
4. Text book of Preventive and social medicine Park. E..Park

ELS06

Theory: 30 Hours

Basics of Biomedical Engineering

Topics

- Insulators and conductors
- Units of measurements
- Electrical power transmission
- Resistors, capacitors and inductors
- Regulated power supply
- Voltage stabilizers
- Uninterrupted power supply systems
- Amplifiers – AC and DC
- Differential amplifiers
- Input impedance
- Output impedance
- Gain and amplification
- Noise
- Common Mode Rejection Ratio (CMRR)
- Filters - Principles
 - High frequency filters
 - Low frequency filters
 - Band Pass filters
- Analog to digital converter (ADC) and Digital Analog converter (DAC)
- Sensitivity & Gain

- Averaging principles

ELS06

Theory: 30 Hours

Basics of Psychology:

SL.NO.	TOPICS
1	<ol style="list-style-type: none">1. Introduction to psychology2. Intelligence, Learning, Memory, Personality, Motivation3. Body integrity-one's body image4. Patient in his Milan5. Self-concept of the therapist, Therapist patient relationship-some guidelines6. Illness and its impact on the patients7. Maladies of the age and their impact on the patient's own and others concept of his body image8. Adapting changes in vision9. Why Medical Psychology needs/demands commitment?

PATTERN OF EXAMINATION

DISTRIBUTION OF QUESTIONS

S.No.	Questions	No. of Questions	No. of Questions to be attempted	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1	Long Essay Questions	3	2	2 x 10	20	60	20	20	100
2	Short Essay Questions	6	5	5 x 5	25				
3	Short Answers	5	5	5 x 3	15				

PRACTICAL EXAMINATION

Particulars	Practical Marks	Internal Assessment	Total
Practical I	160	40	200
Practical II	160	40	200

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in all the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.
- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can

appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass
 - a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
 - b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
 - c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
 - d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA):**

$$\text{SGPA} = \frac{\text{Credits X grade points}}{\text{Total Credits}}$$

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the first year subjects shall have postgraduate degree in the respective subject with 3 years of teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Critical care Technology Degree Course (Semester System) Syllabus/Curriculum 2023-24



Accredited 'A+' Grade by NAAC (3rd Cycle) Placed
in 'A' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research

(Deemed-to-be-University)

[Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Government of India Notification
No. F.9 -19/2000-U.3 (A)]

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth. To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

CONTENTS

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B.Sc. CRITICAL CARE TECHNOLOGY

PREAMBLE

The B.Sc. Critical Care Technology Course is of **3 years (6 semesters) and 1 Year internship** duration aimed at training students in the critical care aspects of medical care with a good scientific foundation. The B.Sc. Critical Care Technology course offered at faculty of Allied Health Sciences, KLE Academy of Higher Education and Research will prepare competent technologist with adequate knowledge and skills necessary for bedside monitoring, setting up equipment, and assist in the clinical decision making process in critical care. They will also be trained in record keeping and data collection in the ICU. Along with the basic knowledge and advanced training in the latest technologies in critical care, these graduates will play an important role in determining the quality of health care provided.

OBJECTIVE

The objective is to impart the basic knowledge & technical skills of critical care and its application in the health care delivery system.

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – **Critical Care Technology** Course shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

OR

- 4) Pre university vocational course from an approved Board with laboratory technology as vocational subject.

II. DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory Rotatory internship

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Job opportunities and prospects

On finishing this course you are easily placed in the hospitals. You work in hospitals in ICUs, emergency rooms, trauma centres and similar healthcare settings requiring emergency and critical care. Hospitals working in both the private and public sector will be in need of your services. Other places to look for employment are government hospitals, military hospitals, railway hospitals and so on. You can undertake a post graduate program like M.Sc. in Intensive care technology. You may also get to do research work in the field by opting for a doctoral program.

Employment:

Those who successfully complete the course will have very good opportunities in all leading hospitals in India and abroad.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Applied Anatomy and Physiology related to Critical Care	60 + 20 + 20	Applied Anatomy and Physiology related to Critical Care	80 + 20
		Applied Pharmacology in Critical Care	60 + 20 + 20	Applied Pharmacology in Critical Care	80 + 20
		Applied Microbiology and Infection Control	60 + 20 + 20	Applied Microbiology and Infection Control	80 + 20
4.	4th Semester	Basics of Intensive Care Technology Part 1	60 + 20 + 20	Basics of Intensive Care Technology Part 1	80 + 20
		Basics of Intensive Care Technology Part 2	60 + 20 + 20	Basics of Intensive Care Technology Part 2	80 + 20
		Basics of Intensive Care Technology Part 3	60 + 20 + 20	Basics of Intensive Care Technology Part 3	80 + 20

Third Year					
5.	5th Semester	Intensive Care Technology- Clinical	60 + 20 + 20	Intensive Care Technology- Clinical	80 + 20
		Intensive Care Technology- Applied (1)	60 + 20 + 20	Intensive Care Technology- Applied (1)	80 + 20
		Intensive Care Technology- Applied (2)	60 + 20 + 20	Intensive Care Technology- Applied (2)	80 + 20
6.	6th Semester	Intensive Care Technology- Advanced	60 + 20 + 20	Intensive Care Technology- Advanced	80 + 20
		CSSD Procedures and Medical Ethics	60 + 20 + 20	CSSD Procedures	80 + 20
		Procedures In Intensive Care Unit	60 + 20 + 20	Procedures In Intensive Care Unit	80 + 20
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Sub)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Sub)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Sub)	80+20=100
		1. Communication Skills	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Sub)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Sub)	80+20=100
		1. Basics Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Sub)	80+20=100
		1. Basics of Biomedical Engineering	
		2. Fundamentals of Electricity and Electronics:	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. EVS	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to Semester Grade Point Average(SGPA):

$$\text{SGPA} = \frac{\text{Credits} \times \text{Grade points}}{\text{Total Credits}}$$

1. Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	CRCT01	Human Anatomy	02		02
2	CRCT02(A)	Human Physiology	02		02
	CRCT02(B)	Basics of Biochemistry	02		02
3	CRCT03(A)	Pathology : Basic Hematology	02		02
	CRCT03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	CRCT04	Human Anatomy		02	02
6	CRCT05 (A)	Human Physiology		02	02
	CRCT05(B)	Basics of Biochemistry		02	02
7	CRCT06(A)	Pathology : Basic Hematology		02	02
	CRCT06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	CRCT01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	CRCT02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	CRCT03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	CRCT04	Practical 1	Human Anatomy	80 + 20	100
6	CRCT05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	CRCT06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester I

PAPER 1: CRCT01 Human Anatomy

Theory 30 Hours

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation

Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief

Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: CRCT01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: CRCT04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of **different parts of Brain & Spinal Cord**

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code CRCT04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: CRCT02 **Section A- Human Physiology**

Theory: 30 Hours

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions
Classification of Body fluid compartments & composition, Homeostasis
Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis
Neuron and Neuroglia
Classification and Properties of Nerve fibers
Classification of Muscles
Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity
Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing,
Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - CRCT05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: CRCT02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: CRCT05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks

40 Marks

IA Marks:

10 Marks

Grand Total

50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata- 700009 (India)

Semester I

PAPER 3 - CRCT03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: CRCT06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- CRCT03 Section B – Microbiology

Theory 30 Hours

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.

- **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methods
- Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
- **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: CRCT06
Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes

- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
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1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education

- 15) Halebidu and Belur
- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	CRCT07	Anatomy	02		02
2	CRCT08(A)	Physiology	02		02
	CRCT08(B)	Biochemistry	02		02
3	CRCT09(A)	Hematology & Clinical Pathology	02		02
	CRCT09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	CRCT10	Human Anatomy		02	02
6	CRCT11(A)	Human Physiology		02	02
	CRCT11(B)	Basics of Biochemistry		02	02
7	CRCT12(A)	Hematology & Clinical Pathology		02	02
	CRCT12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	CRCT07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	CRCT08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	CRCT09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	CRCT10	Practical 1	Human Anatomy	80 + 20	100
6	CRCT11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	CRCT12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - CRCTS07 **Human Anatomy**

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			

3.	Short Answers	5	5	5 x 3	15			
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Practical 1: - CRCT10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code CRCT11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – CRCT08 **Section A - Physiology**

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – CRCT11
Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: CRCT08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: CRCT11

Practical : 30 Hours

Basics of Biochemistry II

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for	VASUDEVAN(D	Jaypee Brothers, New Delhi.

	Medical Students	M), & SREE KUMARI (S)	
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata- 700009 (India)

PAPER 3: CRCT09**Theory : 30 Hours****Section A - Haematology & Clinical Pathology****Hematology**

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:**Reference books (Latest Edition)**

Sl · N o.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10 ·	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: CRCT12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine

11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: CRCT09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
- Immunology
 - a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr.C.P.Baveja.

PRACTICAL 3: CRCT12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices),
Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
 - Youth development programmes at the National level, State level and voluntary sector
- Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking

- Self Confidence and Self esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CRCT13	Applied Anatomy and Physiology related to Critical Care	02			02
2	CRCT14	Applied Pharmacology in Critical Care	02			02
3	CRCT15	Applied Microbiology and Infection Control	02			02
4	AECC01	AECC: Environmental Sciences	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	02			02
6	CRCT16	Applied Anatomy and Physiology related to Critical Care Practical		02	02	04
7	CRCT17	Applied Pharmacology in Critical Care		02	02	04
8	CRCT18	Applied Microbiology And Infection Control		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER

Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	CRCT13	Paper 1	Applied Anatomy and Physiology related to Critical Care	60 + 20 + 20	100
2	CRCT14	Paper 2	Applied Pharmacology in Critical Care	60 + 20 + 20	100
3	CRCT15	Paper 3	Applied Microbiology and Infection Control	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis-Basic Statistics)	80 + 20	100
Grand Total					500
Sr. No.	Practical	Subjects	Practical + IA	Total	
5	CRCT16	Applied Anatomy and Physiology related to Critical Care Practical	80 + 20	100	
6	CRCT17	Applied Pharmacology in Critical Care Practical	80 + 20	100	
7	CRCT18	Applied Microbiology and Infection Control Practical	80 + 20	100	
Grand Total				300	

SEMESTER III

PAPER 1: CRCT13

Theory 30 Hours

Applied Anatomy and Physiology related to Critical Care

Applied Anatomy related to critical care paper1

I RESPIRATORY SYSTEM

- Introduction
- Medical Terminology
- Anatomical terms, planes, relations
- o Anatomy of the upper respiratory tract
- Nose, oral cavity
- Pharynx, Larynx
- o Anatomy of thoracic cage bones, muscles, innervation
- o Anatomy of the lungs - overview
- o Pleura, lobes of lung, bronchi, trachea, hilum, bronchial tree
- o Alveolus, Bronchioles,
- o Blood supply,
- o Lymphatics
- o Innervation

II CARDIOVASCULAR SYSTEM

- Overview of CVS
- Anatomy of heart - Pericardium, myocardium, endocardium, valves,
- Anatomy of Vascular system - Major Vessels, Arteries, Veins, Capillaries
- Regional Circulation - coronary, cerebral, splanchnic

III CENTRAL NERVOUS SYSTEM

- Basic organisation of the nervous system - Central, Peripheral, Autonomic
- Cerebral blood flow
- Pain pathway

Applied physiology related to critical care

I. RESPIRATORY SYSTEM

- Physiology of breathing
- Homeostasis
- Mechanics of Breathing, Muscle action
- Regulation of breathing
- Lung Volumes & Capacity
- Gas exchange & transport- oxygen, carbon dioxide
- Diffusion

- O₂ Transport and abnormalities
- CO₂ Transport and abnormalities
- Pressure, Volume
- Resistance, Compliance
- Ventilation and Perfusion, V/Q ratio
- Gas exchange, mechanism of diffusion
- Work of breathing
- Transport of O₂ and CO₂; factors affecting oxygen transport
- Acid - base balance
- Pulmonary Function Tests
- Arterial Blood Gas
- Types of respiratory failure - causes and treatment

II CARDIOVASCULAR SYSTEM

- Cardiac cycle
- Cardiac output - factors affecting cardiac output
- Cardiac conducting system
- Regulation of rate, basic arrhythmias
- Principles of ECG, Normal ECG
- Blood pressure
- Maintenance of normal blood pressure and factors affecting it
- systolic, diastolic, pulse pressure, mean
- Oxygen delivery, uptake to tissues
- Central venous pressure
- Cardiac output, Stroke volume contractility
- Preload, after load
- Interpretation of common haemodynamic parameters.
- Assessment of hemodynamic parameters
- Recognise the following regarding arterial cannulation
- Indications
- Cannulation sites
- Possible complications
- Normal pressures and their significance
- Pressure wave forms
- Significance of respiratory variation in the pressure wave forms

CVP Monitoring

- Indications
- Factors affecting measurement

- Insertion sites
- Types of catheters
- Correct technique of pressure measurement.

III CENTRAL NERVOUS SYSTEM

- Metabolic requirements of the brain
- Consciousness, Coma, Brain injury
- Sedation
- Brain Death

SCHEME OF EXAMINATION – Semester III

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

PRACTICAL1: CRCT16

Applied Anatomy and Physiology related to Critical Care

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Normal chest X ray, Normal ECG, Normal pressure waveforms (pulse oxymetry, Arterial pressure waveform)	4	4 x 20	80 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Spotters of Normal chest X ray, Normal ECG, Normal pressure waveforms (pulse oxymetry, Arterial pressure waveform)	4	4X10	40 Marks

Practical 80 Marks
I A Marks 20Marks
Grand Total 100 Marks

Recommended Books:

1. Critical Care Physiology Robert H Bartlett
2. Applied Physiology in Critical Care Physiology Michael R. Pinsky

Reference books:

1. Textbook of Medical Physiology, AC Guyton, JE Hall
2. Ganong's review of Medical Physiology

Online Reference

1. WWW.derangedphysiology.com
2. WWW.emcrit.org

PAPER 2: CRCT14

Theory 30 Hours

Applied Pharmacology in critical care:

- Drugs - Nomenclature
- Modes of action of drugs
- Routes of administration
- Drug dose calculation - Dilution, infusion rate

Medical gases: O₂ ; N₂O

- Bronchodilators
- Mucokinetic agents
- Antihistamines
- Steroids

- Drugs affecting autonomic nervous system
- Inotropic agents, Chronotropic agents,
- Vasopressors & Vasodilators

- Anti-hypertensives
- Analgesics; sedatives
- neuromuscular blocking agents
- Antimicrobial drugs, antiviral and anti-fungal agents - basic concepts Antimicrobial Resistance - Basic concepts
- Antiseptic and disinfectants agents

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

PRACTICAL 2: CRCT17

Applied Pharmacology in Critical Care:

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Drug preparation: Inotropes, vasopressors, bronchodilators, Antibiotics reconstitution and administration	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Spotters: all drugs mentioned in syllabus		4x 10	40 Marks

Practical
I A Marks
Grand Total

80Marks
20Marks
100 Marks

Recommended Books:

1. Textbook of Microbiology Anatanarayanan and Paniker
2. Essentials of Medical Pharmacology KD.Tripathi

Reference books:

1. Infectious Diseases in Critical Care Medicine, Burke A Cunha
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham

Online Reference

1. WWW.derangedphysiology.com
2. WWW.intensivecarenetwork.com

PAPER 3: CRCT15
APPLIED MICROBIOLOGY AND INFECTION CONTROL

Theory 30 Hours

INTRODUCTION - Importance of infection in an ICU

Agents causing Infection

SPREAD OF INFECTION Source; host; transmission

Biohazardous materials

INFECTION CONTROL & UNIVERSAL PRECAUTIONS

- Sterilisation & Disinfection - concepts
- Methods of sterilization
- Spread of infection
- Elimination of source - Cleaning and sterilizing equipment
- Interrupting transmission of infection - role of health care workers
- Disposal of infection wastes
- Surveillance; quality control

SPECIFIC INFECTIONS

Community acquired infections

Nosocomial Infections: Types - Prevention.

HIV- AIDS

Hepatitis A, B, C

Tropical Infections -Tetanus, Malaria, Leptospirosis, Dengue, Rickettsial, Amoebiasis

**SCHEME OF EXAMINATION –
Semester III**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 3: CRCT18
APPLIED MICROBIOLOGY AND INFECTION CONTROL**

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Sterilization, disinfection, decontamination, surface cleaning, hand hygiene, contact barrier	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Spotters: disinfectants, sterilizing agents		4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. Textbook of Microbiology Anatanarayanan and Paniker

2. Essentials of Medical Pharmacology KD.Tripathi

Reference books:

1. Infectious Diseases in Critical Care Medicine, Burke A Cunha
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham

Online Reference

1. WWW.derangedphysiology.com
2. WWW.intensivecarenetwork.com

Compulsory Course AECC 1

ENVIRONMENTAL STUDIES

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

Theory and Field work: 50 Hours

♦ **Theory - 45 hours**

♦ **Field work - 5 hours**

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2 hours

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil

erosion and desertification.

g) Role of an individual in conservation of natural resources.

h) Equitable use of resources for sustainable lifestyles

8 hours

3: Ecosystems

◆ Concept of an ecosystem.

◆ Structure and function of an ecosystem.

◆ Producers, consumers and decomposers.

◆ Energy flow in the ecosystem.

◆ Ecological succession.

◆ Food chains, food webs and ecological pyramids.

◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-

a. Forest ecosystem

b. Grassland ecosystem

c. Desert ecosystem

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

6 hours

4: Biodiversity and its conservation

8 hours

◆ Introduction - Definition: genetic, species and ecosystem diversity.

◆ Bio geographical classification of India.

◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.

◆ Biodiversity at global, National and local levels.

◆ India as a mega-diversity nation.

◆ Hot-spots of biodiversity.

◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.

◆ Endangered and endemic species of India

◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

8 hours

Definition

◆ Cause, effects and control measures of:-

a. Air pollution

b. Water pollution

c. Soil pollution

d. Marine pollution

e. Noise pollution

f. Thermal pollution

g. Nuclear hazards

◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

◆ Role of an individual in prevention of pollution.

◆ Pollution case studies.

◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

7 hours

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

6 hours

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets
river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc. (Field work Equal to 5 lecture hours)

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
 - Uses and application of bio-statistics in public health research and medical sciences.
 - Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
 - Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
 - Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
 - Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
 - Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.
- Basic Probability : Concept of probability, its terminology and different types of definition
- Laws of probability: addition law, multiplication law and conditional probability.

ELS03 : Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CRCT19	Basics of Intensive Care Technology Part 1	02			02
2	CRCT20	Basics of Intensive Care Technology Part 2	02			02
3	CRCT21	Basics of Intensive Care Technology Part 3	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	CRCT22	Basics of Intensive Care Technology Part 1		02	02	04
7	CRCT23	Basics of Intensive Care Technology Part 2		02	02	04
8	CRCT24	Basics of Intensive Care Technology Part 3		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	CRCT19	Paper 1	Basics of Intensive Care Technology Part 1	60 + 20 + 20	100
2	CRCT20	Paper 2	Basics of Intensive Care Technology Part 2	60 + 20 + 20	100
3	CRCT21	Paper 3	Basics of Intensive Care Technology Part 3	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					500

Sr. No.	Practical	Subjects	Practical + IA	Total
6	CRCT22	Basics of Intensive Care Technology Part 1	80 + 20	100
7	CRCT23	Basics of Intensive Care Technology Part 2	80 + 20	100
8	CRCT24	Basics of Intensive Care Technology Part 3	80 + 20	100
Grand Total				300

PAPER 1: CRCT19
BASICS OF INTENSIVE CARE TECHNOLOGY PART 1

Theory 30 Hours

Airway Care

INDICATIONS FOR ARTIFICIAL AIRWAYS

- Relieving airway obstruction
- Secretion removal
- Protecting the airway
- Positive Pressure Ventilation

SELECTING AND ESTABLISHING AN ARTIFICIAL AIRWAY

- Nasal airways
- Pharyngeal airways
- Tracheal airways

AIRWAY CLEARANCE TECHNIQUES

- Airway suctioning
- Bronchoscopy

AIRWAY MAINTENANCE

- Securing the airway and confirming placement
- Providing adequate humidification
- Minimizing nosocomial infections
- Providing cuff care
- Facilitating clearance of secretions
- Troubleshooting airway emergencies

EXTUBATION

- Indications
- Procedure
- Post extubation care & complications

Oxygen Therapy

- Sources of oxygen for therapy
- Storage of oxygen
- Oxygen delivery systems
- Hazards of oxygen
- Modes of O₂ therapy B.Sc. Intensive Care Technology Page 43 of 55
- Monitoring O₂ delivery systems (in vitro)

Blood gases in patient (in vitro.)

- Pulse oximetry
- Economic issues

CHEST XRAY and BASIC CONCEPTS IN CT

NORMAL CHEST X-RAY

- Normal anatomy
- Basic physics of X-ray and assessment of film quality
- Cardiac configuration.
- Lung fields and airway
- Optimum position of - ET, NG, Central Lines

ABNORMAL CXR /CT:

- Trauma:
- Pneumothorax
- Hemothorax
- Lung contusion
- Pulmonary oedema
- CCF
- ARDS
- Pneumonia: - Bronchopneumonia
- Lobar pneumonia
- Aspiration pneumonia

Semester IV**Theory Total- 100 Marks****Duration: 3 Hour**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1: CRCT22
BASICS OF INTENSIVE CARE TECHNOLOGY PART 1

Practical Examination-Semester IV**Major Practical**

Topics	No. Of Questions	Number of Question and Marks	Total
Instruments used in Airway management, Abnormal chest X-ray: pneumonia, ARDS, pneumothorax,	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of	Number of Question	Total
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	Questions	and Marks	
Oxygen delivery devices: Simple face mask, NRBM, Nasal prongs, High flow nasal canulae		4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

PAPER 2: CRCT20

Theory 30 Hours

BASICS OF INTENSIVE CARE TECHNOLOGY PART 2

Clinical Scenarios

RESPIRATORY SYSTEM

- Respiratory Failure
- Acute Respiratory Distress Syndrome
- Pneumonia, Tuberculosis
- Opportunistic infections
- Bronchial asthma
- Chronic obstructive airways disease
- Chronic bronchitis
- Emphysema
- Chronic Suppurative Lung Disease Bronchiectasis
- Lung Abscess
- Atelectasis I Collapse
- Pleural diseases: pneumothorax, pleural effusions

CARDIOVASCULAR SYSTEM

- Shock - hypovolemic, cardiogenic, obstructive, septic
- Congestive cardiac failure; Acute-left ventricle failure
- Pulmonary oedema
- Pulmonary hypertension
- Pulmonary embolism
- Ischemic heart disease; Myocardial infarction

**SCHEME OF EXAMINATION –
Semester IV**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 2: CRCT23
BASICS OF INTENSIVE CARE TECHNOLOGY PART 2**

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
CASE SCENARIO: Pneumonia, ARDS, COPD exacerbation, Asthma exacerbation, Pneumothorax. Myocardial Infarction, Shock, Pulmonary embolism, Pulmonary oedema	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
SHORT CASE SCENARIO: Pneumonia, ARDS, COPD exacerbation, Asthma exacerbation, Pneumothorax. Myocardial Infarction, Shock, Pulmonary embolism, Pulmonary oedema		4x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

PAPER 3: CRCT21
BASICS OF INTENSIVE CARE TECHNOLOGY PART 3

Theory 30 Hours

NERVOUS SYSTEM:

- Cerebrovascular Disease
- Neurological Failure:
- Coma
- Delirium
- Neuromuscular disease
- Myasthenia gravis
- Guillain Barre Syndrome
- Cerebrovascular disease, stroke
- Brain Death
- Persistent Vegetative State
- Trauma
- Head injury
- Unstable spine & protection

GASTROINTESTINAL, HEPATIC, PANCREAS:

- Upper GI Bleed
- Hepatic Coma
- Pancreatitis

RENAL:

Renal Failure in ICU

ENDOCRINE & METABOLIC:

- Hypoglycemia
- Hyperglycemia

HAEMATOIOLOGY:

- Haematological Malignancies
- Neutropenia

- Coagulopathy

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MISCELLANEOUS:

- Envenomation - snake bite, scorpion sting
- Poisoning - general supportive care, common poisons

**SCHEME OF EXAMINATION –
SemesterIV**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2.	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 3: CRCT24

BASICS OF INTENSIVE CARE TECHNOLOGY PART 3

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
CASE SCENARIO: Stroke, cervical cord injury,G.B. Syndrome, Poisoning Decontamination and supportive care, Brain Death: inclusion and exclusion criterias	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
SHORT CASE SCENARIO: Hypoglycemia, Hyperglycemia, coagulopathy, retention enema.		4 x 10	40 Marks

Practical

80 Marks

I A Marks
Grand Total

20Marks
100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

Compulsory Course AECC0 2

Theory: 30 Hours

LAW - INDIAN CONSTITUTION

I. GOAL :

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :

A) KNOWLEDGE :

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS

Theory:

- Unit I** a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution.
- Unit II** The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions.
- Unit III** Fundamental Rights and Duties - Their content and significance
- Unit IV** Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.
- Unit V** Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities
- Unit VI** Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.
- Unit VII** The Election Commission and State Public Service Commissions.
- Unit VIII** Method of amending the Constitution.
- Unit IX** Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.
- Unit X** Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/mpi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester: 100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04 Research Methodology & Bioethics

Theory: 30 Hours

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research

- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.

10. Health Education Methods and Media

- **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
- Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
- Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
- Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CRCT25	Intensive Care Technology-Clinical	02			02
2	CRCT26	Intensive Care Technology-Applied (1)	02			02
3	CRCT27	Intensive Care Technology-Applied (2)	02			02
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	CRCT28	Intensive Care Technology-Clinical		02	02	04
7	CRCT29	Intensive Care Technology-Applied (1)		02	02	04
8	CRCT30	Intensive Care Technology-Applied (2)		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER

Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	CRCT25	Paper 1	Intensive Care Technology- Clinical	60 + 20 + 20	100
2	CRCT26	Paper 2	Intensive Care Technology- Applied (1)	60 + 20 + 20	100
3	CRCT27	Paper 3	Intensive Care Technology- Applied (2)	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject : (Hospital Administration/ Disaster Management)	80 + 20	100
Grand Total					400

Sr. No.	Practical	Subjects	Practical + IA	Total
5	CRCT28	Intensive Care Technology- Clinical	80 + 20	100
6	CRCT29	Intensive Care Technology- Applied (1)	80 + 20	100
7	CRCT30	Intensive Care Technology- Applied (2)	80 + 20	100
Grand Total				300

PAPER 1: CRCT25
INTENSIVE CARE TECHNOLOGY- CLINICAL

Theory 30 Hours

1. ARTERIAL BLOOD GASES

- Procedure, puncture sites
- Sampling techniques
- Using an ABG machine,
- Different types of ABG machines - advantages and disadvantages, cost considerations
- Transportation of sample
- Interpretation of values
- Appropriate Interventions

2. MECHANICAL VENTILATION - NON-INVASIVE AND INVASIVE

- Basic concepts: - Mechanics of ventilation
- Work of breathing
- Indications
- Humidification of gas
- Ventilator settings
- Timings -Inspiratory, Expiratory, Inspiratory hold
- Flow
- Tidal volume
- Pressure - Peak
- Plateau
- PEEP
- "POP-OFF"
- Pressure support
- Proximal airway vs. distal
- FiO₂
- Modes of ventilation

Non-Invasive, CPAP, BiPAP

Invasive modes - Controlled, Assisted, SIMV, APRV, Pressure Support

- Alarm settings
- Care of ventilator & tubings- -Sterility
- Weaning – concepts
- Humidifier - types
- Advantages and disadvantages
- Inhaled drug therapy
- Nebulisation - different types, advantages & disadvantages
- MDI with Spacer

3. CARE OF PATIENTS ON VENTILATOR

- Ensuring proper placement of tube
- Cuff pressure,
- Tracheobronchial hygiene, suctioning

- Humidification, Chest physic
- Ventilator settings
- Monitoring vetilatory parameters

4. CARE OF CHEST TUBE

Drainage systems of pleural air, fluid

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1: CRCT28

INTENSIVE CARE TECHNOLOGY- CLINICAL

Practical Examination-Semester vI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Setting up of mechanical ventilator parameters & alarms, troubleshooting alarms Interpretation of ABG	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Humidifiers, Endotracheal tube care, MDI with spacers.		4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham
3. mechanical ventilation by David Chang

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

PAPER 2: CRCT26

Theory 30 Hours

INTENSIVE CARE TECHNOLOGY- APPLIED (I) CARDIOVASCULAR SUPPORT:

A. Assisting in:

1. Arterial and central venous cannulation
2. Peripheral venous cannulation
3. PiCCO I Pulmonary artery catheter insertion - measuring cardiac output by thermodilution
4. Pericardiocentesis
5. Transvenous pacemaker
6. Basic ultrasonography

B. Placement of ECG leads taking 12-lead dynamic ECG.

C. Use of infusion devices for vasoactive medications.

D. Assisting in electrical cardioversion and defibrillation. Placement of transcutaneous pacemaker.

E. Setting up invasive pressure monitoring - levelling, calibration, zeroing; measuring pressures

• MONITORING CARDIOVASCULAR SUPPORT:

Zeroing, calibration and trouble-shooting of pressure transducers.

Troubleshooting invasive blood pressure monitoring and central venous pressure monitoring' Setting up and troubleshooting invasive cardiac output monitoring - PiCCO, PA catheter,

BASIC ULTRASONOGRAPHY

• INVASIVE PRESSURE MONITORING

- Arterial & venous

- Care & maintenance
- Transducers, dome, zeroing, calibration
- BASICS OF FLUID RESUSCITATION & INOTROPIC SUPPORT

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 2: CRCT29
INTENSIVE CARE TECHNOLOGY- APPLIED (I) CARDIOVASCULAR
SUPPORT:**

Practical Examination-Semester V

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<u>Invasive blood pressure monitoring:</u> setup, maintainance, troubleshooting	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Electrical cardioversion and defibrillation: energies used in shockable rhythm, premedications and medications used during cardioversion and defibrillation	8	4 x 10	40 Marks

Practical
I A Marks
Grand Total

80 Marks
20Marks
100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham
3. mechanical ventilation by David Chang

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

PAPER 3: CRCT27 INTENSIVE CARE TECHNOLOGY- APPLIED (2)

Theory 30 Hours

RESPIRATORY SUPPORT:

1. Maintaining an open airway.
2. Assisting in
 - i. Tracheal intubation (oral, nasal)
 - ii. Cricothyrotomy, tracheostomy, trans tracheal catheters
 - iii. Mechanical ventilatory support
- Monitoring airway pressures
- iv. Topical use of respiratory medication (inhalers and nebulisers)
- v. Suctioning: Chest physiotherapy and incentive spirometry.
- vi. Weaning techniques.
- vii. Assisting in fibroptic bronchoscopy.
- viii. Oxygen therapy devices and their limitations
- ix. Assisting in chest tube insertion and chest drainage systems
- x. Bed side pulmonary function tests
- xi. Arterial blood gas sampling; Using the ABG machine
- xii. CPAP & BI P AP circuit

RESPIRATORY THERAPY:

Setting up & troubleshooting:

Oxygen administration

Non-invasive Ventilation - NIV on standard ventilator, BiPAP, CPAP

Invasive Ventilation

Setting up the ventilator

Oxygenation

Ventilation

Alarms

Trigger

Evaluate and trouble shoot the patient- ventilator system

Interpret ventilator graphic waveform

Detect and measure auto-peep

Monitoring of patients who are assisted by mechanical ventilation and are in sudden distress

MONITORING RESPIRATORY SUPPORT

Monitoring of patients who are assisted by mechanical ventilation and are in sudden distress

Recognise the methods and significance of measuring the following lung vol-umes and flows in the ICU.

- a. Tidal volume
- b. Vital capacity
- c. Peak Flow Rate
- d. Negative Inspiratory Pressure
- e. Respiratory Graphics Analysis

7. RECOGNITION OF CARDIORESPIRATORY ARREST

8. BASIC LIFE SUPPORT (Hands on Training)

- Ventilation, Use of Ambu bag
- Cardiac massage

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 3: CRCT30
INTENSIVE CARE TECHNOLOGY- APPLIED (2)**

Practical Examination-Semester vI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Basic Life Support	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Case scenario of cardiac arrest with		4 x 10	40 Marks

one person cpr			
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Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent , Edward Abraham
3. mechanical ventilation by David Chang

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

Disaster & Emergency Management**A. Introduction to Disaster management**

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management**C. Modern disaster management – disaster cycle****D. Hazards**

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
 - stages

-Basic elements

ELS05

30 HOURS

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	CRCT31	Intensive Care Technology-Advanced	02			02
2	CRCT32	CSSD Procedures and Medical Ethics	02			02
3	CRCT33	Procedures In Intensive Care Unit	02			02
5	ELS06	Elective Subject : Fundamentals of Electricity and Electronics / Biomedical Engineering	02			02
6	CRCT34	Intensive Care Technology-Advanced		02	02	04
7	CRCT35	CSSD Procedures		02	02	04
8	CRCT36	Procedures In Intensive Care Unit		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER
Scheme of Examination

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	CRCT31	Paper 1	Intensive Care Technology-Advanced	60 + 20 + 20	100
2	CRCT32	Paper 2	CSSD Procedures and Medical Ethics	60 + 20 + 20	100
3	CRCT33	Paper 3	Procedures In Intensive Care Unit	60 + 20 + 20	100
4	ELS06	Paper 4 Subsidiary	Elective Subject : Fundamentals of Electricity and Electronics/ / Biomedical Engineering	80 + 20	100
Grand Total					400

Sr. No.	Practical	Subjects	Practical + IA	Total
5	CRCT34	Intensive Care Technology- Advanced	80 + 20	100
6	CRCT35	CSSD Procedures	80 + 20	100
7	CRCT36	Procedures In Intensive Care Unit	80 + 20	100
Grand Total				300

**PAPER 1: CRCT31
INTENSIVE CARE TECHNOLOGY- ADVANCED**

Theory 30 Hours

CONCEPTS IN ADVANCED LIFE SUPPORT

- ACLS protocol for cardiac arrest
- Drugs
- Defibrillator

PROLONGED LIFE SUPPORT

- Concept of the "ICU" and team work

10. CARE OF THE UNCONSCIOUS PATIENT

- Comfort, orientation, pain control
- Skin integrity assessment and care
- Physiotherapy - Chest & Limbs
- Nutritional needs and supply
- Basic care of surgical wounds and fractures
- Psychological assessment and support in an ICU.

11. BASIC ADMINISTRATION:

Economic Issues .

Raising purchase orders for equipment

Maintaining consumables stock

Maintaining equipment - repair and troubleshooting

12. Basics Of Trauma resuscitation, Burns resuscitation, Environmental Injuries,
Perioperative Care

**SCHEME OF EXAMINATION –
SemesterVI**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20			20	100

2	Short Essay Question	6	5	5X5	25	60	20		
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1:CRCT34
INTENSIVE CARE TECHNOLOGY- ADVANCED

Practical Examination-Semester VI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
ACLS protocol for cardiac arrest	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
BED SORE PREVENTION AND MANAGEMENT		4x 10	40 Marks

Practical
I A Marks
Grand Total **80 Marks**
20Marks
100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
- 2.ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
- 2.Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

- 1.lifeinthefastlane.com
- 2.criticalcarereviews.com

PAPER 2: CRCT32
CSSD PROCEDURES AND MEDICAL ETHICS

Theory: 30 Hours

CSSD PROCEDURES

1. Waste disposal collection of used items from user area, reception protective clothing and disinfections sage gaurds,
2. use of disinfections sorting and classification of equipment for clean-ing purposes, sharps, blunt lighted etc. contaminated high risk baby care - delicate instruments or hot care instruments,
3. cleaning process - use of detergents. Mechanical cleaning apparatus, cleaning instruments, cleaning jars, receivers bowls etc. trays, basins and similar hand ware utensils. Cleaning of catheters and tubings, cleaning glass ware, cleaning syringes and needles.
4. Materials used for wrapping and packing assembling pack contents. Types of packs prepared. Inclusion of trays ahd galliparts in packs. Method of wrapping and making use of indications to show that a pack of container has been through a sterilization process date stamping.
5. General observations principles of sterilization. Moist heat sterilization. Dry heat sterilization. EO0gas sterilization. H202 gas plasma vapo sterilization.

MEDICAL ETHICS

1. Medical ethics - Definition - Goal - Scope
2. Code of conduct - Introduction –
3. Basic principles of medical ethics – Confidentiality
4. Malpractice and negligence - Rational and irrational drug therapy
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia
8. Organ transplantation
9. Medico legal aspects of medical records - Medicolegal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - rentention of medical records - other various aspects

SCHEME OF EXAMINATION – Semester VI

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 2:CRCT35

CSSD PROCEDURES

Practical Examination-Semester VI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Cleaning, decontaminating, washing used equipment / procedure tray and re-sterilizing process	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Medical Record Keeping and Documentation of significant events and procedures		4 x 10	40 Marks

Practical 80 Marks
I A Marks 20Marks
Grand Total 100 Marks

Recommended Books

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

PAPER 3: CRCT33 Theory: 30 hours
PROCEDURES AND EQUIPMENT MAINTENANCE IN INTENSIVE CARE
UNIT

14, PROCEDURAL SKILLS

EMERGENCY LIFE SUPPORT:

Basic Life Support: Keeping Airway open, Use of Ambu bag and mask ventilation,

Advanced Life Support :

How to Use Defibrillator

Emergency Management of Trauma

1. Assisting in

a. Placement of Endotracheal tube

b. Placement of Central Venous Catheter

c. Placement of Arterial Canulae

d. NG tubes, enteral feeding tubes, Sengstaken-Blackemore tube

e. Maintenance of urinary catheters

f. Placement of hemodialysis catheters

g. Management peritoneal dialysis

h. Management CVVHD

i. bed side screening ultrasonography

NERVOUS SYSTEM:

Assisting in:

Lumbar puncture

Application of intracranial pressure monitoring device

Application of in-line immobilisation (C spine protection)

Cervical neck collar.

TOXICOLOGY:

Gastric lavage

ANALGESIA and SEDATION

Care of Epidural

Patient Controlled Analgesia

HAEMATOLOGICAL DISORDERS:

Assisting in:

Plasmapheresis

15.BASICS OF ULTRASOUND AND RADIOLOGY IN CRITICAL CARE

1. USG physics

2. Basic cardiac ultrasound and ECHO views

3. Basic lung ultrasound

4. Basic abdominal ultrasound

5. Echocardiographic assessment of a patient in shock

6. Ultrasound for vascular access

7. Reading xrays and CT with clinical correlation

16.EQUIPMENT MAINTENANCE & BASIC TROUBLESHOOTING:

Ventilators, CPAP, BiPAP machines

Pumps - Infusion, Syringe

Monitors - Standalone & multipara meter

ECG Machine
 ABG Machine
 Defibrillator
 USG Machine

SCHEME OF EXAM FOR THEORY

Semester VI

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 3:CRCT36
 PROCEDURES IN INTENSIVE CARE UNIT**

Practical Examination-Semester VI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Assisting in Procedures; Endotracheal intubation, Central Venous Catheter placement, Arterial Canulae	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
SPOTTERS: E.T. Tube, Central Venus Catheter, Arterial Canulae, Foley's Catheter, Ryle's Tube, Tracheostomy, Cricothyrotomy kit		4 x 10	40 Marks

Practical 80 Marks
 I A Marks 20Marks
Grand Total 100 Marks

Recommended Books:

1. The ICU book, Paul Marino
2. ICU Protocols A Stepwise approach, Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham
3. Mechanical ventilation by David Chang

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

Resistance: Symbol, units, colour coding equivalent resistance with 'connection in series and parallel.

Capacitance: Symbol, units, series and parallel connection

Inductance and transformers

Parameters of electricity power - voltage, current frequency, power.

Differences between AC and DC - .

AC and DC power supplies, Phase, neutral and earth - conventional colour coding

Ohms law and Kirchoff's law Electrical Circuits.

Earth and grounding - Symbol, importance in patient care.

AC and DC power supplies- Phase, neutral and earth - conventional colour coding

Classification of medical equipment

1. According to type of protection: B C F etc
2. According to mode of protection: Class I -III.

ELS06

Basics of Biomedical Engineering

Topics

- Insulators and conductors
- Units of measurements
- Electrical power transmission
- Resistors, capacitors and inductors
- Regulated power supply
- Voltage stabilizers
- Uninterrupted power supply systems
- Amplifiers – AC and DC
- Differential amplifiers
- Input impedance
- Output impedance
- Gain and amplification
- Noise
- Common Mode Rejection Ratio (CMRR)
- Filters - Principles
 - High frequency filters
 - Low frequency filters
 - Band Pass filters
- Analog to digital converter (ADC) and Digital Analog converter (DAC)
- Sensitivity & Gain
- Averaging principles

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in all the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV

subjects.

- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass

- a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
- b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
- d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA):**

SGPA= Credits X grade points/ Total Credits

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the First year subjects shall have Postgraduate degree in the respective subject with 3 years teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Emergency Medicine Technology Degree Course

(Semester System)

Syllabus/Curriculum

2023-24



KLE
ACADEMY OF HIGHER
EDUCATION AND RESEARCH
Deemed-to-be-University

Accredited '**A+**' Grade by NAAC (3rd Cycle)
Placed in '**A**' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research
(Deemed-to-be-University)

[Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Government of India Notification
No. F.9 -19/2000-U.3 (A)]

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth. To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of lifelong learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

Notification

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B.Sc. EMERGENCY MEDICINE TECHNOLOGY

PREAMBLE

The B.Sc. Emergency Medicine Technology Course is of **3 years(6 semesters) and 1 year internship** duration aimed at training students in the field of trauma and emergency care with a good scientific foundation. The B.Sc. Emergency Medicine Technology course offered at faculty of Allied Health Sciences, KLE Academy of Higher Education and Research will prepare competent technologist with adequate knowledge and skills necessary for assisting in assessment of trauma patients and patients presenting to emergency ward, bedside monitoring, stabilisation, setting up equipment, and assist in the clinical decision making process in emergency care. They will also be trained in record keeping and data collection in the emergency ward. Along with the basic knowledge and advanced training in the latest technologies in emergency care, these graduates will play an important role in determining the quality of health care provided.

OBJECTIVE

The objective is to impart the basic knowledge & technical skills of Emergency care and its application in the health care delivery system.

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science –**Emergency Medicine Technology** Course shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Pre Degree Course from a recognized university (two years after ten years of schooling) with Physics, Chemistry and Biology as principal subjects of study.

OR

- 3) Any equivalent examination recognized by KAHER for the above purpose with Physics, Chemistry and Biology as principal subjects of study.

OR

- 4) Pre university vocational course from an approved Board with laboratory technology as vocational subject.

II. DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory rotatory internship

III. MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English

IV. SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

V. ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Job opportunities and prospects

On finishing this course you are easily placed in the hospitals. You work in hospitals in emergency rooms, trauma centres, ICUs, ambulance services and similar healthcare settings requiring emergency and critical care. Hospitals working in both the private and public sector will be in need of your services. Other places to look for employment are government hospitals, military hospitals, railway hospitals and so on. You can undertake a post graduate program like M.Sc. in Emergency Medicine Technology. You may also get to do research work in the field by opting for a doctoral program.

Employment:

Those who successfully complete the course will have very good opportunities in all leading hospitals in India and abroad.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Applied Anatomy and Physiology related to Emergency Care	60 + 20 + 20	Applied Anatomy and Physiology related to Emergency Care	80 + 20
		Applied Pharmacology in Emergency Care	60 + 20 + 20	Applied Pharmacology in Emergency Care	80 + 20
		Applied Microbiology and Infection Control	60 + 20 + 20	Applied Microbiology and Infection Control	80 + 20
4.	4th Semester	Basics of Emergency Medicine Technology Part 1	60 + 20 + 20	Basics of Emergency Medicine Technology Part 1	80 + 20
		Basics of Emergency Medicine Technology Part 2	60 + 20 + 20	Basics of Emergency Medicine Technology Part 2	80 + 20
		Basics of Emergency Medicine Technology Part 3	60 + 20 + 20	Basics of Emergency Medicine Technology Part 3	80 + 20

Third Year					
5.	5th Semester	Emergency Surgery & Emergency Surgical Services	60 + 20 + 20	Emergency Surgery & Emergency Surgical Services	80 + 20
		Clinical Procedures And Instruments In Emergency Services Part 1 (observation and assisting)	60 + 20 + 20	Clinical Procedures And Instruments In Emergency Services Part 1 (observation and assisting)	80 + 20
		Clinical Procedures And Instruments In Emergency Services Part 2(Observation And Assisting)	60 + 20 + 20	Clinical Procedures And Instruments In Emergency Services Part 2(Observation And Assisting)	80 + 20
6.	6th Semester	Emergency Medicine Technology – Advanced	60 + 20 + 20	Emergency Medicine Technology - Advanced	80 + 20
		CSSD Procedures	60 + 20 + 20	CSSD Procedures	80 + 20
		Procedural Skills In Emergency Care	60 + 20 + 20	Procedural Skills In Emergency Care	80 + 20
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basic of Biomedical Engineering	
		2. Fundamentals of Electricity and Electronics	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits} \times \text{grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester**

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	EMT01	Human Anatomy	02		02
2	EMT02(A)	Human Physiology	02		02
	EMT02(B)	Basics of Biochemistry	02		02
3	EMT03(A)	Pathology : Basic Hematology	02		02
	EMT03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	EMT04	Human Anatomy		02	02
6	EMT05 (A)	Human Physiology		02	02
	EMT05(B)	Basics of Biochemistry		02	02
7	EMT06(A)	Pathology : Basic Hematology		02	02
	EMT06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	EMT01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	EMT02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	EMT03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	EMT04	Practical 1	Human Anatomy	80 + 20	100
6	EMT05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	EMT06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief

Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: EMT01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: EMT04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of **different parts of Brain & Spinal Cord**

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code EMT04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Histology

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: EMT02

Theory: 30 Hours

Section A- Human Physiology

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions

Classification of Body fluid compartments & composition, Homeostasis

Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis

Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity
Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing,
Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - EMT05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: EMT02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: EMT05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks

40 Marks

IA Marks:

10 Marks

Grand Total

50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata- 700009 (India)

Semester I

PAPER 3 - EMT03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: EMT06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethhaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- EMT03 Section B – Microbiology

Theory 30 Hours

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.

- **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methods
- Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
- **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo
2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: EMT06
Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes

- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman

2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur

- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	EMT07	Anatomy	02		02
2	EMT08(A)	Physiology	02		02
	EMT08(B)	Biochemistry	02		02
3	EMT09(A)	Hematology & Clinical Pathology	02		02
	EMT09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	EMT10	Human Anatomy		02	02
6	EMT11(A)	Human Physiology		02	02
	EMT11(B)	Basics of Biochemistry		02	02
7	EMT12 (A)	Hematology & Clinical Pathology		02	02
	EMT12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	EMT07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	EMT08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	EMT09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	EMT10	Practical 1	Human Anatomy	80 + 20	100
6	EMT11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	EMT12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - EMT07 Human Anatomy

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - BMLS10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code EMT11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks

Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – EMT08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – EMT11
Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: EMT08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. Composition of Whole Blood, Serum and Plasma
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. Nutritional Disorders, Diabetic and DASH diets
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism

Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle

Protein Metabolism- General Reactions of amino acids and Urea cycle

Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: EMT11

Practical : 30 Hours

Basics of Biochemistry II

1. Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit
2. Demonstration to Digital Balance
3. Demonstration to Centrifuge
4. Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF
5. Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer
6. Quantitative estimation of Glucose, Urea and Total Protein and Albumin
7. Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New

			Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: EMT09**Theory : 30 Hours****Section A - Haematology & Clinical Pathology****Hematology**

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:**Reference books (Latest Edition)**

Sl · N o.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10 ·	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: EMT12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

SI. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid

10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test
14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: EMT09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr.C.P.Baveja.

PRACTICAL 3: EMT12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices),
Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy
 - Youth development programmes at the National level, State level and voluntary sector
- Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention
- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking
- Self Confidence and Self esteem

- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur

Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EMT13	Applied Anatomy and Physiology related to Emergency Care	02			02
2	EMT14	Applied Pharmacology in Emergency Care	02			02
3	EMT15	Applied Microbiology and Infection Control	02			02
4	AECC01	AECC: Environmental Sciences	02			02
5	ELS03	Elective Subject (Communication Skills / Basic Statistics)	02			02
6	EMT16	Applied Anatomy and Physiology related to Emergency Care Practices		02	02	04
7	EMT17	Applied Pharmacology in Emergency Care Practices		02	02	04
8	EMT18	Applied Microbiology and Infection Control Practices		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER

S. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	EMT 13	Paper 1	Applied Anatomy and Physiology related to Emergency Care	60 + 20 + 20	100
2	EMT 14	Paper 2	Applied Pharmacology in Emergency Care	60 + 20 + 20	100
3	EMT 15	Paper 3	Applied Microbiology and Infection Control	60 + 20 + 20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Basic Statistics)	80 + 20	100
Grand Total					500

S. No.	Practical	Subjects	Practical + IA	Total
5	EMT 16	Applied Anatomy and Physiology related to Emergency Care Practices	80 + 20	100
6	EMT 17	Applied Pharmacology in Emergency Care Practices	80 + 20	100
7	EMT 18	Applied Microbiology and Infection Control Practices	80 + 20	100
Grand Total				300

SEMESTER III

Paper 1: EMT13

Theory 30 Hours

Applied Anatomy and Physiology related to Emergency Care

Applied Anatomy related to Emergency Care

I RESPIRATORY SYSTEM

- Introduction
- Medical Terminology
- Anatomical terms, planes, relations
- o Anatomy of the upper respiratory tract
- Nose, oral cavity
- Pharynx, Larynx
- o Anatomy of thoracic cage bones, muscles, innervation
- o Anatomy of the lungs - overview
- o Pleura, lobes of lung, bronchi, trachea, hilum, bronchial tree
- o Alveolus, Bronchioles,
- o Blood supply,
- o Lymphatics
- o Innervation

II CARDIOVASCULAR SYSTEM

- Overview of CVS
- Anatomy of heart - Pericardium, myocardium, endocardium, valves,
- Anatomy of Vascular system - Major Vessels, Arteries, Veins, Capillaries
- Regional Circulation - coronary, cerebral, splanchnic

III CENTRAL NERVOUS SYSTEM

- Basic organisation of the nervous system - Central, Peripheral, Autonomic
- Cerebral blood flow
- Pain pathway

Applied physiology related to Emergency Care

I. RESPIRATORY SYSTEM

- Physiology of breathing
- Homeostasis
- Mechanics of Breathing, Muscle action
- Regulation of breathing
- Lung Volumes & Capacity
- Gas exchange & transport- oxygen, carbon dioxide
- Diffusion
- O₂ Transport and abnormalities
- CO₂ Transport and abnormalities
- Pressure, Volume
- Resistance, Compliance
- Ventilation and Perfusion, V/Q ratio

- Gas exchange, mechanism of diffusion
 - Work of breathing
- Transport of O₂ and CO₂; factors affecting oxygen transport
- Acid - base balance
- Pulmonary Function Tests
- Arterial Blood Gas
- Types of respiratory failure - causes and treatment

II CARDIOVASCULAR SYSTEM

- Cardiac cycle
- Cardiac output - factors affecting cardiac output
- Cardiac conducting system
- Regulation of rate, basic arrhythmias
- Principles of ECG, Normal ECG
- Blood pressure
- maintenance of normal blood pressure and factors affecting it
- systolic, diastolic, pulse pressure, mean
- Oxygen delivery, uptake to tissues
- Central venous pressure
- Cardiac output, Stroke volume contractility
- Preload, After load
- Interpretation of common haemodynamic parameters.
- Assessment of hemodynamic parameters
- Recognise the following regarding arterial cannulation
- Indications
- Cannulation sites
- Possible complications
- Normal pressures and their significance
- Pressure wave forms
- Significance of respiratory variation in the pressure wave forms

CVP Monitoring

- Indications
- Factors affecting measurement
- Insertion sites
- Types of catheters
- Correct technique of pressure measurement.

III CENTRAL NERVOUS SYSTEM

- Metabolic requirements of the brain
- Consciousness, Coma, Brain injury
- Sedation
- Brain Death

Recommended Books:

1. Critical Care Physiology Robert H Bartlett
2. Applied Physiology in Critical Care Physiology Michael R. Pinsky

Reference books:

1. Textbook of Medical Physiology, AC Guyton, JE Hall
2. Ganong's review of Medical Physiology

Online Reference

1. WWW.derangedphysiology.com
2. WWW.emcrit.org

**SCHEME OF EXAMINATION –
Semester III**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2.	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

Practical 1: EMT16

Applied Anatomy and Physiology related to Emergency Care

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
<u>Normal chest X ray, Normal ECG, Normal pressure waveforms(pulse oxymetry, Arterial pressure waveform)</u>	4	4 x 20	80 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Spotters of Normal chest X ray, Normal ECG, Normal pressure waveforms(pulse oxymetry, Arterial pressure waveform)		4X10	40 Marks

Practical
I A Marks
Grand Total

80 Marks
20Marks
100 Marks

Paper 2: EMT14
Applied Clinical Pharmacology in Emergency Care:

Theory 30 Hours

- Drugs - Nomenclature
- Modes of action of drugs
- Routes of administration
- Drug dose calculation - Dilution, infusion rate

Medical gases: O₂; N₂O

- Bronchodilators
- Mucokinetic agents
- Antihistamines
- Steroids
- Drugs affecting autonomic nervous system
- Inotropic agents, Chronotropic agents,
- Vasopressors & Vasodilators
- Anti-hypertensives
- Analgesics; sedatives
- Neuromuscular blocking agents
- Antimicrobial drugs, antiviral and anti-fungal agents - basic concepts Antimicrobial Resistance - Basic concepts
- Antiseptic agents

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	80	20	20	100
2	Short Essay Question	6	5	5X5	25				

3.	Short Answers	5	5	5 x 3	15				
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Practical Examination-Semester III

PRACTICAL 2: EMT17

Applied Clinical Pharmacology in Emergency Care:

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Drug preparation: Inotropes, vasopressors, bronchodilators, Antibiotics reconstitution and administration	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Spotters: all drugs mentioned in syllabus		4x 10	40 Marks

Practical	80Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. Textbook of Microbiology Anatanarayanan and Paniker
2. Essentials of Medical Pharmacology KD.Tripathi

Reference books:

1. Infectious Diseases in Critical Care Medicine, Burke A Cunha
2. Textbook of Critical Care, Jean Louis Vincent , Edward Abraham

Online Reference

1. WWW.derangedphysiology.com
2. WWW.intensivecarenetwork.com

Paper 3:EMT15
Clinical Microbiology And Infection Control

Theory 30 Hours

INTRODUCTION - Importance of infection in an ICU

Agents causing Infection

SPREAD OF INFECTION Source; host; transmission

Biohazardous materials

INFECTION CONTROL & UNIVERSAL PRECAUTIONS

- Sterilisation & Disinfection - concepts

- Methods of sterilization

- Spread of infection

- Elimination of source - Cleaning and sterilizing equipment

- Interrupting transmission of infection - role of health care workers

- Disposal of infection wastes

- Surveillance; quality control

SPECIFIC INFECTIONS

Community acquired infections

Nosocomial Infections: Types - Prevention .

HIV-AIDS .

Hepatitis A, B, C

Tropical Infections -Tetanus, Malaria, Leptospirosis, Dengue, Rickettsial, Amoebiasis

**SCHEME OF EXAMINATION –
Semester III**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

Practical Examination-Semester III

**PRACTICAL 3: EMT18
Clinical Microbiology And Infection Control**

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Sterilization, disinfection, decontamination, surface cleaning, hand hygiene, contact barrier	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Spotters : disinfectants, sterilizing agents		4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

- 1.Textbook of Microbiology Anatanarayanan and Paniker
- 2.Essentials of Medical Pharmacology KD.Tripathi

Reference books:

1. Infectious Diseases in Critical Care Medicine ,Burke A Cunha
2. Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

1. WWW.derangedphysiology.com
2. WWW.intensivecarenetwork.com

AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.
- g) Role of an individual in conservation of natural resources.

- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy

- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets
river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
 - Uses and application of bio-statistics in public health research and medical sciences.
 - Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
 - Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
 - Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
 - Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
 - Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.
- Basic Probability : Concept of probability, its terminology and different types of definition
Laws of probability: addition law, multiplication law and conditional probability.

Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EMT19	Basics of Emergency Medicine Technology Part 1	02			02
2	EMT20	Basics of Emergency Medicine Technology Part 2	02			02
3	EMT21	Basics of Emergency Medicine Technology Part 3	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	EMT22	Basics of Emergency Medicine Technology Part 1		02	02	04
7	EMT23	Basics of Emergency Medicine Technology Part 2		02	02	04
8	EMT24	Basics of Emergency Medicine Technology Part 3		02	02	04
Grand Total						22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	EMT19	Paper 1	Basics Of Emergency Medicine Technology Part 1	60 + 20 + 20	100
2	EMT 20	Paper 2	Basics Of Emergency Medicine Technology Part 2	60 + 20 + 20	100
3	EMT 21	Paper 3	Basics Of Emergency Medicine Technology Part 3	60 + 20 + 20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Grand Total					400

Sr. No.	Practical	Subjects	Practical + IA	Total
5	EMT 22	Basics of Emergency Medicine Technology Part 1 Particles	80 + 20	100
6	EMT 23	Basics of Emergency Medicine Technology Part 2 Particles	80 + 20	100
7	EMT 24	Basics of Emergency Medicine Technology Part 3 Particles	80 + 20	100
Grand Total				300

PAPER 1 - EMT19

Theory 30 Hours

BASICS OF EMERGENCY MEDICINE TECHNOLOGY I

Airway Care

INDICATIONS FOR ARTIFICIAL AIRWAYS

- Relieving airway obstruction
- Secretion removal
- Protecting the airway
- Positive Pressure Ventilation

SELECTING AND ESTABLISHING AN ARTIFICIAL AIRWAY

- Nasal airways
- Pharyngeal airways
- Tracheal airways

AIRWAY CLEARANCE TECHNIQUES

- Airway suctioning
- Bronchoscopy

AIRWAY MAINTENANCE

- Securing the airway and confirming placement
- Providing adequate humidification
- Minimizing nosocomial infections
- Providing cuff care
- Facilitating clearance of secretions
- Troubleshooting airway emergencies

EXTUBATION

- Indications
- Procedure
- Post extubation care & complications

Oxygen Therapy

- Sources of oxygen for therapy
- Storage of oxygen
- Oxygen delivery systems
- Hazards of oxygen
- Modes Of O₂ therapy
- Monitoring O₂ delivery systems (in vitro)

Blood gases in patient (in vitro.)

- Pulse oxymetry

CHEST XRAY and BASIC CONCEPTS IN CT & MRI

NORMAL CHEST X-RAY

- Normal anatomy
- Basic physics of X-ray and assessment of film quality
- Cardiac configuration .
- Lung fields and airway
- Optimum position of - ET, NG, Central Lines

ABNORMAL CXR /CT:

- Trauma:
- Pneumothorax
- Hemothorax
- Lung contusion
- Pulmonary oedema
- CCF
- ARDS
- Pneumonia: - Bronchopneumonia
- Lobar pneumonia
- Aspiration pneumonia

Semester IV

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 1– EMT22
BASICS OF EMERGENCY MEDICINE TECHNOLOGY I**

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Instruments used in Airway management, Abnormal chest X-ray: pneumonia, ARDS, pneumothorax,	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Oxygen delivery devices: Simple face mask, NRBM, Nasal prongs, High flow nasal canulae		4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
- 2.ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
- 2.Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

- 1.lifeinthefastlane.com
- 2.criticalcarereviews.com

PAPER 2-EMT20

Theory 30 Hours

BASICS OF EMERGENCY MEDICINE TECHNOLOGY II

TRIAGE AND GENERAL EMERGENCIES

Concepts and principles of Disaster Nursing

Causes and Types of Disaster:

Natural and Man made Earthquakes, Floods, Epidemics, Cyclones Fire, Explosion, Accidents, Violence, Terrorism; biochemical, War

Policies related to emergency/disaster management; International, national, state, institutional

Disaster preparedness:

Team, Guidelines, protocols, Equipments, Resources

Coordination and involvement of; Community, various govt. departments, nongovernment.

Organizations and International agencies

Legal Aspects of Disaster

Impact on Health and after effects :Post Traumatic Stress Disorder

Rehabilitation; physical, psychosocial, Financial, Relocation

Concept, priorities, principles and Scope of emergency care

Organization of emergency services: physical setup, staffing,

Equipment and supplies, protocols,

Concepts of triage and role of triage person

Coordination and involvement of different departments and facilities

Principles of emergency management

1. LIFE SUPPORT & RESUSCITATION

Basic life support in perspective
 Cardiopulmonary function and actions for survival
 Adult Basic life support, Introduction to Advanced Cardiac life support
 Pediatric Basic Life support
 Special resuscitation situations(drowning, hanging, Pregnancy)
 Safety during CPR training and actual rescue
 BASIC PRINCIPLES OF TRAUMA CARE (ATLS)
 The principles of kinetic energy Mechanism –Basic mechanics of Injury
 Pattern.
 Primary survey
 Secondary survey as appropriate
 Reassessment
 Identification of Life threatening injuries
 Shock –different types & Categories
 Revised trauma score, Glasgow Coma Score
 Lifting & transporting of injured persons
 Splints and Immobilization
 PRACTICALS:12
 Lead ECG and Interpretation of normal ECG
 IV cannulation
 Blood sampling
 Triage
 .

**SCHEME OF EXAMINATION –
SemesterIV**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	75X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 2 – EMT23
BASICS OF EMERGENCY MEDICINE TECHNOLOGY II

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
CASE SCENARIO: BASICS OF ATLS, BLS Transportation of patients(Spine board and Scoop board) BLS Splinting Immobilization, using of cervical collar	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Peripheral IV access Blood sampling Triage Transportation of patients(Spine board and Scoop board) Splinting Immobilization	4	4x 10	40 Marks

Practical 80 Marks
 I A Marks 20Marks
Grand Total 100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
2. ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

PAPER 3-EMT21
EMERGENCY MEDICINE TECHNOLOGY III

Theory 30 Hours

COURSE CONTENT

1. Medical emergencies

Hypoglycemia

Hyperglycemia, DKA ,HONK

Poisoning

Anaphylaxis

Hypothermia

Hyperthermia

Mental illness

2. Fluids and electrolytes

Fluid administration (Types of Fluids)

Formulas (Hypo and Hyper natremia)

oDehydration

o Over hydration

Electrolyte imbalance (Sodium, Potassium, Bicarbonate, Chloride)

3. Acid base emergencies: (Respiratory and metabolic Acidosis/Alkalosis)

Interpretation

4. Respiratory Emergencies:

Foreign body obstruction

Chronic obstructive pulmonary disease (COPD)

Asthma

Pneumonia, Pulmonary edema, ARDS

Common medication in respiratory problems

(Meter dose inhaler, nebuliser)

Mechanical ventilator – General principles, Basic modes of ventilation, NIV

5. Gastrointestinal Emergencies:

Abdominal pain

Peptic ulcer disease

Cholecystitis

Hepatitis

Pancreatitis

Abdominal aortic aneurysm

Bowel obstruction

Hernias

Gastro intestinal bleeding

6. Cardiovascular Emergencies:

Angina pectoris

Myocardial infarction (MI), Thrombolytic Therapy

Congestive Cardiac Failure (CCF)

Aortic Aneurysm

Hypertensive Emergencies

12 lead ECG and Interpretation

Heart Block and Cardiac Arrhythmias

6. Central Nervous System Emergencies:

Meningitis

Stroke

Seizure

Status epilepticus

Syncope

7. Genito urinary emergencies:

Renal failure

Urolithiasis

Urinary tract infection

Haematuria

8. Hematological Disorders:

Red blood cell disorders:

Anemia and Types/Polycythemia

White blood disorders

Platelet abnormalities

9. Endocrine and Metabolic Emergencies:

Diabetic Ketoacidosis

Hyperosmolar coma

Thyroid crisis

Diabetes insipidus

Vomiting

Diarrhea

11. Dermatological Emergencies:

Viral infections:

Varicella

Herpes zoster

Acute leprosy reactions

Autoimmune disorders:

Pemphigus vulgaris

Systemic lupus erythematosus

Toxic disorders:

Acute erythroderma

Severe pruritus,

Scabies

Allergic reactions – Anaphylaxis/Angioedema

13. Toxicology:

Define the term poison

The four ways in which a poison may enter the body

General principles of assessment and management of poison and overdose

Opiates toxicity

Organophosphates

Carbon monoxide

Cyanide

Caustics

Copper sulphate

Digoxin toxicity

Hydrocarbons

Tricyclic antidepressant toxicity

Metals – Arsenic/Iron

Acetaminophen overdose

Poisonous alcohols Methanol

Poisonous plants – Oleander, Oduvanthalai

14. Emergencies due to venomous bites and stings:

Snake bite

Scorpion stings

Spider bite

Bee and wasp stings

Dog bite

Cat bite

Human bite

Monkey bite

15. INDUSTRIAL HAZARDS

Electrocution

Amputation

Crush injury

Fall from height

Assaults

OBSTETRICAL EMERGENCIES

Pre eclampsia

Placenta praevia/Abruption

Post Partum Hemorrhage

Amniotic fluid embolism

Cord prolapse

Ectopic Pregnancy

17. MENTAL HEALTH EMERGENCIES

Aggressive patient

Suicide

Deliberate self harm

18. Paediatric emergencies

Neonatal resuscitation

Paediatric resuscitation

Assessment of new born and paediatric

Meconium aspiration

Diaphragmatic hernia

Apnoea

Drowning

SIDS (Sudden infant Death Syndrome)

Neonatal Seizure

Febrile convulsion

Shock

**SCHEME OF EXAMINATION –
SemesterIV**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 3 – EMT24
EMERGENCY MEDICINE TECHNOLOGY III**

Practical Examination-Semester IV

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
CASE SCENARIO: ACUTE CARE OF ACUTE POISONING, MYOCARDIAL INFARCTION,HYPERTENSIVE EMERGENCIES, COMA	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
CASE SCENARIO: ACUTE CARE OF COPD EXACERBATION, ASTHAMA, FOREIGN BODY OBSTRUCTION,BASICS OF ABG	4	4x 10	40 Marks

Practical
I A Marks
Grand Total **80 Marks**
20Marks
100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
2. ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- Unit I** a) Meaning of term Constitution.
b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
c) Salient Features of the Constitution.
d) Preamble of the Constitution.
- Unit II** The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions.
- Unit III** Fundamental Rights and Duties - Their content and significance
- Unit IV** Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.
- Unit V** Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities
- Unit VI** Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their

functions in
India.

Unit VII The Election Commission and State Public Service Commissions.

Unit VIII Method of amending the Constitution.

Unit IX Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.

Unit X Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/mpi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04

Theory: 30 Hours

Research Methodology & Bioethics

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

Fundamentals of Health Education & Communication**Introduction to Health Education and health promotion**

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.

10. Health Education Methods and Media

- **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
- Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
- Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
- Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EMT25	Emergency Surgery & Emergency Surgical Services	02			02
2	EMT26	Clinical Procedures And Instruments In Emergency Services Part 1 (observation and assisting)	02			02
3	EMT27	Clinical Procedures And Instruments In Emergency Services Part 2(Observation And Assisting)	02			02
5	ELS05	Elective Subject (Hospital Administration/ Disaster Management)	02			02
6	EMT28	Emergency Surgery & Emergency Surgical Services		02	02	04
7	EMT29	Clinical Procedures And Instruments In Emergency Services Part 1 (Observation And Assisting)		02	02	04
8	EMT30	Clinical Procedures And Instruments In Emergency Services Part 2(Observation And Assisting)		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER

Sr. No.	Subject Code	Theory	Subjects	Theory + IA +Viva Voce	Total
1	EMT 25	Paper 1	Emergency Surgery & Emergency Surgical Services	60 + 20 + 20	100
2	EMT 26	Paper 2	Clinical Procedures And Instruments In Emergency Services Part 1 (observation and assisting)	60 + 20 + 20	100
3	EMT 27	Paper 3	Clinical Procedures And Instruments In Emergency Services Part 2(Observation And Assisting)	60 + 20 + 20	100
4	ELS05	Paper 4	Elective Subject (Hospital Administration/ Disaster Management)	80 + 20	100
Grand Total					400

Sr. No.	Practical	Subjects	Practical + IA	Total
5	EMT 28	Emergency Surgery & Emergency Surgical Services	80 + 20	100
6	EMT 29	Clinical Procedures And Instruments In Emergency Services Part 1 (Observation And Assisting)	80 + 20	100
7	EMT 30	Clinical Procedures And Instruments In Emergency Services Part 2(Observation And Assisting)	80 + 20	100
Grand Total				300

FIFTH SEMESTER

PAPER 1 : EMT25

EMERGENCY SURGERY & EMERGENCY SURGICAL SERVICES

OBJECTIVES

The student should gain knowledge and recognition of major abdominal illness and trauma, ask for relevant investigations, so as to avoid any delay in resuscitation.

1. PRINCIPLES OF ANAESTHESIA

General Anaesthesia

Local Anaesthesia

Regional Anaesthesia

2. WOUNDS AND SUTURING

Types of common wounds

Treatment

Cleansing the wound

Wound healing

Principles of incision and closure (including suturing)

3. BURNS

Skin Anatomy

Classification of Burn

Special Burn considerations

FOREIGN BODY OBSTRUCTION

4. GASTROINTESTINAL SYSTEM

Acute Appendicitis

Acute Pancreatitis

Intestinal obstruction

Upper GI Bleed

Lower GI Bleed

Duodenal and gastric ulcer

Renal colic

5. TRAUMA

* Head injury

Thoracic injuries

Blunt trauma, Penetrating trauma

6. TORSION

TESTIS

PRACTICALS

Assisting in various procedures like:

o Central Venous

Access o Suturing of

Wounds o

Tracheostomy

- o Intercostal Drainage
 - o Needle Thoracocentesis
 - o Cricothyroidectomy
- Skills of intubation in a Maniquenin

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1 – EMT28
EMERGENCY SURGERY & EMERGENCY SURGICAL SERVICES

Practical Examination-Semester vI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
CASE SENERIO: TRAUMA, ACUTE ABDOMEN,BURNS, GI BLEED	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
BASICS OF TYPES OF ANAESTHESIA AND COMPLICATIONS: General Anaesthesia, Spinal Anaesthesia, Epidural Anaesthesia, Regional Anaesthesia, Local Anaesthesia		4 x 10	40 Marks

Practical 80 Marks
 I A Marks 20Marks
Grand Total 100 Marks

Recommended Books:

1. TEXTBOOK OF ANAESTHESIA BY MILLERS
2. The ICU book ,Paul Marino
- 2.ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
- 2.Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham
3. mechanical ventilation by David Chang

Online Reference

- 1.lifeinthefastlane.com
- 2.criticalcarereviews.com

PAPER 2: EMT26

Theory 30 Hours

CLINICAL PROCEDURES AND INSTRUMENTS IN EMERGENCY SERVICES PART 1 (observation and assisting)

CLINICAL PROCEDURES AND INSTRUMENTS EMERGENCY SERVICES COURSE DESCRIPTION

This course is designed to help the students to develop an understanding of the philosophy, objectives, theories and process of accident and emergency care technology in various Supervised Clinical settings. It is aimed at helping the students to acquire knowledge, understanding and skills in techniques of practice them in Supervised Clinical settings

1. INSTRUMENTATION IN EMERGENCY SERVICES

Introduction to Biomedical engineering (Man – machine relationship)

ECG

DC Defibrillator

Intravenous pumps

Laryngoscope, ambubag, suction machine

SPO2 monitoring, Temperature monitoring

BP apparatus, BP monitoring NIBP,

IBP

Ventilators Intensive

care, portable

Manual resuscitator

Radiology equipment & radiation hazards

Suction machine

Nebuliser

Medical gases

Ambulance and its power supply

Dialysis machine

Infant warmer & incubator

1. CLINICAL PROCEDURES IN EMERGENCY ROOM

Vital Sign Measurement:

- o Pulse assessment

- o Respiratory assessment

- o Temperature assessment

- o Blood pressure assessment

SP02

Pain score (VAS)

Respiratory procedures:

- p Endotracheal intubation and extubation

- o Drugs through ET tube

- o Tracheostomy insertion and management

- o Suctioning an artificial airway:

- o Naso-tracheal suctioning

- o Insertion of nasopharyngeal and oropharyngeal airway

- o Mechanical ventilation

- o Intercostal drain

- o age

- o Thoracocentesis

Intermediate Airways

- o Laryngeal Mask Airway

- o Esophageal – Tracheal Combitube

Non-invasive Assessment and Support of Oxygenation and

Ventilation o Pulse oximetry

- o Carbon dioxide Monitoring >

Capnometry o Oxygen therapy

- o Delivery systems for Inhaled Medication

- Nebulizers

- Metered Dose Inhaler

Cardiovascular procedures (Observation)

- o Cardiac Monitoring

- o Central venous pressure monitoring

- o Insertion of Arterial line:

- o Central venous cannulation

- o Transcutaneous cardiac

pacing

- o Transvenous cardiac

pacing

- o Pericardiocentesis

- o Cardioversion

- o Defibrillation
- Cannulating Umbilical Vein
- o Indication
- o Procedure
- o Drugs through umbilical vein
- o Complication
- Intraosseous Infusion
- o Indication
- o Procedure
- o Drugs through intraosseous line
- o Complication
- Gastrointestinal procedures
- Insertion of nasogastric tube
- Insertion of enteral feeding tube and initiation of feedings. Gastric lavage
- Upper gastrointestinal endoscopy
- Insertion of rectal tube
- Paracentesis
- Peritoneal lavage
- Poison decontamination
- p Activated charcoal
- o Whole bowel irrigation
- Genitourinary procedures
- p Urethral catheterization
- o Peritoneal dialysis
- o Placement and Management of external Arteriovenous shunt (Assiting).
- o Continuous Arteriovenous hemofiltration (Assiting)
- Intravenous Therapy
- p Insertion of intravenous catheter
- o Administration of parenteral nutrition
- o Blood and Blood product administration
- Neurologic Procedures
- Lumbar Puncture (Observation/Assiting)

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 2 – EMT29
CLINICAL PROCEDURES AND INSTRUMENTS IN EMERGENCY SERVICES
PART 1 (observation and assisting)**

Practical Examination-Semester VI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
LMA, AMBUBAG , LARYNGOSCOPE BOUGIE, STYLET Combitube ET intubation Capnography Pulse oximeter Chest Xray OXYGEN THERAPY DEVICES	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
MEASUREMENT OF BLOOD PRESSURE, INVASIVE AND NON INVASIVE, VITALS MEASUREMENT, OXYGEN THERAPY DEVICES, Spotters Thermometer BP apparatus Stethoscope Glucometer Intraosseous infusion Nebuliser		4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
2. ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham
3. mechanical ventilation by David Chang

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

**PAPER 3 -EMT 27
CLINICAL PROCEDURES AND INSTRUMENTS IN EMERGENCY SERVICES
PART 2(observation and assisting)**

Cardiovascular procedures

- o Cardiac Monitoring
- o Central venous pressure monitoring
- o Insertion of Arterial line:
- o Central venous cannulation
- o Transcutaneous cardiac pacing
- o Transvenous cardiac pacing
- o Pericardiocentesis
- o Cardioversion
- o Defibrillation
- Cannulating Umbilical Vein
- o Indication
- o Procedure
- o Drugs through umbilical vein
- o Complication

Intraosseous Infusion

o Indication

o Procedure

o Drugs through intraosseous line

o Complication

Gastrointestinal procedures

Insertion of nasogastric tube

Insertion of enteral feeding tube and initiation of feedings. Gastric lavage

Upper gastrointestinal

endoscopy Insertion of rectal

tube Paracentesis

Peritoneal lavage

Poison decontamination

p Activated charcoal

o Whole bowel irrigation

Genitourinary procedures

p Urethral catheterization

o Peritoneal dialysis

o Placement and Management of external Arteriovenous shunt (Assiting).

o Continuous Arteriovenous hemofiltration (Assiting)

Intravenous Therapy

p Insertion of intravenous catheter

o Administration of parenteral nutrition

o Blood and Blood product administration

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 3 – EMT30
CLINICAL PROCEDURES AND INSTRUMENTS IN EMERGENCY SERVICES
PART 2(observation and assisting)

Practical Examination-Semester vI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Insertion of Arterial line: Central venous cannulation Transcutaneous cardiac pacing. Pericardiocentesis o Cardioversion o Defibrillation	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Urethral catheterization o Peritoneal dialysis o Placement and Management of external Arteriovenous shunt (Assiting). o Continuous Arteriovenous hemofiltration (Assiting)		4 x 10	40 Marks

Practical 80 Marks
 I A Marks 20Marks
Grand Total 100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
- 2.ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe’s intensive care medicine
- 2.Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham
3. mechanical ventilation by David Chang

Online Reference

1.lifeinthefastlane.com

2.criticalcarereviews.com

Disaster & Emergency Management**A. Introduction to Disaster management**

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management**C. Modern disaster management – disaster cycle****D. Hazards**

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
-stages

-Basic elements

ELS05

30 Hours

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EMT31	Emergency Medicine Technology - Advanced	02			02
2	EMT32	CSSD Procedures	02			02
3	EMT33	Procedural Skills In Emergency Care	02			02
5	ELS06	Elective Subject : Fundamentals of Electricity and Electronics / Biomedical Engineering	02			02
6	EMT34	Emergency Medicine Technology - Advanced		02	02	04
7	EMT35	CSSD Procedures		02	02	04
8	EMT36	Procedural Skills In Emergency Care		02	02	04
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER

S. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	EMT 31	Paper 1	Emergency Medicine Technology - Advanced	60 + 20 + 20	100
2	EMT 32	Paper 2	CSSD Procedures	60 + 20 + 20	100
3	EMT 33	Paper 3	Procedural Skills In Emergency Care	60 + 20 + 20	100
4	ELS06	Paper 4	Elective Subject : Fundamentals of Electricity and Electronics // Biomedical Engineering	80 + 20	100
Grand Total					400

Sr. No.	Practical	Subjects	Practical + IA	Total
5	EMT 34	Emergency Medicine Technology - Advanced	80 + 20	100
6	EMT 35	CSSD Procedures	80 + 20	100
7	EMT 36	Procedural Skills In Emergency Care	80 + 20	100
Grand Total				300

PAPER I – EMT 31**Theory 30 Hours****EMERGENCY MEDICINE TECHNOLOGY - ADVANCED****CONCEPTS IN ADVANCED LIFE SUPPORT**

- Drugs
- Defibrillator

PROLONGED LIFE SUPPORT

- Concept of the "ICU" and team work

10. CARE OF THE UNCONSCIOUS PATIENT

- Comfort, orientation, pain control
- Skin integrity assessment and care
- Physiotherapy - Chest & Limbs
- Nutritional needs and supply , Various routes of administration
- Basic care of surgical wounds and fractures
- Psychological assessment and support in an ICU.

Theory Total- 100 Marks**Duration: 3 Hour**

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

PRACTICAL 1 – EMT34**EMERGENCY MEDICINE TECHNOLOGY - ADVANCED****Practical Examination-Semester vI****Major Practical**

Topics	No. Of Questions	Number of Question and Marks	Total
ACLS Defibrillation	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
BEDSORE ASSESSMENT AND PREVENTION, PREVENTION OF ASPIRATION IN UNCONSCIOUS		4 x 10	40 Marks

PATIENT, NUTRITIONAL ASSESMENT AND SUPPORT			
--	--	--	--

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
- 2.ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
- 2.Textbook of Critical Care ,Jean Louis Vincent , Edward Abraham

Online Reference

- 1.lifeinthefastlane.com
- 2.criticalcarereviews.com

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

**PAPER 2: EMT32
CSSD PROCEDURES**

Theory : 30 Hours

1. Waste disposal collection of used items from user area, reception protective clothing and disinfections sage gaurds,
2. use of disinfections sorting and classification of equipment for clean-ing purposes, sharps, blunt lighted etc. contaminated high risk baby care - delicate instruments or hot care instruments,
3. cleaning process - use of detergents. Mechanical cleaning apparatus, cleaning instruments, cleaning jars, receivers bowls etc. trays, basins and similar hand ware utensils. Cleaning of catheters and tubings, cleaning glass ware, cleaning syringes and needles.
4. Materials used for wrapping and packing assembling pack contents. Types of packs prepared. Inclusion of trays ahd galliparts in packs. Method of wrapping and making use of indications to show that a pack of container has been through a sterilization process date stamping.
5. General observations principles of sterlization. Moist heat sterlization. Dry heat sterlization. EO0gas sterlization. H202 gas plasma vapo sterlization.

13. EQUIPMENT MAINTEN0NCE & BASIC TROUBLESHOOTING:

Ventilators, CPAP, BiPAP machines

Pumps - Infusion, Syringe

Monitors - Standalone & multiparameter

ECG Machine

ABG Machine

Defibrillator

USG Machine

14. MEDICAL ETHICS

1. Medical ethics - Definition - Goal - Scope
2. Code of conduct - Introduction –
3. Basic principles of medical ethics – Confidentiality
4. Malpractice and negligence - Rational and irrational drug therapy
5. Autonomy and informed consent - Right of patients
6. Care of the terminally ill- Euthanasia
8. Organ transplantation
9. Medico legal aspects of medical records -

**SCHEME OF EXAMINATION –
SemesterIV**

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	5X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 2 – EMT35
CSSD PROCEDURES**

Practical Examination-Semester III

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
CLEANING AND DECONTAMINATION OF INSTRUMENTS AFTER PROCEDURE,PROCEDURETRAY PREPARATION	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
TYPES OF STERLIZATION: MOIST HEAT STERLIZATION, DRY HEAT STERLIZATION, ETHYLINE OXIDE STERLIZATION	4	4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
- 2.ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi
3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham

Online Reference

1. lifeinthefastlane.com
2. criticalcarereviews.com

**PAPER 3: EMT33
PROCEDURAL SKILLS IN EMERGENCY CARE**

Theory : 30 Hours

EMERGENCY LIFE SUPPORT:

Basic Life Support - Keeping Airway open, Use of Ambu bag and mask ventilation,
Advanced Cardiac Life Support

Use of Defibrillator

Emergency Management of Trauma

Assisting in Endotracheal Intubation

a. Placement of trans oesophageal devices.

NG tubes, enteral feeding tubes, Sengstaken-Blackmore tube

b. Maintenance of urinary catheters

c. Placement of hemodialysis catheters

d. Management peritoneal dialysis

e. Management CVVHD

f. bed side screening ultrasonography

NERVOUS SYSTEM:

Assisting in:

Lumbar puncture

Application of intracranial pressure monitoring device

Application of in-line immobilisation (C spine protection)

Cervical neck collar.

TOXICOLOGY:

Gastric lavage

ANALGESIA and SEDATION

Care of Epidural

Patient Controlled Analgesia

HAEMATOLOGICAL DISORDERS:

Assisting in:

Exchange Transfusion

Plasmapheresis

ULTRASOUND AND RADIOLOGY IN EMERGENCY CARE

1. USG physics

2. Basic cardiac ultrasound and ECHO views

3. Basic lung ultrasound

4. Basic abdominal ultrasound

5. Echocardiographic assessment of a patient in shock

6. Ultrasound for vascular access

7. Reading xrays and CT with clinical correlation

:

SCHEME OF EXAM FOR THEORY

Theory Total- 100 Marks

Duration: 3 Hour

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Theory Total	Viva	Internal Assessment	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	60	20	20	100
2	Short Essay Question	6	5	6X5	25				
3.	Short Answers	5	5	5 x 3	15				

**PRACTICAL 3 – EMT36
PROCEDURAL SKILLS IN EMERGENCY CARE**

Practical Examination-Semester vI

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
ACLS Defibrillation, Central Venous Catheterization, Hemodialysis Catheterization	2	2 x 20	40 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Lumbar puncture, Gastric Lavage, USG Probes and its uses	4	4 x 10	40 Marks

Practical	80 Marks
I A Marks	20Marks
Grand Total	100 Marks

Recommended Books:

1. The ICU book ,Paul Marino
2. ICU Protocols A Stepwise approach ,Rajesh Chawla and Subash Todi

3. Washington manual of critical care

Reference books:

1. Irwin and Rippe's intensive care medicine
2. Textbook of Critical Care, Jean Louis Vincent, Edward Abraham
3. mechanical ventilation by David Chang

Online Reference

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2. criticalcarereviews.com

ELS06

Fundamentals of Electricity and Electronics:

Resistance: Symbol, units, colour coding equivalent resistance with connection in series and parallel.

Capacitance: Symbol, units, series and parallel connection

Inductance and transformers

Parameters of electricity power - voltage, current frequency, power.

Differences between AC and DC - .

AC and DC power supplies, Phase, neutral and earth - conventional colour coding

Ohms law and Kirchoff's law Electrical Circuits.

Earth and grounding - Symbol, importance in patient care.

AC and DC power supplies- Phase, neutral and earth - conventional colour coding

Classification of medical equipment

1. According to type of protection: B C F etc
2. According to mode of protection: Class I -III.

ELS06

Basics of Biomedical Engineering

Topics

- Insulators and conductors
- Units of measurements
- Electrical power transmission
- Resistors, capacitors and inductors
- Regulated power supply
- Voltage stabilizers
- Uninterrupted power supply systems
- Amplifiers – AC and DC
- Differential amplifiers
- Input impedance
- Output impedance
- Gain and amplification
- Noise
- Common Mode Rejection Ratio (CMRR)
- Filters - Principles
 - High frequency filters
 - Low frequency filters
 - Band Pass filters
- Analog to digital converter (ADC) and Digital Analog converter (DAC)
- Sensitivity & Gain

Averaging principles

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in all the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.

- For appearing for semester V he /she should have cleared semester III and can appear for papers pending from semester IV along with semester V subjects.
- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass
 - a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
 - b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
 - c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
 - d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA):**

SGPA= Credits X grade points/ Total Credits

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the first year subjects shall have Postgraduate degree in the respective subject with 3 years of teaching experience or M.Sc. (Medical) with 5 years teaching experience.

Ordinance Governing B.Sc. Endoscopy Technology Degree Course (Semester System) Syllabus/Curriculum 2023 - 24



Accredited 'A+' Grade by NAAC (3rd Cycle)
Placed in 'A' Category by Government of India (MHRD)

KLE Academy of Higher Education & Research (Deemed-to-be-University)

Declared as Deemed-to-be-University u/s 3 of the UGC Act, 1956 vide Government of India
Notification No. F.9 -19/2000-U.3 (A)]

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VISION

To be an outstanding KAHER of excellence ever in pursuit of newer horizons to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge, through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry/organization, interaction/collaborations with regional/national/international bodies.
- To establish healthy systems for communication among all stakeholders for vision oriented growth.
- To fulfill the national obligation through rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovation in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities.
- To enhance reading and learning capabilities among faculty and students and inculcate sense of life long learning.
- To promulgate process for effective, continuous, objective oriented student performance evaluation.
- To ordinate periodic performance evaluation of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs.
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social, and community demands.
- To promote public-private partnership.



INSIGNIA

The Emblem of the **KAHER** is a Philosophical statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "KAHER of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the palm of the teacher- the hand that acts, promises & guides the students to reach for the SevenStars...

The Seven Stars signify the 'Saptarishi Dnyanamandal', the Great Bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another significance of the raised palm is our tribute to these great Souls for making this KAHER a possibility.

Empowering Professionals...

'Empowering Professionals', inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

Notification

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B.Sc. ENDOSCOPY TECHNOLOGY

PREAMBLE

The B.Sc. Endoscopy Technology Course is of **3 years (Semester) and 1 Year internship** degree course aimed at training the young graduates in the technological aspects of endoscopy care with good scientific foundation. These students will be in a position to competently carry out and will also be trained in assisting during endoscopy procedure. They will be in demand both within the country and outside as Allied Healthcare personnel. With advanced training in the endoscopy procedure like Capsule Endoscopy, EUS, ERCP, SEMS, other procedure- Hydrogen Breath Test, Manometry. These graduates will play an important role in determining the quality of healthcare provided.

TITLE OF THE COURSE

Bachelor of Science in Endoscopy Technology (B.Sc. Endoscopy Technology)

I. ELIGIBILITY FOR ADMISSION

A candidate seeking admission to the Bachelor of Science – Endoscopy Technology Course shall have passed:

- 1) The two year Pre-University examination or equivalent as recognized by KAHER with Physics, Chemistry and Biology as principal subjects of study.

OR

- 2) Those who have completed GNM Course (3 years or 3 year six months course).

OR

- 3) Those who has completed diploma in endoscopy technology course from a recognized university.

II.DURATION OF COURSE

The duration of the Course shall be for period of three years and one year compulsory rotatory internship.

III.MEDIUM OF INSTRUCTION

The medium of instruction and examination shall be English.

IV.SCHEME OF EXAMINATION

There shall be six examinations during the course, each at the end of the first, second, third, fourth, fifth and sixth semester.

YEARLY INTAKE: 5 students per year

V.ATTENDANCE

Every candidate shall attend at least 80% of the total number of classes conducted in a calendar year from date of commencement of the term to the last working day as notified by the University in each of the subjects prescribed for that year separately in Theory and Practical. Only such candidates are eligible to appear for the University examinations in their first attempt. Special classes conducted for any purpose shall not be considered for the calculation of percentage of attendance for eligibility. A Candidate lacking in prescribed percentage of attendance in any one or more subjects either in Theory or Practical in the first appearance will not be eligible to appear the University Examination either in one or more subjects. Failed candidates should have attended at least 80% of the total number of classes conducted in that term in individual subjects separately in Theory and Practical to become eligible to appear for the University Examination in that subject in the supplementary or subsequent Examination. However, this is not applicable in case of carryover subjects.

Course Structure

S. NO	Year	Theory	Marks (Theory + IA + Viva)	Practical	Marks (Practical + IA)
First Year					
1.	1st Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Pathology : Basic Hematology	30 + 10 + 10	Pathology : Basic Hematology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
2.	2nd Semester	Human Anatomy	60 + 20 + 20	Human Anatomy	80 + 20
		Human Physiology	30 + 10 + 10	Human Physiology	40 + 10
		Basics of Biochemistry	30 + 10 + 10	Basics of Biochemistry	40 + 10
		Haematology & Clinical Pathology	30 + 10 + 10	Haematology & Clinical Pathology	40 + 10
		Microbiology	30 + 10 + 10	Microbiology	40 + 10
Second Year					
3.	3rd Semester	Basic of Gastroenterology (Symptomatology)	60 + 20 + 20	Applied Aspects of Pathology	120+30
		Applied Aspects of pathology	60 + 20 + 20	Applied Aspects of Microbiology	120+30
		Applied Aspects of Microbiology	60 + 20 + 20		
4.	4th Semester	Concept in Gastroenterology diseases (Luminal – Esophagus, stomach, small & Large intestine)	60 + 20 + 20	Applied Technology in Pharmacology	120+30
		Pharmacology related to Endoscopy	60 + 20 + 20	Applied Technology in Endoscopy	120+30
		Basics in Endoscopy Technology (Introduction to endoscope, indication, how to use, cleaning, storage.)	60 + 20 + 20		

Third Year					
5.	5th Semester	Concept of Gastroenterology diseases (Hepato - Pancreatico- Billiary tract disease)	60 + 20 + 20	Applied Technology in UGI Scopy	120+30
		Applied Endoscopy Technology 1 (UGI Scopy)	60 + 20 + 20	Applied Technology in LGI Scopy	120+30
		Applied Endoscopy Technology 2 (LGI Scopy)	60 + 20 + 20		
6.	6th Semester	Applied Endoscopy (Advanced Endoscopy)	60 + 20 + 20	Applied Technology -I	160+40
		Applied GI Physiology	60 + 20 + 20	Applied GI Physiology	160+40
One Year Compulsory Rotatory Internship					

List of Electives

Sl .No	Semester	Name of the Subject	Marks
1	First Semester	Choice Based (Any one Subject)	80+20=100
		1. English	
		2. Kannada	
2	Second Semester	Choice Based (Any one Subject)	80+20=100
		1. Computer Science	
		2. NSS	
3	Third Semester	Choice Based (Any one Subject)	80+20=100
		1. Communication Skill	
		2. Fundamentals of Data Processing and Analysis-Basic Statistics	
4	Fourth Semester	Choice Based (Any one Subject)	80+20=100
		1. Research Methodology & Bioethics	
		2. Fundamentals of Health Education & Communication	
5	Fifth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Hospital Administration	
		2. Disaster Management	
6	Sixth Semester	Choice Based (Any one Subject)	80+20=100
		1. Basics of Biomedical Engineering	
		2. Fundamentals of Electricity and Electronics	

(Compulsory) Subjects

Sl .No	Semester	Name of the Subject	Marks
1.	Third Semester	1. Environmental Studies	80+20=100
2.	Fourth Semester	2. Law - Indian Constitution	80+20=100

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA)**:

$$\text{SGPA} = \frac{\text{Credits} \times \text{grade points}}{\text{Total Credits}}$$

1. **Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA /No. of Semester**

FIRST SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	EDT01	Human Anatomy	02		02
2	EDT02(A)	Human Physiology	02		02
	EDT02(B)	Basics of Biochemistry	02		02
3	EDT03(A)	Pathology : Basic Hematology	02		02
	EDT03(B)	Microbiology	02		02
4	ELS01	Elective Subject: English / Spoken Kannada	02		02
5	EDT04	Human Anatomy		02	02
6	EDT05 (A)	Human Physiology		02	02
	EDT05(B)	Basics of Biochemistry		02	02
7	EDT06(A)	Pathology : Basic Hematology		02	02
	EDT06(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit					

FIRST SEMESTER
Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	EDT01	Paper 1	Human Anatomy	60 + 20 + 20	100
2	EDT02	Paper 2 Section A	Human Physiology	30 + 10 + 10	50
		Section B	Basics of Biochemistry	30 + 10 + 10	50
3	EDT03	Paper 3 Section A	Pathology: Basic Hematology	30 + 10 + 10	50
		Section B	Microbiology	30 + 10 + 10	50
4	ELS01	Paper 4	<u>Elective Subject:</u> English / Spoken Kannada	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	EDT04	Practical 1	Human Anatomy	80 + 20	100
6	EDT05	Practical 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	EDT06	Practical 3A	Pathology : Basic Hematology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester I

PAPER 1: EDT01 Human Anatomy

Theory 30 Hours

The Human body as a whole:

Definitions, subdivisions of Anatomy, Terms of location and position, Fundamental Planes, Vertebrate structure of man, Organization of the Body cells and Tissues

Locomotion and support:

The Skeletal system: Types of bones, structure and growth of bones, Divisions of the skeleton, Appendicular skeleton, Axial skeleton, names of all the bones and their parts, joints - classification, types of movements with examples.

Anatomy of the Nervous System:

Central nervous system: Brain and Spinal cord, functions, meninges.

The Brain- Brief structure of Hind Brain, Midbrain and Forebrain, Location, gross features, parts, functional areas, cerebral blood circulation and coverings, Functions of peripheral nervous system, Organization and Structure of Typical Spinal Nerve, Spinal Cord: Gross features, extent, blood supply and coverings, spinal reflex- arc. Applied Anatomy of spinal cord Applied Anatomy of brain

Anatomy of circulatory system:

Heart: Size, location, coverings, chambers, pericardium and valves, Blood supply and Nerve supply.

External features, Interior of chambers of heart, structural features inflow and outflow characteristics.

The study of blood vessels, General plan of circulation, pulmonary and systemic circulation Names of arteries and veins and their positions, general plan of lymphatic system.

Coronary Circulation, Venous drainage Lymphatic drainage of heart in brief Applied aspects of heart and pericardium

Anatomy of the Respiratory system:

Organization of Respiratory System, Gross structure and interior of Nose, Nasal cavity, Para nasal air sinuses,

Gross structure and interior of Pharynx, Larynx, trachea, bronchial tree, Pleura

Gross structure and Histology of Lungs, Pulmonary Circulation, Bronchopulmonary segments.

Nerve Supply of Respiratory System and Applied aspects of Respiratory System

General Histology:

Epithelial, Types of connective tissue, types & Histology of Cartilage, Microscopic structure of bones, types & Microscopic structure of blood vessels, Histology of Lymphoid Organs, Type & Microscopic structure of muscles, Histology of peripheral nerve.

**Type of questions and distribution of marks for Theory examination in each subject
in First Semester for Subject Codes: EDT01**

Sr. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5X5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: EDT04
Human Anatomy –

Practical 30 Hours

1. **General Histology Slides:**

- ❖ Epithelial Tissue,
- ❖ Connective tissue
- ❖ Hyaline Cartilage,
- ❖ Fibro Cartilage,
- ❖ Elastic Cartilage,
- ❖ T.S. & L.S. of Bone,
- ❖ Blood Vessels,
- ❖ Tonsil,
- ❖ Spleen,
- ❖ Thymus,
- ❖ Lymph node,
- ❖ Skeletal and Cardiac Muscle
- ❖ Peripheral Nerve and Optic Nerve

2. **Systemic Histology Slides:**

- ❖ RS -Lungs and Trachea
- ❖ Cerebrum

3. Demonstration of all bones – Showing parts, joints.

4. X-rays of all normal bones and joints.

5. Demonstration of heart and normal angiograms.

6. Demonstration of different parts of Brain & Spinal Cord

7. Demonstration of different parts of respiratory system and normal X-rays

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code EDT04:

Sr. no	Practical	Practical	IA	Grand Total
1	Practical - 1	80	20	100

Scheme of Exam for Practicals:

Practicals**Histology**

Spotters- 10 X 2marks =20 marks

Gross Anatomy

Discussion- 2 X 20 marks =40 marks

Spotters- 10 X 2marks =20 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Hand Book of General Anatomy	B.D.Chaurasia	C.B.S.Publishers, New Delhi
3. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
4. Practical manual of Histology for Medical students	NeelkanthKote	Jaypee Brothers, Medical Publishers, Delhi
5. Gray's Anatomy	Susan Standring	Elsevier Churchill Livingstone, Edinburg
6. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER I

PAPER 2: EDT02

Theory: 30 Hours

Section A- Human Physiology

GENERAL PHYSIOLOGY

Structure & Functions of Cell, Cell membrane and Cell Organelles, Intercellular junctions

Classification of Body fluid compartments & composition, Homeostasis

Transport across cell membrane —Active transport, Passive transport & Vesicular transport

NERVE MUSCLE PHYSIOLOGY

Definition of Resting Membrane Potential & Action Potential - Phases & ionic basis

Neuron and Neuroglia

Classification and Properties of Nerve fibers

Classification of Muscles

Structure and Properties of Skeletal Muscle, Molecular mechanism of skeletal muscle contraction

Neuromuscular Junction - Definition, Structure and Mechanism of neuromuscular transmission, Myasthenia gravis.

Excitation-contraction coupling of skeletal muscles.

BLOOD

Composition and functions of blood

Plasma proteins: types & functions

Red Blood Cells: Morphology & functions, Erythropoiesis

Hemoglobin: structure, types, functions & fate of Hb

Definition and Classification of Anaemia & Jaundice

White blood cells: Morphology, functions & variations, Leucopoiesis, Immunity – definition and classification

Platelets and Blood Coagulation: Morphology & functions of platelets, Mechanism of Haemostasis, Anticoagulants, Bleeding disorders

Blood Groups: Classification of Blood Groups, ABO and Rh blood group systems, uses of blood grouping test and cross-matching, Blood Transfusion and its hazards

CENTRAL NERVOUS SYSTEM

Organization of CNS-

Introduction to Nervous System

Functional organization of CNS, Structure of Spinal Cord

Autonomic Nervous System - Divisions & their Functions

Synapse- Definition, Classification, Structure and Properties of synapse, Mechanism of Synaptic transmission

Receptor- Definition, Types & Properties in brief

Reflex- Definition & Classification, Reflex arc

Sensory system-

Overview of sensory system, Ascending tracts – Anterior Column, Lateral Column and Posterior Column Tract – Course, termination and functions, Referred pain

Motor system-

Overview of motor system, Pyramidal tract– Course, termination and functions, Extra-pyramidal tracts & their functions, Upper & Lower Motor Neuron lesions, Lumbar Puncture.

Cerebrum, Cerebellum, Basal ganglia, Thalamus, Hypothalamus, Limbic system & Vestibular Apparatus- Functions

Temperature Regulation-

Normal temperature of body, Regulation of body temperature & Fever

Sleep- REM & NREM

CSF: composition, formation, circulation & functions

Blood brain barrier

SPECIAL SENSES

Vision

Structure of Eye, Structure & Functions of rods and cones, Visual pathway, Visual acuity Refractive errors of eye & correction, Color vision, Light reflex, Accommodation

Hearing

Structure and functions of external ear, middle and inner ear, Mechanism of hearing, Deafness & its types

Taste: Taste buds, pathway and primary taste sensations

Olfaction: olfactory receptors and pathway

PRACTICAL 2A - EDT05

Practical: 30 Hours

Section 2A: Physiology

- Study of Microscope and its use
- Collection of Blood and study of Haemocytometer
- Haemoglobinometry

- White Blood Cell count
- Red Blood Cell count
- Determination of Blood Groups
- Leishman's staining and Differential WBC Count
- Determination of Bleeding Time
- Determination of Clotting
- Tests for Visual acuity, Colour vision & Hearing

Practical Total 50 Marks

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total - 50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva 10	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

Biochemistry

PAPER 2: EDT02

Theory 30 Hours

Section B: Basics of Biochemistry

1. Introduction to Medical lab Technology:

(a) Role of Medical lab Technologist (b) Ethics, Responsibility (c) Safety measures (d) First aid. (e) Cleaning and care of general laboratory glass ware and equipment.

2. Introduction to Apparatus- Chemical Balance: Different types, Principles and applications.

3. Units of Measurements: Concepts of Molecular weight, Atomic weight, Normality, Molarity, Standards, Atomic structure, Valence, Acids, Bases, Salts & indicators

4. Concepts of pH: Concepts of Acid Base reaction and hydrogen ion concentration. Definition of pH and buffer

5. Introduction to Nutrition and balanced diet

6. Chemistry of Carbohydrates:

a. Definition, Classification and biological importance.

b. Monosaccharides, Oligosaccharides, Disaccharides & Polysaccharides:

7. Chemistry of Lipids:

a. Definition, Classification and biological importance.

b. Simple lipids: Triacylglycerol and waxes-composition and functions.

c. Compound lipids : Phospholipids, Sphingolipids, Glycolipid and Lipoproteins : Composition and functions.

d. Derived lipids: Fatty acids — saturated & unsaturated. Steroids and their properties.

8. Chemistry of Proteins:

a. Amino acids: Classification, properties, side chains of amino acids.

b. Protein: Definitions, Classifications and functions.

c. Peptides: Biologically active peptides

d. Overview of Structural organization of proteins.

e. Denaturation of proteins and denaturing agents

9. Plasma Proteins: Definitions, Classifications and functions

10. Chemistry of Nucleic acids:

a) Nucleosides, Nucleotides and their functions

b) DNA Structure and function

c) RNA: Types, Structure (only t RNA) and Functions.

11. Minerals-RDA, sources, biochemical functions, deficiency manifestations and toxicity of Calcium, Phosphorus, Iron, copper, zinc, selenium and fluoride

PRACTICAL 2B: EDT05
Section B: Biochemistry

Practical 30 Hours

1. Introduction to apparatus, Instruments and use of Chemical Balance.
2. Maintenance of Laboratory Glassware and apparatus.
- 3. Different grades of water**
4. Reactions of Carbohydrates (Glucose, fructose, maltose, lactose, sucrose and starch)
5. Reactions Proteins (Albumin and Casein)
6. Colour reactions of Proteins
7. Identification of Unknown Carbohydrates and proteins
- 8. Introduction to Colorimeter**
- 9. Visit to BSRC and to Hitech laboratory**

SCHEME OF EXAMINATION-

Theory

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	5	3	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester I

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Qualitative Analysis: Identification of Unknown Carbohydrate or protein	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Color reactions of proteins (any one)	1	1 x 20	20 Marks

Practical Marks	40 Marks
IA Marks:	10 Marks
Grand Total	50 Marks

Suggested Readings:

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

Semester I

PAPER 3 - EDT03

Theory 30 Hours

Section A – Pathology: Basic Hematology

Basic Haematology

- Introduction to Hematology: (a) Definition (b) Importance (c) Important equipment used.
- Laboratory organization and safety measures in haematology Laboratory
- Introduction to blood, its composition, function and normal cellular components.
- Collection and preservation of blood sample for various haematological investigations.
- Normal Values in Hematology
- Preparation of blood Films- Types. Methods of preparation (Thick and thin smear/film)
- Definition, principles & procedure, Normal values, Clinical significance, errors involved, means to minimize errors for the following:
 1. Hemoglobinometry : Sahli's method & Cyanmethhaemoglobin method
 2. RBC Count
 3. PCV
 4. Red Cell Indices
 5. Total leucocytes count (TLC)
 6. Differential leucocytes count (DLC)
 7. Absolute Eosinophil count
 8. Reticulocyte count
 9. Platelet Count.
 10. Erythrocyte Sedimentation Rate (ESR)
 11. Blood Grouping : Basics, Landsteiner's law , Procedures
- Staining techniques in Haematology (Romanowsky's stains) :Principle, composition, preparation of staining reagents and procedure of the following
 1. Giemsa stain
 2. Leishman stain
 3. Wright's stain
 4. Field's stain

Scheme of Examination

Type of questions and distribution of marks for Theory examination in each subject in First Semester.

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			

3.	Short Answers	5	5	5 x 2	10			
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Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad

Practical 3A: EDT06 Section A – Haematology

Practical 30 Hours

Basic Haematology

1. Hb Estimation-Sahli's method & Cyanmethaemoglobin method
2. RBC Count
3. PCV
4. Blood Indices
5. Preparation of blood smears and staining with Leishman stain
6. WBC Total Count
7. WBC -Differential Count
8. Platelet Count
9. Reticulocyte Count
10. Absolute Eosinophil Count
11. ESR- Westergreens & Wintrobe's method

Spotters :

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Hb Pipette
4	Sahli's Hemoglobinometer
5	Vacutainers
6	Wintrob's Tube
7	Westergren's Pipette
8	Neubaur's Chamber
9	Platelet diluting fluid
10	Neutrophil
11	Eosinophil
12	Lymphocyte
13	Monocyte
14	Leishman's Stain
15	AEC diluting fluid
16	N/10 HCL
17	RBC diluting fluid
18	WBC diluting fluid
19	Photocalorimeter
20	Drabkin's Reagent

Exam Pattern

I. Major Experiment: Perform any two exercises: 20 Marks

- Hb Estimation- Sahli's method & Cyanmethhaemoglobin method
- RBC Count
- Preparation of blood smears and staining with Leishman stain
- WBC Count
- WBC - Differential count
- Platelet Count
- Absolute Eosinophil Count

II. Minor Experiment: Any one examination 10 Marks

- Reticulocyte Count
- ESR- Westergren's Method
- PCV - Wintrobe's Method

III. Spotters 10 Marks

IV. Internal Assessment: 10 Marks

Total: 50 Marks

Practical Assessment

Scheme of Practical Examination for First Semester.

(Section A Pathology -50 Marks + Section B Microbiology 50 Marks)

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Scheme of Exam for Practicals:

Major Experiment: 20 Marks

Minor Experiment: 10 Marks

Spotters : 10 Marks

Internal Assessment: 10 Marks

Total : 50 Marks

Semester I

PAPER 3- EDT03

Theory 30 Hours

Section B – Microbiology

- **Introduction to Medical Microbiology:** - Definition - History - Host-Microbe relationship.
 - **Microscopy:** - Introduction and history - Types of microscopes
 - (a) Light microscope
 - (b) Dark ground Microscope
 - (c) Fluorescent Microscope
 - (d) Phase contrast Microscope
 - (e) Electron microscope:
- Principles and operational mechanisms of various types of microscopes
- **Classification and Morphology of Bacteria.**
 - **Physiology of Bacteria**
 - **Sterilization:** - Definition -- Types and principle of sterilization methods.
 - (a) Physical methods- (a) Heat (dry heat, moist heat with special Reference to autoclave - their care and maintenance) (b) Radiation (c) Filtration. Efficiency testing to various sterilizers.
 - (b) Chemical methods
 - Antiseptics and disinfectants: Definition, Types and properties - Mode of action - Uses of various disinfectants, Precautions while using the disinfectants - Qualities of a good disinfectant, Testing efficiency of various disinfectants.
 - **Antibiotics and drug resistance**
 - **Bacterial genetics and mechanisms of Bacterial gene transfer.**
 - **Ubiquity of microbes.**

Scheme of Examination for Theory

Type of questions and distribution of marks for Theory examination in each subject in First Semester. Section B - Microbiology - 50 marks

S. No.	Question	Question asked	Question to attempt	Marks	Max. Marks	Internal assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

1. Ananthanarayan and Paniker's Textbook of Microbiology. Tenth Edition. Reba Kanungo

2. Textbook of Microbiology for MLT. Second Edition. Dr. C. P. Baveja.

Practical 3B: EDT06
Section B – Microbiology

Practical 30 Hours

- Focusing, handling and care of Microscopes
- Hanging drop
- Simple stain
- Gram stain
- ZN stain
- Sterilization and Disinfection.

Scheme of Practical Examination for First Semester: Practical Examination for First Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Section A	40 (Major 30 + Minor 10)	10	50
2	Section B	40 (Major 30 + Minor 10)	10	50

Major : 30 Marks

Gram
Stain=15Marks
ZN Stain =15 Marks

Minor : 10 Marks

Spotter =10 Marks

IA : 10 Marks

Total: 50 Marks

Suggested Readings:

- Practical Microbiology, Fourth Edition. C.P Baveja.

ENGLISH

Elective Subject: ELS01

30 hours

COURSE CONTENTS:

Subsidiary subject 60 hours for 1st year marks to be sent to university before IInd year exam. Course description: It is designated to help the students to acquire a good command over English language for common and medical terminology used in medical practice.

Behavioural objectives:

- Ability to speak and write proper English
- Ability to read and understand English
- Ability to understand and practice medical terminology.
- Paragraph
- Letter writing
- Note making
- Description
- The use of paragraphs
- Essay writing
- Telegrams
- Precise-writing and abstracting
- Report writing
- Medical Terminology
- Use of dictionary

Scheme of examination

Theory: 80 Marks Duration: 3 hours

- 1) Fill in the blanks - 10 marks
- 2) Articles (Passage/fill in the blanks) - 10 marks
- 3) Tense (Sentence identification/rewriting a sentence) - 10 marks
- 4) Voice (Rewrite) - 10 marks
- 5) Speech (Rewrite) - 10 marks
- 6) Linkers (Paragraph) - 10 marks
- 7) Paragraph writing - 10 marks
- 8) Letter writing - 10 marks

Text Books Recommended (Latest Edition)

Sl. No.	Name of the Book & Title	Author	Publisher's Name Place of Publication
1.	Sharma Strengthen your writing	V. R. Narayana	New Delhi, Orient Longman
2.	Grammar and composition	Wren and Martin	Delhi, Chand & Co.
3.	Spoken English	Shashikumar V. D'Souza P. V.	New Delhi, Tata Mergaw Hill
4.	Medical dictionary	Dorland's pocket IBH Publishing Co.	New Delhi; Oxford &

KANNADA

Elective Subject: ELS01

30 hours

GOAL:

The students should gain knowledge of local language (Kannada) so as to communicate and reciprocate with local people in general and patients in particular to impart proper patient care during the course of their study and future.

OBJECTIVES:

a) KNOWLEDGE

At the end of the 1st semester course the student is expected to know:

1. The basic of Kannada Language.
2. To communicate and interact in Kannada Language with patients and colleagues.

b) SKILLS

At the end of the 1st semester course the student is expected to:

1. Identify and write small words and sentences.
2. Acquire communicative skills.
3. Be compassionate towards patient in treatment delivery.

COURSE CONTENTS

- 1) Interaction (Small words & sentences)
- 2) Introducing each other
- 3) Enquiring about the College
- 4) Enquiring about Room
- 5) Vegetable market
- 6) About Medical college
- 7) In a Cloth Shop
- 8) Plan for a Picnic
- 9) Enquiring about one's family
- 10) Conversation between Doctor and Patient
- 11) Enquiring about friend's family
- 12) Conversation between friends
- 13) Routine activities of students
- 14) About children's education
- 15) Halebidu and Belur
- 16) Discussion about examination and future plan
- 17) Karnataka : Lesson for reading
- 18) Lesson for reading
- 19) Presentation by students

Scheme of Examination

Institutional Theory Examination at the 1st semester B.Sc. Allied

Reference Books:

Sl.No	Title	Author	Yr. of Publ.	Publisher
1.	Kannada Kali	Lingadevaru Halemane	2002	Kannada University

SECOND SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Total Credits
1	EDT07	Anatomy	02		02
2	EDT08(A)	Physiology	02		02
	EDT08(B)	Biochemistry	02		02
3	EDT09(A)	Hematology & Clinical Pathology	02		02
	EDT09(B)	Microbiology	02		02
4	ELS02	Elective Subject: Computer Science / NSS	02		02
5	EDT10	Human Anatomy		02	02
6	EDT11(A)	Human Physiology		02	02
	EDT11(B)	Basics of Biochemistry		02	02
7	EDT12 (A)	Hematology & Clinical Pathology		02	02
	EDT12(B)	Microbiology		02	02
Grand Total					22
1-hour lecture per week for 15 weeks =1 credit, 2-hour Practical per week for 15 weeks = 1 credit					

SECOND SEMESTER

Scheme of Examination:

Sr. No.	Subject Code	Theory	Subjects	Theory + IA + Viva Voce	Total
1	EDT07	Paper 1	Human Anatomy	60 + 20 + 20	100
2	EDT08	Paper 2 Section 2A	Human Physiology	30 + 10 + 10	50
		Section 2B	Basics of Biochemistry	30 + 10 + 10	50
3	EDT09	Paper 3 Section 3A	Haematology & Clinical Pathology	30 + 10 + 10	50
		Section 3B	Microbiology	30 + 10 + 10	50
4	ELS02	Paper 4	<u>Elective Subject:</u> Computer Science / NSS	80 + 20	100
Grand Total					400

Sr. No.	Subject Code	Practical	Subjects	Practical + IA	Total
5	EDT10	Practical 1	Human Anatomy	80 + 20	100
6	EDT11	Practical 2 2A	Human Physiology	40 + 10	50
		2B	Basics of Biochemistry	40 + 10	50
7	EDT12	Practical 3A	Hematology & Clinical Pathology	40 + 10	50
		3B	Microbiology	40 + 10	50
Grand Total					300

Semester II

PAPER 1 - EDT07 Human Anatomy

Theory 30 Hours

Anatomy of the Digestive System:

Components of Digestive system, Alimentary tube, Anatomy of organs of digestive tube, mouth, tongue, tooth, salivary glands, liver, Biliary apparatus, pancreas. Names and positions and brief functions - with its applied anatomy.

Anatomy of Renal System

Organization of renal system

Kidneys: Location, gross features, relations, structure, blood supply, nerve supply, lymphatic drainage with its applied anatomy.

Ureters and urinary bladder-Location, gross features, structure - with its applied anatomy
Urethra in brief along with its applied anatomy.

Anatomy of Reproductive System.

Male Reproductive System: Testis, Duct system - with its applied anatomy

Female Reproductive System: Uterus, Ovaries, Duct system, Accessory organs- with its applied anatomy

Anatomy of the Endocrine System.

Names of all endocrine glands their positions, Hormones and their functions- Pituitary, Thyroid and parathyroid glands, Adrenal glands, Gonads and Endocrine part of pancreas- with its applied anatomy

Systemic Histology

1. G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.
2. Renal System - Kidney, ureter and urinary bladder.
3. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
4. Reproductive System Uterus, Ovary, Testis.

Type of questions and distribution of marks for Theory examination in each subject in Second Semester for Subject Codes:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	7	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

Practical 1: - EDT10 Human Anatomy

Practicals-30 Hours.

Gross Anatomy Practical:

- 1) Demonstration of the digestive system organs
- 2) Demonstration of excretory systems organs
- 3) Demonstration of Male & Female reproductive organs
- 4) Demonstration of Endocrine glands

Systemic Histology Practical:

G.I.T – oesophagus, stomach, small intestine, large intestine, liver, pancreas and gall bladder.

1. Kidney, ureter and urinary bladder.
2. Endocrine glands – Adrenal, Pancreas, Pituitary, Thyroid and Parathyroid
3. Uterus, Ovary, Testis.

PRACTICAL ASSESMENT

Scheme of Practical Examination for First Semester for subject code BMLS11:

Sr. no	Practical	Marks	IA	Grand Total Marks
1	Practicals 1	80	20	100

Scheme of Exam for Practicals:

Practicals

Gross Anatomy

Discussion- 3 X 10 marks =30 marks
Spotters- 10 X 2 marks =20 marks

Histology

Spotters- 15 X 2 marks =30 marks

IA marks

=20 marks

Total = 100 Marks

Suggested Readings:

Name of the Books & Title	Author	Publisher's Name, Place of Publication
1. Human Anatomy Regional and Applied. Vol. 1, Vol.2 & Vol.3	B.D.Chaurasia	C.B.S.Publishers, New Delhi
2. Text Book of Human Histology	Inderbir Singh	Jaypee Brothers, Medical Publishers, Delhi
3. Clinically Oriented Anatomy	Keith L. Moore	Williams and Wilkins, Baltimore
4. Gray's Anatomy	Susan Standing	Elsevier Churchill Livingstone, Edinburg
5. Text book of Histology – A Practical Guide	J.P. Gunasegaran	Elsevier Publication, Gurgaon , Hariyana
6. Practical manual of Histology for Medical students	Neelkanth Kote	Jaypee Brothers, Medical Publishers, Delhi

SEMESTER II

PAPER 2 – EDT08 Section A - Physiology

Theory : 30 Hours

RESPIRATOR SYSTEM

Physiological Anatomy of Respiratory System and Functions

Mechanics of Breathing - Mechanism of Respiration, Lung volume and capacities, Surfactant, Dead Space, Compliance

Transport of Gases - Transport of Oxygen, ODC Curve and forms of CO₂ transport.

Respiratory Centers - Types and functions

Applied Aspects - Hypoxia – definition and types, Cyanosis, Dyspnea, Apnea

CARDIOVASCULAR SYSTEM

Physiological Anatomy of Heart, **Conducting system, Types of blood vessels & blood flow**

Cardiac Cycle – Definition and Phases

Normal Electrocardiogram – Definition and Waves of ECG

Cardiac Output - Definition, Regulation of CO

Blood pressure - Definition, Determinants & Factors affecting blood pressure, Regulation

Coronary Circulation

Applied Aspects - Definition of Hypertension and Hypotension, Myocardial Ischemia and Infarction, **Shock- definition & types**

EXCRETORY SYSTEM

Functional anatomy of kidneys, structure of a nephron & functions of each part, juxtaglomerular apparatus

Mechanism of Urine formation

Glomerular Filtration – glomerular filtration rate, factors affecting GFR

Tubular Reabsorption and **Secretion - Na⁺, Glucose, Water, K⁺ & Urea**

Micturition

Innervation of urinary bladder, Micturition reflex & concept of Artificial Kidney

DIGESTIVE SYSTEM

Functional Anatomy of GIT

Saliva - Composition & Functions

Gastric Juice - Mechanism of Secretion, Composition & Functions

Pancreatic Juice - Composition & Functions

Functions of Liver

Bile Juice - Composition & Functions

Small Intestinal Juice - Composition & Functions

Movements of GI Tract - Deglutition, Movements of Small Intestine

ENDOCRINES

Pituitary Gland: Anterior & Posterior Pituitary Hormones and their actions

Thyroid Gland: Hormones secreted and their actions, Goiter

Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their actions

Endocrine Pancreas: Hormones and their actions, Diabetes Mellitus

Parathyroid Gland - Hormones and their actions

Calcium Regulating Hormones

REPRODUCTIVE SYSTEM

Puberty

Pubertal changes in male and female

Male Reproductive System

Male reproductive organs, Spermatogenesis & factors influencing it, Morphology of a sperm, Semen, Actions of Testosterone

Female Reproductive System

Female reproductive organs, Menstrual cycle with its hormonal basis, Actions of Estrogen & Progesterone, Tests for Ovulation, **Menopause**

Pregnancy & Lactation

Functions of Placenta, Pregnancy tests, Contraceptive methods, Milk Ejection Reflex

PRACTICAL 2A – EDT11
Section A – Human Physiology

Practical: 30 Hours

- 1) Clinical Examination of Pulse
- 2) Blood Pressure Recording
- 3) Spirometry – Graph interpretation
- 4) Auscultation of Heart Sounds
- 5) Electrocardiogram of a normal person – Description of ECG waves in Lead II

Practical Total 50 Mark

Major- 25 Marks

Minor- 15 Marks

Internal-Assessment- 10 Marks

Total -50 Marks

Scheme of Examination

Theory Total 50 Marks

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Recommended Text Books (Latest Edition)

Sl. No	Name of the Book & Title	Author	Publisher's Name, Place of Publication
1	Textbook of Physiology for MLT	Prof A.K.Jain	Avichal Publishing company
2	Textbook of Medical Physiology	D.Venkatesh & H.H.Sudhakar	Wolters Kluwers
3	Concise Medical Physiology	Sujit K Choudhari	New Central Books Calcutta
4	Textbook of Physiology	Arthur C Guyton	Prism Publishers Bangalore
5	Practical Physiology	Prof. A.K.Jain	Arya Publication

SEMESTER II

PAPER 2: EDT08

Theory 30 Hours

Section B : Basics of Biochemistry

1. Specimen collection of blood, urine, cerebrospinal fluid, Pleural Fluid and ascitic Fluid, preservation and preparation of protein free filtrate. **Composition of Whole Blood, Serum and Plasma**
2. Enzymes: definition, classification, coenzymes, factors affecting enzyme activity and inhibitors, units of measurements, isoenzymes, Diagnostic enzymology (AST, ALT ALP, LDH, CPK and Troponin).
3. Digestion and Absorption of Carbohydrates, proteins and lipids
4. Nutrition – Calorific value and nutritional importance of Carbohydrates, Lipids, Proteins and Dietary fibers. BMR & Factors affecting BMR. **Nutritional Disorders, Diabetic and DASH diets**
5. Vitamins- Sources, RDA, functions and deficiency manifestations.
6. Non Protein Nitrogenous compounds-Clinical Significance of Urea, Uric acid, creatinine, acetone and HCL
7. Overview of Metabolism
Carbohydrate Metabolism-Glycolysis, Gluconeogenesis and TCA Cycle
Protein Metabolism- General Reactions of amino acids and Urea cycle
Lipid metabolism- Beta Oxidation of Fatty Acids and Ketone body metabolism

PRACTICAL 2B: EDT11 Basics of Biochemistry II

Practical : 30 Hours

1. **Demonstration to Specimen Collection(Blood and CSF)- Simulation Lab Visit**
2. **Demonstration to Digital Balance**
3. **Demonstration to Centrifuge**
4. **Use of Centrifuge for preparation of Serum and Plasma Samples for further analysis and Preparation of PFF**
5. **Demonstration of Colorimeter (End point and Kinetic Method) and spectrophotometer**
6. **Quantitative estimation of Glucose, Urea and Total Protein and Albumin**
7. **Biochemically important substance- Urea, Uric acid, creatinine, acetone and HCL**

SCHEME OF EXAMINATION-

Theory Examination-Semester II

No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva	Total Marks
1.	Long Essay Question	2	1	1 x 10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Practical Examination-Semester II

Major Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Quantitative analysis of Glucose/Urea/ creatinine /Estimation of urine creatinine	1	1 x 20	20 Marks

Minor Practical

Topics	No. Of Questions	Number of Question and Marks	Total
Analysis of biochemically important substances	1	1 x 20	20 Marks

Practical
IA Marks:
Grand Total

40 Marks
10 Marks
50 Marks

Suggested Readings :

Sl. No.	Name of the Books & Title	Author	Publisher's Name
1	Manipal Manual of Clinical Biochemistry	Shivananda Naik	JAYPEE
2.	Textbook of Medical laboratory technology	Prafull Godkar	BHALANI
3.	Textbook of Clinical Biochemistry	Ramnik Sood	CBS Publishers
4.	Text Book of Medical Biochemistry	TEITZ	W.B. Saunders Company Harcourt(India) Private Limited New

			Delhi-110048.
5.	Test Book of Bio Chemistry for Medical Students	VASUDEVAN(D M), & SREE KUMARI (S)	Jaypee Brothers, New Delhi.
6.	Biochemistry	U. Satyanarayan	Books and Allied (P) Ltd. Kolkata-700009 (India)

PAPER 3: EDT09

Theory : 30 Hours

Section A - Haematology & Clinical Pathology

Hematology

1. Anemias
2. Leukemias
3. Bone Marrow Studies
 - a. Bone marrow Aspiration – Technique, preparation and staining of films
 - b. Bone marrow biopsy – Technique, preparation and staining of films
4. Cytochemistry in hematology
5. Preparation of buffy coat smears
6. Laboratory test used in investigation of hemolytic anemia's
 - a. Osmotic fragility
 - b. Test for sickling
 - c. Estimation on of Hb-F, Hb-A2
 - d. Plasma haemoglobin and Haptoglobin, demonstration of haemosiderin in urine
 - e. Haemoglobin electrophoresis
 - f. Coomb's test (Direct & Indirect) - Test for auto immune hemolytic Anaemias.
7. Organisation and quality control in haematology laboratory.
8. Preparation of glassware and disposal of the waste in the laboratory –
9. Biomedical waste management in haematology laboratory (Other than Radioactive material)

Clinical Pathology

1. Urine examination
Physical, Chemical & Microscopy
2. Semen analysis

SCHEME OF EXAMINATION

Type of questions and distribution of marks for Theory examination in each subject in Second Semester.

(Section A - Pathology - 50 marks + Section B - Microbiology - 50 marks)

No.	Question asked	Questions asked	Questions to attempt	Marks	Max. marks	IA	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

Reference books (Latest Edition)

Sl. No.	Name of Book & title	Author	Publisher, Name, Place of publication
1	Practical Pathology	P. Chakraborty Gargi Chakraborty	New Central Book Agency, Kolkotta
2.	Text Book of Haematology	Dr. Tejinder Singh	Arya Publications, Sirmour (H.P)
3.	Text Book of Medical Laboratory Technology	Praful Godkar	Bhalani Publication House, Mumbai
4.	Practical Haematology	Sir John Dacie	Churchill Livingstone, London
5.	Todd & Sanford, Clinical Diagnosis & Management by Laboratory Methods	John Bernard Henry	All India Travellar Booksellar, Delhi.
6.	Practical Pathology	Dr. Ganga S. Pilli	Prabhu Publications, Dharwad.
7.	Hematology Blood Banking & Transfusion (PB)	Dutta B. A.	CBS Publishers & Distributors Pvt. Ltd.
8.	Blood Transfusion in Clinical Practice (HB)	Kochhar P. K.	CBS Publishers & Distributors Pvt. Ltd.
9.	Transfusion Medicine, 3e (PB)	Mc Cullough	CBS Publishers & Distributors Pvt. Ltd.
10	Practical Transfusion Medicine,4e (HB)	Murphy	CBS Publishers & Distributors Pvt. Ltd.

PRACTICAL 3: EDT12

Practical: 30 Hours

Section A: Haematology and Clinical Pathology

I. HAEMATOLOGY

- Sickling test-Demonstration
- Bone Marrow Smear preparation & staining procedure- Demonstration
- MPO stain
- Sudan black stain
- Demonstration of Malarial Parasite.

II. CLINICAL PATHOLOGY

- Visit to pathology laboratory – Postings in batches - 15 days for 2 hours
- Urine examination
 - Physical
 - Chemical – Reducing substances ketone bodies, proteins and blood
 - Microscopy
 - Dipstick method – Demonstration
- Semen Analysis Demonstration

Spotters

Sl. No	SPOTTERS
1	RBC Pipette
2	WBC Pipette
3	Sodium Citrate vacutainer
4	Plain vacutainer
5	EDTA vacutainer
6	Neubaur's Chamber
7	PT reagent
8	APTT reagent
9	Platelet diluting fluid
10	Centrifuge machine
11	Sickling test
12	Chart of Direct Coomb's Test
13	Chart of Indirect Coomb's Test

14	Histogram Chart
15	Sudan Black
16	MPO Stain
17	Calcium chloride

Practical Assessment

Scheme of Practical Examination for Second Semester.

Sr. No.	Practical	Practical	IA	Grand Total
1	Practical A	40 (Major 30 + Minor10)	10	50
2	Section B	40 (Major 30 + Minor10)	10	50

(Section A Pathology 50 Marks + Section B Microbiology -50 Marks)

Pathology Practicals

I. Major

30 marks

Urine Examination

b. General Physical Examination

10 marks

c. Microscopy

10 marks

d. Chemical Examination

10 marks

II. Minor

10 marks

a. Spotters - Test

10 marks

IA

10 marks

Total

50 marks

PAPER 3: EDT09

Theory 30 Hours

Section B – Microbiology

- Culture media and different methods of cultivation.
 - Immunology
- a) Introduction
 - b) Immunity
 - c) Antigens.
 - d) Antibodies – Structure and function.
 - e) Complement
 - f) Antigen-Antibody reaction.

Scheme of Examination

Theory 40 Marks

No .	Question asked	Questions to attempt	Questions	Marks	Max. marks	Internal assessment	Viva	Total marks
1.	Long Essay Question	2	1	1x10	10	10	10	50
2.	Short Essay Question	3	2	2 x 5	10			
3.	Short Answers	5	5	5 x 2	10			

Suggested Readings:

- 1) Ananthanarayan and Paniker's Testbook of Microbiology. Tenth Edition. Reba Kanungo
- 2) Textbook of Microbiology for MLT. Second Edition. Dr. C.P. Baveja.

PRACTICAL 3: EDT12

Section B - Microbiology

Practicals 30 Hours

- Biomedical waste management
- Collection of various clinical specimens .
- Serological tests
- Un-inoculated culture media and culture techniques.

Practical Exam Pattern

Major :

- Biomedical waste management
- Serological tests/Inoculation techniques

25 marks

10 marks

15 marks

Minor :

- Spotters

15 marks

15 marks

IA

10 marks

Total -50 marks

COMPUTER SCIENCE

Elective Subject: ELS02

30 Hours

Fundamentals of Computers-I

- 1. Introduction to computer:** introduction, characteristics of computer, block diagram of computer, generations of computer, computer languages.
 - a. **Input output devices:** input devices (keyboard, point and draw devices, data scanning devices, digitizer, electronic card reader, voice recognition devices, vision-input devices),
Output devices (monitors, pointers, plotters, screen image projector, voice response Systems)
 - b. **Processor and memory:** The Central Processing Unit (CPU) and main memory.
 - c. **Storage Devices:** sequential and direct access devices, magnetic tape, magnetic disk, optical disk, mass storage devices.
- 2. Introduction to MS-Word:** introduction, components of a word window, creating, opening and inserting files, editing a document file, page setting and formatting the text, saving the document, spellchecking, printing the document file, creating and editing of table and mail merge.
- 3. Introduction to Excel:** introduction, about worksheet, entering information, saving workbooks and formatting, printing the worksheet, creating graphs.
- 4. Introduction to power-point:** introduction, creating and manipulating presentation, views, formatting and enhancing text, slide with graphs.
- 5. Introduction of Operating System:** introduction, operating system concepts, types of operating system
 - a. **Introduction to MS-DOS:** History of DOS, features of MS-DOS, MS-DOS Commands (internal and external).
 - b. **Introduction of windows:** History, features, desktop, taskbar, icons on the desktop, operation with folder, creating shortcuts, operation with windows (opening, closing, moving, resizing, minimizing and maximizing, etc.).
- 6. Computer networks:** introduction, types of network (LAN, MAN, WAN, Internet, Intranet), network topologies (star, ring, bus, mesh, tree, hybrid), components of network.
- 7. Internet and its Applications:** definition, brief history, basic services (E-Mail, File Transfer Protocol, telnet, the World Wide Web (WWW)), www browsers, use of the internet.
- 8. Application of Computer in various fields:** Medical, Education, Railway, Defense, Industry, Management, Sports, Commerce, Internet.
- 9. Introduction to installation of different software and introduction about different software related to MLS.**

Practicals:

Learning to use MS Office: MS WORD, MS EXCEL & MS PowerPoint and Internet

NSS-I II III IV

Elective Subject: ELS02

30 Hours

NSS-I

UNIT 1: Introduction and Basic Concepts of NSS

- History, philosophy, aims & objectives
- Emblem, flag, motto, song, badge
- Organizational structure, roles & responsibilities of various NSS functionaries

UNIT 2: NSS Programmes and Activities

- Concept of regular activities, special camping, day camps
- Basis of adoption of village/slums, methodology of conducting survey
- Financial pattern of the scheme
- Other young programmes/schemes of GoI
- Coordination with different agencies
- Maintenance of the diary

UNIT 3: Understanding Youth

- Definition, profiles, categories of youth
- Issues, challenges and opportunities of youth
- Youth as an agent of social change

UNIT 4: Health, Hygiene & Sanitation

- Definition, needs and scope of health education
- Food and nutrition
- Safe drinking water, water borne diseases and sanitation (SBA)
- National Health Programme
- Reproductive Health

UNIT 5: Volunteerism and Shramdaan

- Indian Tradition of volunteerism
- Needs & importance of volunteerism
- Motivation and constraints of volunteerism
- Shramdaan as part of volunteerism

NSS II

UNIT 1: Importance and Role of Youth leadership

- Meaning and types of leadership
- Qualities of good leaders; traits of leadership
- Importance and role of youth leadership

UNIT 2: Life Competencies

- Definition and importance of life competencies
- Communication
- Inter Personal
- Problem-solving and decision-making

UNIT 3: Social Harmony and National Integration

- Indian history and culture
- Role of youth in peace-building and conflict resolution
- Role of youth in Nation Building

UNIT 4: Youth Development Programmes in India

- National Youth Policy

- Youth development programmes at the National level, State level and voluntary sector
- Youth-focused and Youth-led Organizations

NSS III

UNIT 1: Citizenship

- Basic Features of Constitution of India
- Fundamental Rights and Duties
- Human Rights
- Consumer awareness and legal rights of consumer
- RTI

UNIT 2: Family and Society

- Concept of family, community, (PRIs & other community-based organizations) and society
- Growing up in the family- dynamics and impact
- Human Values
- Gender Justice

UNIT 3: Community Mobilization

- Mapping of community stakeholders
- Designing the message in the context of the problem and culture of community
- Identifying methods of mobilization
- Youth-adult partnership

UNIT 4: Environment Issues

- Environment conservation, enrichment and sustainability
- Climate change
- Waste management
- Natural resource management

UNIT 5: Project Cycle Management

- Project planning
- Project implementation
- Project monitoring
- Project evaluation: impact assessment

UNIT 6: Documentation and Reporting

- Collection and analysis of data
- Preparation of documentation/ reports
- Dissemination of documents/reports

UNIT 7: Additional Life Skills

- Positive Thinking
- Self Confidence and Self Esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

NSS IV

UNIT 1: Youth Health and Yoga

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid
- Yoga: history, concept, misconceptions, traditions, impacts
- Yoga as preventive, promotive and curative method

UNIT 2: Youth and Crime

- Sociological and psychological factors influencing youth crime
- Peer mentoring in preventing crimes
- Awareness about anti-ragging
- Cybercrime and its prevention

- Juvenile Justice

UNIT 3: Civil/ Defense

- Positive Thinking
- Self Confidence and Self esteem
- Setting Life Goals and working to achieve them
- Management of Stress including Time Management

UNIT 4: Entrepreneurship Development

- Definition & Meaning
- Qualities of good entrepreneur
- Steps/ ways in opening an enterprise

THIRD SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EDT13	Basic of Gastroenterology (Symptomatology)	02			02
2	EDT14	Applied Aspects of pathology	02			02
3	EDT15	Applied Aspects of Microbiology	02			02
4	AECC01	AECC: Environmental Studies	02			02
5	ELS03	Elective Subject (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	02			02
6	EDT16	Applied Aspects of Pathology		03	02	05
7	EDT17	Applied Aspects of Microbiology		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

THIRD SEMESTER
Scheme of Examination

Sl.No	Subject Code	Examination	Subjects	Theory+ IA + Viva	Total
1	EDT13	Paper 1	Basic of Gastroenterology (Symptomatology)	60+20+20	100
2	EDT14	Paper 2	Applied Aspects of pathology	60+20+20	100
3	EDT15	Paper 3	Applied Aspects of Microbiology	60+20+20	100
4	AECC01	Paper 4	Environmental Studies	80 + 20	100
5	ELS03	Paper 5	Elective Subject : (Communication Skills / Fundamentals of Data Processing and Analysis- Basic Statistics)	80 + 20	100
Total					500

Sl.No	Subject Code	Examination	Subjects	Practical + IA	Total
6	EDT16	Practical 1	Applied Aspects of Pathology	120+30	150
7	EDT17	Practical 2	Applied Aspects of Microbiology	120+30	150
Total					300

Type of questions and distribution of marks for Theory examination in each subject:

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL EXAMINATION
Scheme of Practical Examination for Third Semester

Sr. no	Examination	Practical	IA	Grand Total
1	Practical paper	120	30	150

Semester III

PAPER 1: EDT13
BASIC OF GASTROENTEROLOGY
(Symptomatology)

Theory 30 Hours

1. Abdominal pain
2. Nausea and vomiting
3. Dyspepsia
4. Diarrhea
5. Bloating
6. Constipation
7. Jaundice
8. GI bleed
9. Fecal incontinence
10. Abdominal distension
11. Nutrition in gastroenterology disease

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Gastrointestinal & liver Disease	Sleisenger & Fordtan's	10 th Edition	Elsevier
2	Textbook Of Clinical Gastroenterology And Hepatology	Hawkey, John Wiley	2nd Edition	John Wiley
3	Yamada's Textbook of Gastroenterology	Yamada	6th Edition	John Wiley & Sons Inc
4.	Clinical Gastroenterology	Mehta	4th Edition 2020	Paras Medical Publisher

PAPER 2 : EDT14
APPLIED ASPECTS OF PATHOLOGY

Theory 30 Hours

1. Congenital anomaly of Gastrointestinal system
2. Classification of Gastrointestinal diseases
3. Dysphagia- causes, types, pathology
4. Constipation – causes, types, pathology

5. Peptic ulcer diseases - causes, types & pathology
6. Malabsorption syndrome
7. Cirrhosis of liver - causes & pathology
8. Pathology of Gastrointestinal tract tumor

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Robbins And Cotran Pathologic Basis Of Disease	Robbins	8 th Edition	Elsevier
2	Harsh Mohan Textbook Of Pathology,	Harsh Mohan	7th Edition	Jaypee
3	Practical Pathology (By Harsh Mohan	Harsh Mohan	5th Ed (2021)	Jaypee

PAPER 3 : EDT15

Theory 30 Hours

APPLIED ASPECTS OF MICROBIOLOGY

1. Hepatotrophic viruses in detail - mode of transfusion, universal precautions, vaccinations
2. Human immunodeficiency virus (HIV), mode of transfusion, universal precautions
3. Opportunistic infections
4. Microbiology of Gastrointestinal tract infections

PRACTICAL I: EDT16

APPLIED ASPECTS OF PATHOLOGY

1. Cirrhosis of liver
2. Stomach with ulcer / tumor
3. Small intestine pathology
4. Large intestine pathology
5. Gall bladder pathology
6. Stool routine -Macroscopic, Microscopic

PRACTICAL 2: EDT17
APPLIED ASPECTS OF MICROBIOLOGY

1. Disinfectant- types, duration of use
2. Collection of specimen and transport, Universal Precaution
3. Microbiological specimens- Bacteriology, Virology, Parasites
4. H. pylori – identification, collection, interpretation of Tests

Sl. No.	Title	Author	Edition & Year	Publisher
1	Ananthanarayan and paniker's textbook of microbiology	Ananthanarayan	Tenth edition 2017	The orient blackswan
2	Textbook of Microbiology	Prof C P Baveja	Fourth Edition 2017	Arya publisher
3	Essentials of Practical Microbiology	Apurba Sankar Sastry	2018	Jaypee

Compulsory Course AECC 01

ENVIRONMENTAL STUDIES

Theory : 30 Hours

GOAL:

The students should gain knowledge to understand the multidisciplinary nature of the environment and the awareness of the eco system, which maintains the natural environment.

OBJECTIVES:

c) KNOWLEDGE

At the end of the 3rd semester course the student is expected to know:

3. The natural resources like forest, water, mineral, food, energy and land.
4. Functions of the eco system.
5. Bio-diversity and its conservation.
6. Environmental pollution & its prevention.
7. Social issues.

d) SKILLS

At the end of the 3rd semester course the student is expected to:

4. Visit local areas to understand and document environmental assets like river, forest, grassland, hill and mountain.
5. Visit an industrial area or agricultural area to know about local pollutants.
6. Identify common plants, insects and birds in their local areas.
7. Identify rivers, hills and mountains in their local areas.
8. To make use of the knowledge to protect natural resources.

COURSE CONTENTS

1: Multi-disciplinary nature of environmental studies

Definition, scope and importance, need for public awareness.

2: Natural Resources:

Renewable and non-renewable resources:

Natural resources and associated problems.

- a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.
- b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.
- c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
- d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
- e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies.
- f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- g) Role of an individual in conservation of natural resources.
- h) Equitable use of resources for sustainable lifestyles

3: Ecosystems

- ◆ Concept of an ecosystem.
- ◆ Structure and function of an ecosystem.
- ◆ Producers, consumers and decomposers.
- ◆ Energy flow in the ecosystem.
- ◆ Ecological succession.
- ◆ Food chains, food webs and ecological pyramids.
- ◆ Introduction, types, characteristic features, structure and function of the following ecosystems:-
 - a. Forest ecosystem
 - b. Grassland ecosystem
 - c. Desert ecosystem
 - d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

4: Biodiversity and its conservation

- ◆ Introduction - Definition: genetic, species and ecosystem diversity.
- ◆ Bio geographical classification of India.
- ◆ Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ◆ Biodiversity at global, National and local levels.
- ◆ India as a mega-diversity nation.
- ◆ Hot-spots of biodiversity.
- ◆ Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
- ◆ Endangered and endemic species of India
- ◆ Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

5: Environmental Pollution

Definition

- ◆ Cause, effects and control measures of:-
 - a. Air pollution
 - b. Water pollution
 - c. Soil pollution
 - d. Marine pollution
 - e. Noise pollution
 - f. Thermal pollution
 - g. Nuclear hazards
- ◆ Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- ◆ Role of an individual in prevention of pollution.
- ◆ Pollution case studies.
- ◆ Disaster management: floods, earthquake, cyclone and landslides.

6: Social Issues and the Environment

- ◆ From Unsustainable to Sustainable development
- ◆ Urban problems related to energy
- ◆ Water conservation, rain water harvesting, watershed management
- ◆ Resettlement and rehabilitation of people; its problems and concerns. Case Studies
- ◆ Environmental ethics: Issues and possible solutions.
- ◆ Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies.
- ◆ Wasteland reclamation.
- ◆ Consumerism and waste products.
- ◆ Environment Protection Act.
- ◆ Air (Prevention and control of Pollution) Act.
- ◆ Wildlife Protection Act
- ◆ Forest Conservation Act
- ◆ Issues involved in enforcement of environmental legislation.

7: Human Population and the Environment

- ◆ Population growth, variation among nations.
- ◆ Population explosion - Family Welfare Programme.
- ◆ Environment and human health.
- ◆ Human Rights.
- ◆ Value Education.
- ◆ HIV/AIDS
- ◆ Women and Child Welfare.
- ◆ Role of Information Technology in Environment and human health.
- ◆ Case Studies.

8: Field work

- ◆ Visit to a local area to document environmental assets river/forest/grassland/hill/mountain
- ◆ Visit to a local polluted site - Urban / Rural/ Industrial/Agricultural.
- ◆ Study of common plants, insects, birds.
- ◆ Study of simple ecosystems-pond, river, hill slopes, etc

SCHEME OF EXAMINATION

A. Theory : 80Marks

- ◆ Long Essay 2 X 10 = 20
- ◆ Short Essay 8 X 5 = 40
- ◆ Short Answers 5 X 4 = 20

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Environmental Biology	Agarwal, K.C.	2001	Nidi Publication Ltd. Bikaner
2	The Biodiversity of India	Bharucha Erach		Mapin Publishing Pvt. Ltd., Ahmedabad - 380 013
3	Environmental Encyclopedia	Cunningham W.P., Copper T.H., Gorhani E. & Hepworth M.T.	2001	Jaico Publication House, Mumbai.
4	Global Biodiversity Assessment	Heywood V. H. & Waston R.T.	1995	Cambridge University Press 1140p
5	Environmental Protection and Laws	Jadhav H. & Bhosale V. M.	1995	Himalaya Publishing House, Delhi 284p
6	Environmental Science Systems & Solutions	Mckinney M. L. & School R.M.	1996	

ELS03

Theory: 30 Hours

Fundamentals of Data Processing and Analysis-Basic Statistics

- Definition of statistics and bio-statistics and its types, scope, limitations
- Uses and application of bio-statistics in public health research and medical sciences.
- Descriptive Statistics: Basic concept of variables, types of variables (discrete and continuous variables), scales of measurement
- Data Collection:
 - Collection and recording of statistical information on public health and its related fields from primary and secondary sources
 - Presentation of statistical data. Classification and Tabulation of data: frequency distribution and different types of tables (one way, two ways).
 - Diagrammatic and graphic presentation: Bar diagram (simple, multiple, subdivided) , pie chart, map diagram, pictogram histogram, frequency polygon, frequency curve, cumulative frequency curve, line chart, scatter diagram.
- Measures of Central Tendency: Mean, Median & Mode and identify the ideal averages, requisites and its merits and demerits.
- Analysis of outliers: different partition values (quartiles, deciles & percentiles) and its uses.
- Measures of dispersion (variability). Range, quartile deviation, mean deviation, standard deviation, variance and coefficient of variation and identify the ideal dispersion, requisites and its merits and demerits. Measures of skewness and kurtosis.

Basic Probability : Concept of probability, its terminology and different types of definition

Laws of probability: addition law, multiplication law and conditional probability.

Communication Skills

Theory 30 Hours

Unit-I:

Communication, its types and significance: Communication, Process of communication its kinds, channels and role in the society.

Methods of Communication (Oral, Written, One-way, two-way communication skills).

Reading skills: - Process of reading, reading purpose, models, strategies methodologies, reading activities, structure of meaning techniques.

Unit-II

Précis and Communication.

Writing skills: - Elements of effective writing, writing styles, scientific and technical writing.

Grammar: - Transformation of sentences, words used as different parts of speech, one word substitution, abbreviations, technical terms etc.

Unit-III

Listening skills: - Process of listening, barriers to listening, effective listening skills, feedback skills.

Speaking skills: - Speech mechanism, organs of speech, production and classification of speech sounds, phonetic transcription, skills of effective speaking components of an effective talk, oral presentation and the role of audio-visual aids in it.

Reading of text book.

Unit-IV

Barriers of communication and technique to overcome those.

Meaning of effective communication.

Technical Report writing.

Practice of writing personal resume and writing application for employment.

Theory	: 80 Marks
IA	: 20 Marks
Total	: 100 Marks

FOURTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EDT18	Concept in Gastroenterology diseases (Luminal – Esophagus, stomach, small & Large intestine)	02			02
2	EDT19	Pharmacology related to Endoscopy	02			02
3	EDT20	Basics in Endoscopy Technology (Introduction to endoscope, indication, how to use, cleaning, storage.)	02			02
4	AECC02	AECC: Indian Constitution	02			02
5	ELS04	Elective Subject: (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	02			02
6	EDT21	Applied Technology in Pharmacology		03	02	05
7	EDT22	Applied Technology in Endoscopy		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FOURTH SEMESTER

Scheme of Examination

Sl.No	Subject Code	Examination	Subjects	Theory+ IA + Viva	Total
1	EDT18	Paper 1	Concept in Gastroenterology diseases (Luminal – Esophagus, stomach, small & Large intestine)	60+20+20	100
2	EDT19	Paper 2	Pharmacology related to Endoscopy	60+20+20	100
3	EDT20	Paper 3	Basics in Endoscopy Technology (Introduction to endoscope, indication, how to use, cleaning, storage.)	60+20+20	100
4	AECC02	Paper 4	Law- Indian Constitution	80 + 20	100
5	ELS04	Paper 5	Elective Subject (Research Methodology & Bioethics / Fundamentals of Health Education & Communication)	80 + 20	100
Total					500

Sl.No	Subject Code	Examination	Subjects	Practical + IA	Total
6	EDT21	Practical 1	Applied Technology in Pharmacology	120+30	150
7	EDT22	Practical 2	Applied Technology in Endoscopy	120+30	150
Total					300

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL EXAMINATION

Scheme of Practical Examination for Forth Semester

Sr. no	Examination	Practical	IA	Grand Total
1	Practical paper	120	30	150

Semester IV

PAPER 1: EDT18

Theory 30 Hours

CONCEPT IN GASTROENTEROLOGY DISEASES

1. Clinical feature and management of motility disorder of esophagus and role of manometry
2. Clinical feature and management of GERD and role of Manometry
3. Types, Clinical feature, endoscopic finding and management esophageal ulcers
4. Clinical feature and endoscopic finding and management esophageal tumors.
5. Clinical feature and endoscopic finding and management of gastric, duodenal ulcer and bleed.
6. Clinical feature and endoscopic finding and management gastric tumors.
7. Clinical feature and endoscopic approach for H. pylori
8. Clinical feature and endoscopic feature, management of Malabsorption syndrome
9. Types, Clinical feature, endoscopic finding and management IBD
10. Types, Clinical feature, endoscopic finding and management Large intestine polyp and tumor .
11. Approach and endoscopic management UGI, LGI bleed.

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Gastrointestinal & liver Disease	Sleisenger & Fordtan's	10 th Edition	Elsevier
2	Textbook Of Clinical Gastroenterology And Hepatology	Hawkey, John Wiley	2nd Edition	John Wiley
3	Yamada's Textbook of Gastroenterology	Yamada	6th Edition	John Wiley & Sons Inc
4.	Clinical Gastroenterology	Mehta	4th Edition 2020	Paras Medical Publisher

PAPER 2: EDT19
PHARMACOLOGY RELATED TO ENDOSCOPY

Theory 30 Hours

1. IV fluid therapy with special emphasis in Gastrointestinal diseases
2. Formalin, sodium hypochlorite, Enzymatic solution, Gluteroldehyde - role as Disinfactants and adverse effects of residual particles applicable to formalin
3. Drugs used for sedation & anaesthesia : midazolam , propofol , ketamine , pethidine , fetanyl , dexemedetomidine
4. Drugs used for pain control : Nsaids , opioids ,
5. Drugs used for bowel Anatomy : hyoscine , glucagon
6. Drugs used for preventing post ERCP pancreatitis : rectal suppository of indomethacin
7. Sclerosant drugs : polidocanol , sodium tetradecyl sulfate(sts) , alcohol
8. Cyanoacrylate glue : n-butyl 2-cyanoacrylate.

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Essentials of Medical Pharmacology	K. D. Tripathi	8th Edition - 2018	Jaypee
2	Medical pharmacology	Padmaja uday kumar	7th edition -2021	Cbs publishers and distributors pvt ltd
3	Pharmacology for medical graduates, 4th updated edition	Tara shanbhag	4th updated edition - 2021	Elsevier

PAPER 3: EDT20
BASICS IN ENDOSCOPY TECHNOLOGY

Theory 30 Hours

1. Indications of endoscopy
2. Types of scopes & their structure & function
3. Principles of endoscopies
4. Introduction to endoscopic machine
5. Common complications of endoscopic procedure
6. Monitoring of patients during endoscopy

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Cotton and Williams' Practical Gastrointestinal Endoscopy: The Fundamentals	Cotton and Williams'	7th edition 2014	Wiley-Blackwell;
2	Clinical Gastrointestinal Endoscopy	Vinay Chandrasekhara MD	3 rd edition -2018	Elsevier
3	Atlas Of Clinical Gastrointestinal Endoscopy	Wilcox	3 rd edition	Elsevier

PRACTICAL 1: EDT21 APPLIED TECHNOLOGY IN PHARMACOLOGY

1. Identification of sclerogent agent, application, side effect
2. Identification of Sedative agent, application, side effect
3. Identification of Disinfectant agent, application, side effect

PRACTICAL 2: EDT22 APPLIED TECHNOLOGY IN ENDOSCOPY

1. Identification, application of various endoscope
2. Identification, application of various endoscope accessories
3. Identification, application of endoscope equipment's

LAW - INDIAN CONSTITUTION**I. GOAL :**

The students should gain the knowledge and insight into the Indian Constitution so that they are aware of the fundamental rights and freedom bestowed through the democratic governance of our country.

II. OBJECTIVES :**A) KNOWLEDGE :**

At the end of the B.Sc. 4th Semester the student is expected to know:

- 1) Basic knowledge of the Indian Constitution.
- 2) Democratic institutions created by the Constitution.
- 3) Special rights created by the Constitution for regional and linguistic minorities.
- 4) Election Commission.
- 5) Legislative, Executive and Judicial powers and their functions in India.

B) SKILLS:

At the end of the B.Sc. 4th Semester the student is expected to make use of knowledge:

- 1) To perform his / her duties towards the society judiciously and with conscious effort for self-development.
- 2) To utilize State policies in their future practice.

COURSE CONTENTS**Theory:**

- Unit I**
- a) Meaning of term Constitution.
 - b) Making of the Indian Constitution - 1946 - 1949 and role played by Dr. B. R. Ambedkar.
 - c) Salient Features of the Constitution.
 - d) Preamble of the Constitution.
- Unit II**
- The democratic institutions created by the Constitution.
Bicameral System of Legislature at the Centre and in the States.
Devolution of Powers to Panchayat Raj Institutions.
- Unit III**
- Fundamental Rights and Duties - Their content and significance
- Unit IV**
- Directive Principles of State policies - The need to balance Fundamental Rights with Directive Principles.
- Unit V**
- Special rights created in the constitution for Dalits, Backward class, Women and Children, and the Religious and Linguistic Minorities

Unit VI Doctrine of Separation of Powers - Legislative, Executive and Judicial, and their functions in India.

Unit VII The Election Commission and State Public Service Commissions.

Unit VIII Method of amending the Constitution.

Unit IX Enforcing rights through Writs Certiorari, Mandamus, Quowarranto and Habeas Corpus.

Unit X Constitution and Sustainable Development in India.

Reference: 1. Durga Das Basu, Introduction to the Constitution of India, Gurgaon; LexisNexis, 2018 (23rd edn.)

2. M.V.Pylee, India's Constitution, New Delhi; S. Chand Pub., 2017 (16th edn.)

3. J.N. Pandey, The Constitutional Law of India, Allahabad; Central Law Agency, 2018 (55th edn.)

4. Constitution of India (Full Text), India.gov.in., National Portal of India, https://www.india.gov.in/sites/upload_files/npi/files/coi_part_full.pdf

5. Durga Das Basu, Bharatada Samvidhana Parichaya, Gurgaon; LexisNexis Butterworths Wadhwa, 2015 6. Kb Merunandan, Bharatada Samvidhana Ondu Parichaya, Bangalore, Meragu Publications, 2015

Scheme of Examination

University Theory Examination at the end of fourth Semester:100 Marks

Reference Books Latest Edition :

Sl. No.	Title	Author	Publisher
1	The Constution of – A Politico – Legal Study	J C. Jhari	Sterling Publication Pvt. Ltd.
2	Constitution Law	J N. Pandey	Central Law Agency
3	The Indian Constitution	Granville Austin	Corner Stone of Nation

ELS04
Research Methodology & Bioethics

Theory: 30 Hours

Research Methodology:

- Introduction to Research Methodology
- Types of research methods
 - Qualitative
 - Quantitative
- Introduction to Cross Sectional, Case Control, Cohort, Experimental Design
- Introduction to qualitative methods (Participant Observation, Focus Groups discussion, In-Depth Interviews)
- Comparing Quantitative and Qualitative Research – Mixed method study

Bioethics

- Historical Perspectives
- General Principles on Ethical Considerations Involving Human Participants
- General Ethical Issues
- Ethical Guidelines in Qualitative Research
- ICMR Guidelines for biomedical Research
- Informed Consent process and informed consent form
- Composition & Functions of Institutional Ethical Committee/ Independent Review Boards (IRB)
- Duties & Roles of Principal Investigator/sponsor

ELS04

Theory: 30 Hours

Fundamentals of Health Education & Communication

Introduction to Health Education and health promotion

1. Introduction to Health education(Definition, Changing concepts, aims and objectives, role health care providers)
2. Introduction to Health promotion: Definition, concepts, objectives, principles and strategies)
3. Aims, purposes, principles and scope of health education in relation to health promotion.
4. Role of health Education Specialists.
5. Approaches and models in Health education
6. Distinguishing between education and propaganda.
7. Role of health education/health promotion in primary health care
8. Models of Health behavior change – Health belief model in detail
9. Child to Child approach
 - Meaning, elements and types of communication, principles of effective communication, Mass Communication.
10. Health Education Methods and Media
 - **Appraisal of various methods of health education such as:**
 - Individual methods: Counseling and interview.
 - Group methods: Demonstration, group discussion, buzzes session, field trip, workshop, symposium, mini-lecture, brainstorming, role play and dramatization .
 - Mass methods: Exhibition, advertisement, film show, public addressing system, Speeches, radio broadcasting, and television telecast.
 - Various types of health education media, its advantages and disadvantages and uses
 - Audio- radio programme, songs, stories
 - Visual – poster, flash cards, flip chart, hand puppets, hand bill, pamphlets, slides show hoardings/ banners, models
 - Audio and visual – film/ video, television
 - E -media
 - Preparation of selected health education media in classroom and field setting: poster, flashcard, flip chart, hand puppets, models, pamphlets, slides song ,video film.
 - Preparation of lesson plan, and classroom teaching.

FIFTH SEMESTER

S.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EDT23	Concept of Gastroenterology diseases (Hepato -Pancreatico-Billiary tract disease)	03			03
2	EDT24	Applied Endoscopy Technology 1 (UGI Scopy)	02			02
3	EDT25	Applied Endoscopy Technology 2 (LGI Scopy)	03			03
5	ELS05	Elective Subject (Basics of Hospital Administration/ Disaster Management)	02			02
6	EDT26	Applied Technology in UGI Scopy		03	02	05
7	EDT27	Applied Technology in LGI Scopy		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

FIFTH SEMESTER

Scheme of Examination

Sl.No	Subject Code	Examination	Subjects	Max + IA + Viva	Total
1	EDT23	Paper 1	Concept of Gastroenterology diseases (Hepato - Pancreatico- Billiary tract disease)	60+20+20	100
2	EDT24	Paper 2	Applied Endoscopy Technology 1 (UGI Scopy)	60+20+20	100
3	EDT25	Paper 3	Applied Endoscopy Technology 2 (LGI Scopy)	60+20+20	100
4	ELS05	Paper 4	Elective Subject (Basics of Hospital Administration/ Disaster Management)	80+20	100
Total					400

Sl.No	Subject Code	Examination	Subjects	Practical + IA	Total
5	EDT26	Practical 1	Applied Technology in UGI Scopy	120+30	150
6	EDT27	Practical 2	Applied Technology in LGI Scopy	120+30	150
Total					300

Type of questions and distribution of marks for Theory examination in each subject

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL EXAMINATION
Scheme of Practical Examination for Fifth Semester

Sr. no	Examination	Practical	IA	Grand Total
1	Practical paper	120	30	150

Semester V

PAPER 1: EDT23

Theory 30 Hours

CONCEPT OF GASTROENTEROLOGY DISEASES (HEPATO -PANCREATICO-BILIARY TRACT DISEASE)

1. Clinical feature and management of Alcoholic hepatitis
2. Clinical feature and management of viral hepatitis
3. Clinical feature and endoscopic management of portal HTN
4. Clinical feature and management of acute and chronic pancreatitis
5. Clinical feature and management of cholecystitis
6. Clinical feature and management of cholangitis
7. Clinical feature and management of CBD calculi
8. Clinical feature and management of biliary stricture

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Gastrointestinal & liver Disease	Sleisenger & Fordtan's	10 th Edition	Elsevier
2	Textbook Of Clinical Gastroenterology And Hepatology	Hawkey, John Wiley	2nd Edition	John Wiley
3	Yamada's Textbook of Gastroenterology	Yamada	6th Edition	John Wiley & Sons Inc
4.	Clinical Gastroenterology	Mehta	4th Edition 2020	Paras Medical Publisher

PAPER 2: EDT24

Theory 30 Hours

APPLIED ENDOSCOPY TECHNOLOGY 1 (UGI Scopy)

1. Gastroscope- indication, uses, technique and complication
2. Uses of gastroscope, use of various accessories
3. Techniques of diagnostic endoscopy
4. Techniques of therapeutic endoscopy

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Cotton and Williams' Practical Gastrointestinal Endoscopy: The Fundamentals	Cotton and Williams'	7th edition 2014	Wiley-Blackwell;
2	Clinical Gastrointestinal Endoscopy	Vinay Chandrasekhara MD	3 rd edition -2018	Elsevier
3	Therapeutic Endoscopy	Soehendra, Binmoeller	5 th edition -2018	Thieme
3	Endoscopy and Biopsy in Gastroenterology: Technique and Indications	H. V. Ammon	4 th edition -2015	Springer

PAPER 3: EDT25

Theory 30 Hours

APPLIED ENDOSCOPY TECHNOLOGY 2

(LGI Scopy)

1. Colonoscope - indication, uses, technique and complication
2. Uses of colonoscope, use of various accessories
3. Techniques of diagnostic colonoscopy
4. Techniques of therapeutic colonoscopy

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Cotton and Williams' Practical Gastrointestinal Endoscopy: The Fundamentals	Cotton and Williams'	7th edition 2014	Wiley-Blackwell
2	Practical Colonoscopy	Waye, John Wiley	2 nd edition 2013	Wiley-Blackwell

3	Atlas of Colonoscopy: Techniques, Diagnosis, Interventional Procedures	Helmet messman	6 th edition 2016	George Thieme Verlag
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PRACTICAL 1: EDT26

APPLIED ENDOSCOPY TECHNOLOGY UGI SCOPY

1. Parts Identification Of UGI Scope
2. Handling / Cleaning of UGI Endoscope.
3. Identify different size of UGI endoscope.
4. Identify & Application Used in UGI Endoscope
5. Identification of Structure of Esophagus Stomach & Small Intestine.

PRACTICAL 2: EDT27

APPLIED ENDOSCOPY TECHNOLOGY LGI SCOPY

1. Parts Identification of LGI Scope
2. Handling / Cleaning of LGI Endoscope.
3. Identify different size of LGI endoscope.
4. Identify & Application Used in LGI Endoscopy
5. Identification of Structure of Large Intestine.

ELS05

Theory: 30 Hours

Disaster & Emergency Management

A. Introduction to Disaster management

- Disaster definition, types of disaster
- Disasters in history
- Disaster trends
- Health problems common to all disasters
- Effects of disasters

B. Public Health aspects of disaster management

C. Modern disaster management – disaster cycle

D. Hazards

- Differences between Hazards and disasters
- Hazards identification and assessment
- Hazard mapping
- Hazard profiles

E. Risk

- Concept and categories of vulnerabilities
- Concept of parameters of risk
- Components of risks
- Risk assessment, analysis and perception

F. Mitigation

- Measures of Mitigation
- Types of mitigation
- Obstacles
- Assessing and selecting mitigation options
- Components of mitigation

Preparedness

- Overview of disaster preparedness
- Government preparedness
- Public preparedness
- Media management in disaster
- Obstacles

Response

- What is response
- Response to emergency
- Water management / food / shelter management
- Media response

Recovery

- Elements in recovery
- Principle's process of recovery

Agencies

- Role of government in disaster management
- Emergency planning
-stages

-Basic elements

ELS05

30 Hours

BASICS OF HOSPITAL ADMINISTRATION

- Evolution and classification of Hospitals, functions of hospitals
- Introduction, History and growth of management science - Classical, Behavioral and Management sciences
- Functions of management
- Analytical skill and Decision Making models.
- Leadership style and theories
- Employee Centered Management
- Time Management
- Interpersonal skills
- Motivation and Theories of Motivation
- Basic Principles of Communication & Barriers of Communication.
- Principle, policies and procedure for material management
- Inventory Management Techniques & Tools
- Health Insurance – Evolution of Insurance, IRDAI, TPA
- Consumer Protection Act
- Introduction to accounting & financial statement, Budgets & Budgeting
- Health Maintenance Organization (H.M.O)
- Public Private Partnership
- Objective of HMIS/Need and purpose of MIS
- BMW – Biomedical waste management
- Accreditation – NABH & NABL

SIXTH SEMESTER

Sr.No	Subject code	Name of the Subject	Theory Credits	Practical Credits	Clinical Posting	Total Credits
1	EDT28	Applied Endoscopy (Advanced Endoscopy)	04			04
2	EDT29	Applied GI Physiology	04			04
3	ELS06	Elective Subject : Basics of Biomedical Engineering // Fundamentals of Electricity and Electronics	02			02
4	EDT30	Applied Technology -I		03	02	05
5	EDT31	Applied GI Physiology		03	02	05
Grand Total						20
1-hour lecture per week for 15 weeks =1 Credit, 2-hour Practical per week for 15 weeks = 1 Credit 2-hour Clinical Posting per week for 15 weeks = 1 Credit						

SIXTH SEMESTER

Scheme of Examination

Sl.No	Subject Code	Examination	Subjects	Max + IA + Viva	Total
1	EDT28	Paper 1	Applied Endoscopy (Advanced Endoscopy)	60+20+20	100
2	EDT29	Paper 2	Applied GI Physiology	60+20+20	100
3	ELS06	Paper 3	Elective subject: Basic of Biomedical Engineering / Fundamentals of Electricity and Electronics	80+20	100
Total					300

Sl.No	Subject Code	Examination	Subjects	Practical + IA	Total
1	EDT30	Practical 1	Applied Technology -I	160+40	200
2	EDT31	Practical 2	Applied GI Physiology	160+40	200
Total					400

Type of questions and distribution of marks for Theory examination

Sl. No	Question	Question Asked	Question to Attempt	Marks	Maximum Marks	Internal Assessment	Viva Voce	Total Marks
1.	Long Essay Question	3	2	2 x 10	20	20	20	100
2	Short Essay Question	6	5	5 X 5	25			
3.	Short Answers	5	5	5 x 3	15			

PRACTICAL ASSESMENT**1. Scheme of Practical Examination for Sixth Semester**

Sr. no		Practical	IA	Grand Total
1	Practical I	160	40	200
2	Practical II	160	40	200

PAPER 1: EDT28
APPLIED ENDOSCOPY
(Advance Endoscopy)

Theory 30 Hours

1. ERCP- Indication, instruments, various Techniques.
2. Details of side view Endoscope.
3. What is Cholangioscope, Indication & various Techniques.
4. Details About spy camera.
5. Various Technique for cannulation of CBD & PD.
6. EUS - Indication, instruments, various Techniques.
7. Therapeutic Endoscopy – Sclerotherapy, EVL, Biopsy, Endoscopy dilation, Hemoclip, Foreign Body Removal.
8. Details of EMD & EMR
9. SEMS- Indication, instruments, various Techniques.
10. POEM - Indication, instruments, various Techniques

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1	Advanced Therapeutic Endoscopy for Pancreatico-Biliary Diseases	Tetsuya Mine	1 st edition-2020	Springer
2	Therapeutic Endoscopy Color Atlas Of Operative Techniques For The Gastrointestinal tract	Soehendra	4 th Edition - 2018	Thieme Medical Publisher
3	Practical Endoscopy Tips By Experts	TANDULWAD KAR SUNITA R	2 nd edition-2015	Jaypee Brothers Medical Publishers
4	ERCP – the fundamentals	Cotton and Williams'	3 rd edition	John Wiley and Sons Ltd
5	Endoscopic Ultrasound: An Introductory Manual and Atlas Hardcover	Christoph Frank Dietrich	1 st edition - 2006	Thieme Medical Publisher
6	Practical Handbook of Endoscopic Ultrasonography	Kazuyan Akahoshi, Amol Bapaye	2012 th editon	Springer

PAPER 2 : EDT29
APPLIED GI PHARMACOLOGY

Theory 30 Hours

1. HBT- Indication, instruments, Techniques
2. Oral Manometry- Indication, instruments, Techniques
3. Ano-Rectal Manometry- Indication, instruments, Techniques
4. Fibro Scan- Indication, instruments, Techniques
5. PH metry- Indication, instruments, Techniques

Recommended Books:

Sl. No.	Title	Author	Edition & Year	Publisher
1.	Evaluation of Gastrointestinal Motility and its Disorders	Uday Ghosal	1st ed. 2016 Edition	Springer
2	Gastrointestinal Physiology, 9/E (Pb) by	Johnson	9 th edition - 2018	Elseiver

PRACTICAL 1: EDT30
APPLIED TECHNOLOGY -I

1. ERCP
2. EUS
3. SEMS
4. Endoscopy Accessories

PRACTICAL 2: EDT31
APPLIED GI PHARMACOLOGY

1. HBT
2. Manometry
3. FibroScan
4. PH Metry

Basics of Biomedical Engineering**Topics**

- Insulators and conductors
- Units of measurements
- Electrical power transmission
- Resistors, capacitors and inductors
- Regulated power supply
- Voltage stabilizers
- Uninterrupted power supply systems
- Amplifiers – AC and DC
- Differential amplifiers
- Input impedance
- Output impedance
- Gain and amplification
- Noise
- Common Mode Rejection Ratio (CMRR)
- Filters - Principles
 - High frequency filters
 - Low frequency filters
 - Band Pass filters
- Analog to digital converter (ADC) and Digital Analog converter (DAC)
- Sensitivity & Gain
- Averaging principles

ELS06

Theory: 30 Hours

Fundamentals of Electricity and Electronics:

Resistance: Symbol, units, colour coding equivalent resistance with 'connection in series and parallel.

Capacitance: Symbol, units, series and parallel connection

Inductance and transformers

Parameters of electricity power - voltage, current frequency, power.

Differences between AC and DC - .

AC and DC power supplies, Phase, neutral and earth - conventional colour coding

Ohms law and Kirchoff's law Electrical Circuits.

Earth and grounding - Symbol, importance in patient care.

AC and DC power supplies- Phase, neutral and earth - conventional colour coding

Classification of medical equipment

1. According to type of protection: B C F etc
2. According to mode of protection: Class I -III

Internal Assessment

1. There shall be a minimum of two periodical tests preferably one in each term in theory and practical of each subject in an semester, and the average marks of the two tests will be calculated and reduced to 20 or 10 as applicable and the marks are to be communicated to the University at least 15 days before the commencement of the University examination.
2. The marks of the internal assessment must be displayed on the notice boards of the respective departments.
3. If a candidate is absent for anyone of the tests due to genuine and satisfactory reasons, such a candidate may be given a re-test.

Declaration of result

1. Criteria for pass

- a. **Main Subjects:** A candidate is declared to have passed the examination in a subject, if he / she secure 40% of the total marks in Theory and Practical separately. (Theory includes University written examination and Theory Internal marks. Practical includes University Practical examination marks along with Practical Internal assessment marks and Viva Voce marks). Pass will be declared based on the Paper and not on individual subject. Eg: For Pass in Paper No III (Pathology and Microbiology) of 1st year, A candidate must get in minimum of 40% marks together in Pathology and microbiology.
- b. **Subsidiary Subjects:** The minimum marks for a pass in a subsidiary subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he /she has to appear for both theory and practical in the subject in any subsequent examination and he / she must obtain the minimum for a pass in the subject (theory and practical separately as started para 'a' above).
- d. A candidate shall be declared to have passed the examination if he / she passes in al the main subjects.

Carry over benefit

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he/she is appearing for. Example:-

- If the candidate has not cleared semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- For appearing for semester III he/she should have cleared semester I and can appear for papers pending from semester II along with semester III subjects.
- For appearing for semester IV he/she should have cleared semester II and can appear for papers pending from semester III along with semester IV subjects.
- For appearing for semester V he /she should have cleared semester III and

can appear for papers pending from semester IV along with semester V subjects.

- For appearing for semester VI he/she should have cleared semester IV and can appear for papers pending from semester V along with semester VI subjects.

Declaration of Results (Class):

1. Criteria for pass

- a. Main subject: A Candidate is declared to have passed the examination in a subject, if he/she secures 40% of the total marks in Theory and Practical separately.
- b. Elective Subjects: The minimum marks for a pass in a elective subject shall be 35% of the maximum marks prescribed for a subject and the marks shall be communicated to the University before the commencement of the Practical examination.
- c. In case a candidate fails in either theory or practical, he/she has to appear for both theory and Practical in the subject in any subsequent examination and he/she must obtain the minimum for a pass in the subject (theory and practical separately)
- d. A candidate shall be declared to have passed the examination if he/she passes in all the main subjects.

CUMULATIVE GRADE POINT AVERAGE (CGPA)

Letter grades and grade points equivalent to percentage of mark and performance

10 Point Grade Scale

Percentage of Marks obtained	Letter Grade	Grade Point	Performance
91.00-100	O	10	Outstanding
80.00-89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
40-49.99	P (Pass)	5	Pass
Less than 40	F	0	Fail
Absent	AB	0	Fail

Conversion of Grades in to **Semester Grade Point Average (SGPA):**

$SGPA = \text{Credits} \times \text{grade points} / \text{Total Credits}$

Cumulative Grade Point Average (CGPA) of all six semesters will be calculated as: Total No. of SGPA / No. of Semester

Examiners:

- There should be minimum two examiners, one internal from the same University and one external
- Examiners for the first year subjects shall have postgraduate degree in the respective subject with 3 years of teaching experience or M.Sc. (Medical) with 5 years teaching experience.

SECTION – I

PREAMBLE

- The Master's program of Nutrition and Dietetics provides professional education for those who wish to develop a career in Dietetics, Community Nutrition, Food industry or Nutrition research. The aim of the course is to impart a comprehensive knowledge, skills and to ensure that the students acquire competence including public health, medical nutrition therapy, food service management, communication, management, research and evaluation in nutrition. The candidate will be able to assist Medical and Allied Health Professionals to understand the principles of dietary management and apply, while providing Quality service in relation to nutrition in the Hospital and Community
- Why Master of Science in Nutrition and Dietetics?
With increase in number of communicable and non communicable diseases in the population and also with the increased awareness on nutrition, a structured professional program to train students is essential. These trained students are qualified to implement Medical Nutrition Therapy to the patients in hospitals, clinics and also in community at large.
In many health problems, Medical Nutrition Therapy should be the first line of treatment.

SECTION – II

VISION:

To create a cadre of nutritional professionals and integrate nutritional therapy widely in health care.

MISSION:

The Department of Nutrition and Dietetics is committed to:

- Create and share nutritional knowledge to ensure healthy and quality life
- Promote quality nutritional research

This shall be achieved by following objectives:

Objectives:

- To impart knowledge and develop capacities of the students through higher education in the areas of human nutrition viz. food science, food safety, quality control and food product development.
- Enable the students to assess, evaluate, monitor and interpret the nutritional problems of different disease conditions of the patients or interpretations of various nutritional case studies in the hospitals, community.
- To plan a therapeutic diet according to the individual's requirement in health and disease conditions
- To provide adequate nutritional counseling and to evaluate the nutritional needs of people of all age group. Therapeutic diet counseling of patients in the outpatient department

SECTION-III

Regulations Governing MSc Degree Semester Course

3.1. Eligibility for Admission:

3.1.1 Eligibility: Candidates must have a bachelor's degree from a recognized university in Home Science or Nutrition or Dietetics or Food Science or Biology or Microbiology or Clinical Biochemistry or Life Sciences or BNYS (Naturopathy) or BAMS (Ayurveda) or BHMS (Homeopathy) or PG Diploma in Dietetics with a minimum of 50% marks in aggregate.

3.1.2 The degree should have been obtained from any University recognized by UGC, established by law in India and the medium of instruction for the degree should be English. For international candidates their degree should be recognized by AIU and where medium of instruction may not be English they should have passed any International proficiency test like IELTS, TOEFL etc.

3.1.3 A Candidate who has scored a minimum of 50% of the marks (aggregate of three/four years for graduate degree holders) prescribed for the qualifying examination shall be eligible for the admission to this Course.

3.2. Proposed Intake of Candidates: 20

3.3. Duration of the Course:

The course of study including submission of dissertation on the topic registered shall be semester based, that includes 4 semesters each extending for six months from the commencement of academic semester. At the end of each semester, there shall be a University examination. At the end of Semester IV, there shall be a Final University Examination. Candidate shall submit a dissertation on the topic approved by the University five months prior to Semester IV Examination.

Medium of Instruction and Examination shall be English

Nature of Course: Full Time Course

3.4. Requirement to Complete the Course:

Semester I	+	Semester II	+	Semester III	+	Semester IV	+	Dissertation	+	Intern ship	=	MSc Degree
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3.5. Training, Teaching and Learning Activities:

A candidate pursuing the course shall work in the Department as a full time candidate. No candidate shall be permitted to run a clinic/ laboratory/ nursing home while studying.

Every candidate shall take part in seminars, group discussions, journal review meetings etc. Every candidate shall attend teaching and learning activities during each semester as prescribed by the Department and not absent himself /herself without valid reasons.

A list of teaching and learning activities designed to facilitate acquiring of essential knowledge and skills outlined is given below:

Lectures & Practical's: For all subjects lectures and practical (concerned subject) shall be conducted by the faculty.

Journal Club: Recommended to be held once a week. All the MSc candidates are expected to attend and actively participate in discussion and enter the relevant details in the log book. Further, every candidate must make a presentation from the allotted journal(s), selected articles with special emphasis on public health nutrition related topics, at least two times a year.

Subject Seminar: Recommended once a week. All the MSc candidates are expected to attend and actively participate in discussion and enter in the log book the relevant details. Further, every candidate shall present a seminar on selected topics at least four times a year and have a total of 4 seminars in two years. The presentations would be evaluated using checklist and would carry weightage for internal assessment. A timetable with the subjects and the names of the candidate and the moderator will be scheduled at the beginning of each semester.

Field Visit: Food manufacturing industries, tertiary care hospitals, hotels, food science labs, CDPO office, milk diary and other nutritional departments.

3.6. Attendance and Monitoring Progress:

3.6.1 Attendance:

3.6.1.1 A candidate pursuing MSc Course shall study for the entire period as full time candidate. No candidate shall join any other course of study or appear for any other examination conducted by this University or any other University in India or abroad during the period of registration.

3.6.1.2 Each semester shall be considered as a unit for the purpose of calculating attendance.

3.6.1.3 Every candidate shall attend symposia, seminars, conferences, journal review meetings, dissertation review meetings and lectures during each year as prescribed by the Department/College/University and not absent himself / herself without valid reasons.

3.6.1.4 Candidate who has put in a minimum of 75% of attendance in the theory and practical assignments separately shall be permitted to appear for University examination at the end of each semester.

3.6.1.5 Candidate will be allowed to appear the Semester IV examination only if the dissertation submitted is accepted.

3.6.1.6 Any candidate who fails to complete the course in the manner stated above shall not be permitted to appear for the semester University examinations.

3.6.2 Monitoring Progress of Studies

3.6.2.1 *Log Book:* Every candidate shall maintain a log diary and record his/her participation in the training programs conducted by the Department such as journal reviews, seminars, etc. Special mention shall be made of the scientific presentations in conference by the candidate as well as details of assessment works like essay writing, etc submitted by the candidate. A separate practical book should be maintained for each practical subjects signed by the concerned faculty. The work diary and practical books shall be scrutinized and certified by the Head of the Department and presented in the University viva-voce examination.

3.6.2.2 *Sessional Examination:* Records and marks obtained in sessional test shall be maintained by the Head of the Department and sent to the University, when called for.

3.6.2.3 *Records:* Records and marks obtained in sessional tests, seminars, journal club, field activities, and weekly written assignments which shall be maintained by the Head of the Department and shall be made available to the University.

3.7. Dissertation

3.7.1 *Synopsis:* Every candidate shall submit a synopsis of the intended dissertation work through the guide to the Director Academic Affairs of KAHER through the HOD and Head of the institution, not later than five months from the date of admission to MSc. (Nutrition and Dietetics). The date will be notified by KAHER.

3.7.2 Such synopsis will be reviewed and the dissertation topic will be registered by the University. No change in the dissertation topic or guide shall be made without prior approval of the University.

3.7.3 Every candidate pursuing MSc. Nutrition and Dietetics course is required to carry out work on a selected research project under the guidance of a recognized guide. The results of such work shall be submitted in the form of a dissertation.

3.7.4 The dissertation is aimed to train the candidate in research methodology. It includes identification of the problem, formulation of a hypothesis, review of literature, getting acquainted with recent

advances, designing of a research study, collection of data, critical analysis and comparison of results and drawing conclusions.

3.7.5 Dissertation shall require approval of the Institutional Ethics Committee (IEC) prior to initiation of any dissertation work. Candidate shall work under the supervisor to attain IEC approval. Student shall maintain regular contact with the guide during his/her dissertation work.

3.7.6 The dissertation should be written under the following headings:

Introduction

Objectives

Review of literature

Material and Methods

Results – including tables & graphs

Discussion

Conclusion

Summary

References

Annexures

3.7.7 The written text of dissertation shall be not less than 50 pages and shall not exceed 150 pages excluding references, tables, questionnaires and other annexures. It should be neatly typed with double line spacing on one side of the bond paper (A4 size, 8.27” x 11.69”) and bound properly. Spiral binding is not permitted. The dissertation shall be certified by the guide and co-guide if any, Head of the Department and Head of the Institution.

3.7.8 The dissertation shall be valued by examiners appointed by the University.

3.7.9 A guide shall be a full time postgraduate teacher of a constituent college of KAHER and recognized by KAHER as a guide for supervision of dissertation work.

3.7.10: Change of Guide: Guide may be changed with prior permission from the University.

3.7.11 Submission of Dissertation: Two copies of the dissertation duly certified by the Guide, the Head of Department shall be submitted to the Controller of Examinations, KAHER, through the Head of the Department at least five months before University Examination of semester IV.

3.8 Internship:

Every candidate shall undergo field training for a period of two months in fourth semester at an organization of national recognition for field experience.

Candidate should submit two copies of the training report duly certified by the authorities of the training center in which he/she has undergone training duly accepted and certified by the Head of the Department.

3.9. Schedule of Examination

There shall be a University examination at the end of each semester for all four semesters, Practical and viva-voce. There shall be a dissertation presentation at the end of semester IV in addition to viva voce.

3.10. Scheme of Examination

3.10.1 Sessional Examination

There shall be a minimum of two sessional examinations in each subject conducted by the Department at midterms and before term end in theory and viva-voce.

The sessional marks shall be awarded out of a maximum of 80 for theory and 50 for viva-voce separately as follows and shall be calculated out of 20 marks and 10 marks respectively.

Theory

Written examination 80 marks

The total marks obtained have to be calculated out of 10.

Seminar 10 marks

Journal Club 10 marks

Reports of field visits 10 marks

Practical log book 10 marks

The total marks obtained have to be calculated out of 10.

2 marks will be given to candidates who make scientific presentations in National Conferences

A cumulative total will be calculated out of 20 as “Internal Assessment” (IA) marks

3.10.2 University Examinations

3.10.2.1 Theory:

There shall be four University examinations for the entire course namely I, II, III, IV semester examination. The examination will be conducted at the end of each semester. There shall be three (3) core theory papers and elective papers. All core subjects will have University exam and electives will have college exam. Each theory paper shall be of 3 hours duration carrying 80 marks each.

3.10.2.2 Practical & Viva-voce:

Each candidate shall give practical examination with viva-voce in all semester.

SCHEME OF EXAMINATION FOR THEORY

Question	Number of Questions	Marks	Maximum Marks	Total Marks
Long Essay Questions	2	15	30	80
Short Essay Questions	5	10	50	

MSc. Semester I:

Sr. no	Subject Code	Theory	Subjects	Credit Points	Changes	Credits
1	NADI-1T	Paper 1	Human Physiology and Nutrition Science	4	Human Physiology	4
2	NADI-2 T	Paper 2	Research Methodology and Biostatistics	4	Nutrition Science	4
3	NADI-3 T	Paper 3	Advanced Human Nutrition	4	Advanced H N	4
4	NADI-PI	Practical 1	Advanced Human Nutrition	2	Research Methodology and Biostatistics	4
					Advanced Human Nutrition Practical	2
5	NADI-4	Electives- 2		4	Elective -1	2
6	Dissertation (Synopsis development)		Practical	2		2
Total				20		22

Semester - II

Sr. no	Subject Code	Theory/ Practical	Subjects	Credit Points	Changes	Credit Points
1	NADII-1 T	Paper 1	Nutritional Biochemistry	4	Nutritional Biochemistry	4
2	NADII-2 T	Paper 2	Principles of Food Science	4	Principles of Food Science	4
3	NADII-3 T	Paper 3	Food Microbiology and Safety	4	Food Microbiology	3
					Food Safety and Preservation	3
4	NADII PI	Practical I	Principles of Food Science	2	Principles of Food Science	2
5	NADII-4 T	Elective 2		4	Elective-1	2
6	NAD II P	Practical	Dissertation (Synopsis development)	6	Dissertation (Synopsis development)	6
				24		24

SEMESTER III

Sr. no	Subject Code	Theory	Subjects	Credits	Changes	Credits
1	NADIII-1T	Paper 1	Food Service Management	4	Food Service Management	4
2	NADIII-2T	Paper 2	Therapeutic Nutrition -I	4	Clinical Nutrition & Dietetics -I	4
3	NADIII-3T	Paper 3	Community Nutrition	4	Community Nutrition	4
4	NADIII-1PI	Practical I	Food Service Management	2	Food Service Management	2
5.	NADIII-PII	Practical II	Therapeutic Nutrition-I	2	Clinical Nutrition & Dietetics -I	2
6	NADIII-4T	Elective 2		4	Elective -1	2
7	NADIII P2		Dissertation (Data collection and analysis)	4	Dissertation (Data collection and analysis)	4
Total				24		22

SEMESTER IV

Sr. no	Subject Code	Theory	Subjects	Credits	Changes	
1	NADIV-1T	Paper 1	Therapeutic Nutrition –II	4	Clinical Nutrition & Dietetics - II	4
2	NADIV-2T	Paper 2	Nutraceuticals and Functional Food	4	Functional Foods and Nutraceuticals	4
3	NADIV-PI	Practical	Therapeutic Nutrition –II	2	Clinical Nutrition & Dietetics –II	2
4	NADIV-PII	Practical	Master Dissertation – Part II – Evaluation	08	Master Dissertation – Part II – Evaluation	10
5	NADIV-3	Elective 2		4	Elective -1	2
6		Internship		10		10
Total				32		32

(D) Practical Examination

All Practical will have University examinations.

Sr. no	Theory	Practical + IA + Viva	Grand Total
1	Practical (Major 40 + Minor 20)	60 + 20 + 20	100

3.10.3. Dissertation Valuation:

The examiners appointed by the University shall evaluate the dissertation. Approval of dissertation work is an essential prerequisite for a candidate to appear in the semester IV University examination. The dissertation shall be valued by two evaluators (examiners) one within the University and one outside. Any one-evaluator acceptance will be considered as a prerequisite for eligibility to take up the examination.

3.10.3.1 Viva-Voce and Defense Examination: The viva-voce and defense examination shall aim at assessing the depth of knowledge, logical reasoning, confidence and oral communication skills.

The viva – voce and defense examination shall be held after the submission of dissertation. If a candidate fails to submit the dissertation on or before the date prescribed, his/her viva-voce and defense shall be conducted during the subsequent University examination.

3.10.3.2 Examiners: There shall be at least two examiners, out of them one shall be external examiner and the other internal examiner.

3.11. Criteria for Declaring Pass

3.11.1 A candidate shall be declared to have passed MSc if all the conditions below are fulfilled:

MSc. (Nutrition and Dietetics)-Semester I:

- Candidate who secures Grade B or above in each subject in theory & practical of University examinations

MSc. (Nutrition and Dietetics)-Semester II

- Candidate who secures Grade B or above in each subject in theory & practical of University examinations

MSc. (Nutrition and Dietetics)-Semester III

- Candidate who secures Grade B or above in each subject in theory & practical of University examinations

MSc. (Nutrition and Dietetics)-Semester IV

- Candidate who secures Grade B or above in each subject in theory & practical of University examinations
- Candidate shall further obtain Grade B or above in viva-voce.

Candidate has to pass practical and theory examinations separately. (eg: If a candidate fails in theory examination but passes in practical examination, he/she has to appear for theory examination only.)

3.11.2 Carry over:

At any given point of time a candidate shall have subjects pending to clear of only previous semester in addition to the subjects of the current semester that he is appearing for. e.g:

- If the candidate has not passed semester I, he/she can appear for semester II and pending subjects of semester I simultaneously.
- Appearing for semester III he/she should have passed semester I and can appear for papers pending from semester II along with semester III subjects.
- Appearing for semester IV he/she should have passed semester II completely and can appear pending papers of semester III simultaneously.

Cumulative Grade Point Average (CGPA)

Letter Grades and Grade Points equivalent to percentage of marks and performances

10 Point Grade Scale

Percentage of marks obtained	Letter Grade	Grade Point	Performance
90.00 - 100	O	10	Outstanding
80.00 -89.99	A+	9	Excellent
70.00-79.99	A	8	Good
60.00-69.99	B+	7	Fair
50.00-59.99	B	6	Average
Less than 50	F	0	Fail
Absent	AB	0	Fail

1. Conversion of Grades in to GPA:

GPA= Credits x Grade Points / Total Credits

2. **Cumulative Grade Point Average (CGPA)** of all 4 Semester will be calculated as:

Total No. GPA / No. of Semester

**SECTION-IV
COURSE CONTENT**

4.1 SEMESTER I

Sr. no	Subject Code	Theory	Subjects	Credit Points
1	NADI-1T	Paper 1	Human Physiology a	4
2	NADI -2T	Paper 2	Nutrition Science	4
3	NADI-3 T	Paper 3	Research Methodology and Biostatistics	4
4	NADI-4 T	Paper 4	Advanced Human Nutrition	4
5	NADI-PI	Practical 1	Advanced Human Nutrition	2
6	NADI-5	Electives		2
7	Dissertation (Synopsis development)		Practical	2
Total				22

**Note- Choose 1 elective (from List of Electives) amounting to 2 CREDITS.*

THEORY

Semester I

NAD-I-1T Human Physiology

Section A

Subject: Human Physiology

Theory 60 Hours

General Physiology (3 Hours):

- Structure of Cell membrane and Cell Organelles
- intercellular junctions.

Blood (6 Hours) :

- Composition and functions of blood and plasma proteins
- Erythropoiesis & its regulation, Anemia
- Leucopoiesis and its regulation
- Blood Groups: ABO and Rh blood group systems
- Hemostasis
- Immunity
 - Immune System

- Classification
- Specific and Non Specific Defense Mechanisms
- Antibodies

Cardiovascular System (6 Hours):

- Physiological Anatomy of Heart
- Cardiac Cycle – Definition and Phases
- Cardiac Output - Definition, factors and measurement of cardiac output
- Blood pressure - Definition, Determinants & factors affecting blood pressure, regulation of blood pressure, Hypertension
- **Normal Electrocardiogram – Definition, Waves and Uses (Deleted)**

Respiratory System (5 Hours):

- Physiological Anatomy of Respiratory System and Functions,
- Concept of Dead Space,
- Mechanism of Respiration,
- Lung volume and capacities,
- Surfactant, definition of compliance,
- Transport of Oxygen, ODC Curve and CO₂ transport,
- Neural and Chemical Regulation of Respiration,
- Cyanosis, Dyspnea, Apnea, Hypoxia – definition and types

Digestive System (5 Hours):

- Functional Anatomy of GIT
- Composition & functions of saliva
- **Composition of gastric juice, mechanism & regulation of HCL secretion (rearranged)**
- Composition and functions of pancreatic juice
- Functions of Liver and bile Juice
- Jaundice and it types
- Movements of GI Tract - Deglutition, Movements of Small Intestine.
- **Digestion and Absorption of Macronutrients, Stomach Emptying, Gastric Secretion, Secretions of Small Intestine & Large Intestine, Functions of Gall bladder, Bile Juice (added)**
-

Excretory System (5 Hours):

- Functional anatomy of kidneys,
- Structure of a nephron,
- Features of renal circulation,
- Juxtaglomerular apparatus,
- Mechanism of Urine formation,
- Micturation: Muscles of the bladder, nerves of bladder, pressure rise in bladder, control of micturation, Cystomatrogram, Diuretics & concept of Artificial Kidney

Reproductive System (5 Hours):

- **Sex determination & differentiation (deleted)**
- Development of gonads & genitalia
- Puberty, Pubertal changes
 - Male Reproductive System:
 - Male reproductive organs
 - Spermatogenesis
 - **Morphology of a sperm, Semen (deleted)**
 - Factors influencing spermatogenesis
 - Functions of testosterone
- Female Reproductive System:
 - Female reproductive organs
 - Oogenesis
 - Ovulatory cycle with its hormonal basis
 - **Tests for Ovulation Menstrual cycle with its hormonal basis (deleted)**
 - Functions of Estrogen & Progesterone

Nervous System (5 Hours):

- Organization of CNS-
- Introduction, Structure of neuron
- Properties of nerve fiber, Axonal Transport, Classification of nerve fibers
- Nerve injury – degeneration & regeneration
- Definition of synapse, receptor & reflex
- Functions of Various parts of Brain:
 - Cerebellum
 - Basal ganglia
 - Hypo thalamus
 - Thalamus
 - Autonomic Nervous System
- Temperature Regulation:
 - Normal temperature of body
 - Regulation of body temperature & Fever

Endocrines (5 Hours): Major Endocrine glands

- Pituitary Gland: Anterior & Posterior Pituitary Hormones and functions
- Thyroid Gland: Hormones Secreted and Functions, Goiter
- Adrenal Gland: Hormones secreted by adrenal cortex and medulla and their functions
- Pancreas: Endocrine Hormones of Pancreas and their functions, Diabetes Mellitus
- Parathyroid Gland: PTH, calcitonin and its actions

Suggested Readings:

- Guyton and Hall. Medical physiology, 12th edition.
- Saunder- An imprint of Elsevier. 2003.
- Anil Baran Singha Mahapatra. Essentials of Medical physiology. Second edition. Kolkata,

Mumbai. Current Books International, 2006. p.300 14.

- Chandi Charan Chatterjee, Human Physiology, Vol. 2. Calcutta, Medical Allied Physiology, 2004.
- Review of medical physiology, Ganong 23rd edition. Blood as circulating fluid. 2010.
- K Sembulingam, Prem Sembulingam. Essentials of Medical Physiology.

NAD-I-1T Nutrition Science:

Section B

Nutrition Science:

Theory 45 Hours

- **Introduction to Nutritional Science:**
 - Definitions,
 - History,
 - Nutrition research in India, **Recent Findings**
- **Recommended Dietary Allowances:**
 - Factors affecting RDA
 - general principles
 - determination of RDA
 - Requirements and RDA
 - Reference man and reference woman
 - **Concept of My Healthy Plate**
- **Energy Metabolism and basics of nutrition:**
 - Energy requirement in humans: Basal metabolic rate (BMR), physical activity, and thermic effect of food (formerly termed specific dynamic action)
 - Basal metabolic rate: Definition, factors affecting and measurement
 - **TEE, REE, Factors affecting, TEF, PA**
- **Carbohydrates:**
 - Classification: Monosaccharide's, Oligosaccharides, Polysaccharides,
 - Nutritional importance,
 - Dietary carbohydrate (dietary sources) type of carbohydrate in commonly used food items, dietary fibers.
 - **Dietary Fibers -Addition of types, sources, RDA, physiological and metabolic effects, role in prevention of diseases. Glycemic Index**
- **Lipids:**
 - Classification of lipids general and Properties,
 - Plasma lipids classification,
 - Nutritional importance,
 - Role to provide energy, Dietary lipids sources.
 - Type of lipids in commonly used food items.
 - **EFA- Types, Functions, Nutritional Importance, RDA, Sources, deficiency manifestation of**

EFA

- **Proteins:**

- **Amino Acids**

- **Classification and Properties**

- **Proteins**

- Nutritional Classification and Properties
 - Structure of Proteins (overview)
 - Role in the body
 - Assessment of nutritional value of proteins
 - Limiting amino acids and mutual supplementation
 - Nitrogen balance: Positive and negative nitrogen balance

- **Vitamins:**

- fat and water Soluble - Sources, RDA, Functions, Absorption in GIT, Deficiency manifestations, Toxicity if any
 - digestion, transport, metabolism and storage for all vitamins

- **Minerals:**

- Calcium, Phosphorus, Magnesium, Iron, Iodine, Zinc, Selenium, Copper, Chromium Cobalt, Manganese
 - Fluoride - Sources, RDA, Functions, Absorption in GIT, Deficiency manifestations, Toxicity if any
 - digestion, transport, metabolism and storage for all minerals

- **Water and electrolytes in diet:**

- Intake and output of water,
 - Distribution of water in the body (ICF & ECF),
 - Electrolyte composition of body fluids,
 - Isotonic/hypotonic/hypertonic contraction and expansion of ECF
 - Water balance and Thirst Mechanism, Oedema, Electrolyte balance (Na⁺, K⁺)

NAD-I-2T

Subjects: **Research Methodology and Biostatistics**

Theory 60 Hours

Research Methodology:

- Introduction to Research Methodology
- Developing a Research Plan
 - Research Problem
 - Research Question
 - Research Hypothesis
 - Variables
- Study designs (Qualitative & Quantitative)
 - Epidemiological study designs: Cross Sectional, Cohort, Case Control
 - Experimental Design: Randomized, Non randomized,

- Causal association
- Overview of Qualitative Research Methods
 - Comparing Quantitative and Qualitative Research
 - Sampling in Qualitative Research
 - Recruitment in Qualitative Research
 - Participant Observation
 - In-Depth Interviews
 - Focus Groups

Bio- Statistics:

- Introduction to Biostatistics
- Data – Definition and Types
- Methods of data collection
- Organization of data
- Measures of central Tendency and dispersion
- Sample size and Sampling method
- Testing of Hypothesis
- Parametric methods
- Non parametric methods

Suggested Readings:

- Research Methodology By C. R Kothari Publisher : NEW AGE (2013-09-01)
- Leon gordis : Epidemiology, 5th edition, Elsevier saunders, 1600 John F Kennedy. Blvd. Ste.1800, Philadelphia, PA 19103-2899
- World Health Organization: Health Research Methodology A Guide for Training in Research Methods

NAD-I-3T Advanced Human Nutrition

Theory : 60 hours

PAPER: NADI-1

Unit 1- Introduction to Nutrition (Repeat)

- Definitions
- History
- Nutrition research in India
- Future research

Unit 2- Nutritional Requirements and Food Security for Adults

- Nutritional Requirements
- Food Security
- Low Cost Balanced Diets

Unit 3- Nutritional and Food Requirements for Infants

IYFC Guidelines

- Growth and Development during Infancy
- Nutritional Requirements
- Food Requirements

Unit 4- Nutritional and Food Requirements for Preschool Children (1-6 years) and

School Children (6-12 years)

- Nutritional Requirements
- Factors affecting Nutritional Status
- Food Requirements
- Nutrition Related Problems of Preschoolers
- Packed Lunches
- School Lunch Programmes

Unit 5 - Nutritional and Food Requirements during Adolescence

- Nutritional Requirements
- Food Habits
- Nutritional Problems

Unit 6 - Nutritional and Food Requirements for Expectant Mothers

- Physiological Changes
- Nutritional Requirements
- Dietary Modifications
- General Dietary Problems
- Complications
- Nutritional Problems

Unit 7 - Nutritional and Food Requirements for Lactating Women

- Role of Hormones
- Nutritional Requirements
- Food Requirements
- Indian Nursing Mothers

Unit 8 - Nutritional and Food Requirements during Old Age

- Process of Ageing
- Nutritional Requirements
- Food Requirements
- Nutritional Related Problems of old age
- Degenerative Diseases

Suggested Readings:

- Briggs, G. M. & Doers K. Collaway: Bogery Nutrition And Physical Fitness (9th Ed.) Saunders, Philadelphia, 1979.
- Chaney, M. S. Rose M.L. & Wischi J. C. Nutrition, Houghton Mifflin, Boston, 1979.
- Guthrie H.: Introductory Nutrition (6th Ed.) Times Mirror/Mostry College Publishing, 1986.
- Robinson, Lawler: Normal & Therapeutic Nutrition (17th Ed.) Macmillan Publishing Co. 1986.
- Swaminathan S.: Advanced Textbook On Food & Nutrition Vol. 1 & N (2nd Ed. Revised _ Enlarged) Bapp Co. 1985.
- Robinson. Basic Nutrition And Diet Therapy (8th Edition)
- Krause' s Food and Nutrition Therapy 2010, 12th Edition
- Wildman, R.E.C. ed. (2000) Handbook of Nutraceuticals and Functional Foods, CRC Press, Boca Raton.
- Indian Council of Medical Research. Nutritive Value of Indian Foods –Latest Publication.
- Indian Council of Medical Research. Recommended Dietary Intakes for Indians – Latest Recommendations.

NAD-I- P Advanced Human Nutrition

- Preparation of Standardized Recipes
- Planning of Protein and Energy rich dish.
- Planning of Vitamin A rich dish.
- Planning of Vitamin B1 rich dish.
- Planning of Vitamin B2 rich dish.
- Planning of Vitamin B3 rich dish.
- Planning of Vitamin C rich dish.
- Planning of Calcium rich dish.
- Planning of Iron rich dish.
- Planning of weaning food for infants (6 -12 months)
- Planning of mid-day meal for school children
- Planning of low cost nutritious recipe for pregnant women.
- Planning of low cost nutritious recipe for lactating mothers

NAD-I-4 & 5

Subject: Electives

SEMESTER II

Sr. no	Subject Code	Theory/ Practical	Subjects	Credit Points
1	NADII-1 T	Paper 1	Nutritional Biochemistry	4
2	NADII-2 T	Paper 2	Principles of Food Science	4
3	NADII-3 T	Paper 3	Food Microbiology	3
4	NADII-4 T	Paper 4	Food Safety	3
5	NADII PI	Practical I	Principles of Food Science	2
6	NADII-4 T	Elective 1		2
7	NAD II P	Practical	Dissertation (Synopsis development)	6
Total				24

**NOTE: Choose 2 electives (from List of Electives) amounting to total of 2 CREDITS each*

NAD-II-1 T Nutritional Biochemistry

Subject: Nutritional Biochemistry

Theory 50 Hours

- **Digestion, Absorption and Transport** of Carbohydrates, Proteins and Lipids and related disorders.
- **Metabolisms:**
- Carbohydrate :
 - Glycolysis – Pathway, Energy Production, Regulation, Oxidation of Pyruvate to Acetyl CoA
 - Citric Acid Cycle: Pathway and its regulation, Significance, Energy Production
 - Gluconeogenesis: Gluconeogenesis-Substrates, Gluconeogenesis-Pathway, Regulation of Gluconeogenesis
 - Metabolism of Glycogen: Glycogenesis and Glycogenolysis, Regulation, Glycogen Storage Disorders
 - HMP shunt pathway (over view) and Essential pentosuria
 - Metabolism of fructose and galactose and related disorders
 - Regulation of Blood Glucose level

- **Lipids:**

- Lipid Metabolism: Oxidation of Fatty Acids- Energetics, Regulation of beta oxidation and related disorders
- Ketone body metabolism- Denovo Synthesis of Fatty Acids , Regulation
- Metabolism of Triacylglycerols (over view), Metabolism of Cholesterol- Regulation, Lipoprotein Metabolism (over view), Dyslipidemia

- **Amino Acid Metabolism:**

- Transamination Reaction, Deamination Reaction
- Urea Cycle and related disorders, Metabolism of Glycine, Branched chain Amino Acids, Aromatic amino acids, Sulphur containing Amino Acids, Histidine
- Synthesis of Specialized Products from Amino Acids: Thyroxine, Melanin, Serotonin, Histamine, Melatonin, Dopamine.
- Disorders associated with amino acid metabolism : Phenylketonuria (Phenylpyruvic Oligophrenia), Maple Syrup Urine Disease (MSUD)

- **Nucleotide Metabolism:**

- Purine Nucleotide Synthesis-De Novo Synthesis (over view), Salvage Pathway for Purines (over view), Degradation of Purine Nucleotides, Pyrimidine Metabolism (over view)

- **Antioxidants :**

- Antioxidants and Free Radicals, Production of Oxygen Free Radicals,
- Physiological Mechanisms to Limit Free Radical Damage, Free Radical in Human Pathology and Disease,
- Natural and Diet-Derived Antioxidants

- **Enzymes and Coenzymes:**

- Definition Nomenclature and Classification of Enzymes, Specificity of Enzymes, Mechanism of Enzyme Activity, Factors Affecting Enzyme Activity, Enzyme Inhibition. Role of Coenzymes and cofactors in enzyme activity.

- **Vitamins in nutrition:**

- Water soluble vitamins :
 - Vitamin C, thiamin, riboflavin, niacin, pantothenic acid, biotin, folic acid.(Physicochemical properties, stability, biochemical indicators).
- Fat soluble vitamins :
 - Vitamin A, D, E and K (.Physicochemical properties, stability, biochemical indicators, factors affecting requirements
 - Vitamin A – role in visual cycle.
 - Vitamin D- Formation in the skin, photochemical regulation and factors affecting synthesis of vitamin D3 in human body.
 - Vitamin E – Vitamin E as a part of endogenous antioxidant system
 - Vitamin K – Role in blood clotting process.

- **Minerals in Nutrition:**

- Macro Minerals: (Physicochemical properties, stability, biochemical indicators).
- Micro minerals: (Physicochemical properties, stability, biochemical indicators).

- Ultra-trace minerals – (Physicochemical properties, stability, biochemical indicators).

Suggested Readings

- Harvey, Richard A., and Denise R. Ferrier. Biochemistry. Sixth Edition Lippincott Williams & Wilkins, 2011.
- Orten, James M., and Otto Wilhelm Neuhaus. Human biochemistry. CV Mosby
- Vasudevan, D. M., and S. Sreekumari. "Text book of Biochemistry. Eight Edition Jay Pee Brothers." (2016).
- AOAC, 1995, Association of Official Analytical Chemists. Washington, DC.
- Gruenwedels, D.W. and Whitakor, J.R., 1984, Food Analysis: Principles and Techniques. Vols. I-VIII. Marcel Dekker.
- Joslyn, M.A., 1970, Methods in Food Analysis: Physical, Chemical and Instrumental Methods of Analysis. Academic Press.
- Pomeranz, Y. and Molean, C.E., 1977, Food Analysis Theory and Practice. AVI Publ.
- Sawhney, S.K. and Singh, R., 2000. Introductory Practical Biochemistry. Narosa.

NAD-II-2 T Principles of Food Science

Subject: Principles of Food Science

Theory 45 Hours

Unit 1: Introduction to Food Science **2 hrs**

Unit 2: Properties Of foods

- Quality Attributes
- Gustation
- Texture
- Colour

Sensory Evaluation **4 hrs**

- Definition
- Types of tests, Objective Evaluation
- Selection of Panel Judges
- Preparation of samples

Unit 3: Simple sugars and polysaccharides

- Chemistry, Functionality and their role in food industry
- Characteristics and Functional Properties of Starches

Cereals and Millets. **7 hrs**

- Structure, Composition, Nutritive Value and significance
- Millets and its Products - Nutritional Significance.
- Effect of cooking on nutrient composition.
- Starch - Gelatinization, Malting, Retrogradation, Syneresis, Dextrinization, Gluten Formation, Fermentation
- Role Cereals in cookery
- Cereal based convenience food – Food of the future
- Sugar – Properties, Stages of sugar and jaggery syrup, Role of sugar and jaggery in

cookery.

Unit 4 Proteins

Classification, composition and biological functions

Functional properties

Protein concentrates, hydrolysates and isolates

Pulses and Legumes

5hrs

Composition, Nutritive value and significance, Toxic constituents

Processing of pulses, legumes, dals, lentil – decortication, soaking, germination, fermentation, roasting, puffing

Role of pulses in cookery

Effect of cooking on nutrient composition.

Nutritional significance of Pulses.

Vegan Protein -Protein concentrates, hydrolysates and isolates

Unit3: Lipids

Classification and Composition

Functional properties

Deep fat frying

Deteriorative changes in fats and oils

Unit 5 Fats and Oils

Classification, Composition, Nutritive Value and significance

Chemical and Physical properties

Functional and Nutritional properties

Effect of processing and storage on fats and oils

Emulsion, Rancidity, Polymerisation

Unconventional Oils and fat substitutes.

Nuts and Oilseeds

Composition, Nutritive value and significance, Toxic constituents

Effect of processing and storage on Nuts and Oil Seeds

Role of Nuts and Oil Seeds in cookery

Extraction, Refining and Processing of Oils

Unit 6: Vitamins and Minerals

Vitamin A

Vitamin B complex

Vitamin C

Vitamin D

Vitamin E

Vitamin K

Minerals

Classification

Nutritional and functional role

Effect of processing on minerals

Unit 6: Vegetable and Fruits

Classification, Composition and Nutritive Value and significance

Compounds Present – Pigments, organic acids, enzymes, flavour compounds

Post Harvest changes and nutrient losses

Effect of processing and storage – vegetables and fruits

	<p>Non enzymatic Reaction and its prevention Role of vegetables and fruits in cookery Fungi and Algae as food</p>
Unit 7:	<p>Introduction to Food processing Traditional Methods of food processing Methods of Food processing: Thermal processing, dehydration, Microwave Processing, Fermentation, Deep fat frying</p>
Unit 7:	<p>Milk and Milk Products Composition, nutritive value and significance, Physical properties Effect of processing on Milk and its products Microbial spoilage Role of Milk in cookery – coagulation of milk proteins, Milk products and its substitutes – Fermented and unfermented products.</p>
Unit 8:	<p>Effect of Processing and storage on foods Alteration occurring in fruits and vegetables Alteration occurring in milk and milk products Alteration occurring in meat and poultry, fish and eggs Alteration occurring in cereals and legumes Alteration occurring in nuts and oilseeds</p>
Unit 8:	<p>Egg Composition, nutritive value and significance, Physical and functional properties Effect of processing on Egg and its products Microbial spoilage – Quality, testing, grading Role of Egg in cookery – coagulation of milk proteins.</p>
Unit -9:	<p>Animal Food Composition, Classification, nutritive value and significance, Physical properties, selection, post mortem changes, Aging, cuts and grades Effect of processing on Poultry, Fishes, Meat, and its products Microbial spoilage – Preservation and storage. Poultry, Fishes, Meat cookery – coagulation of proteins.</p>
Unit 10:	<p>Introduction to Food processing Traditional Methods of food processing Methods of Food processing: Thermal processing, dehydration, Microwave Processing, Fermentation, Deep fat frying.</p>
Unit 11:	<p>Emerging trends in Food Technology Processed and Convenience Food Food Fortification</p>

Suggested Readings:

- Paul P.C. And Palmer H.H. (1972): Food Theory And Application John Wiley And Sons, London
- Griswold, R.M. (1979): The Experimental Study Of Food, Houghton Mifflin Boston.

- Peckham G.C. and Freeland-Graves, J.H. (1979): Foundation Of Food Preparation, 4th Edition Macmillan Publishing Co .Inc .New York
- Bennion, Marion And O. Hughes (1986): Introductory Foods, Macmillan, New york
- Maryland R.E and Welsby D.A (1980), Basic Cookery, Fundamental Recipes and variations, William Heinemann Ltd. London
- Charley M. J (I 982) : Food Science (2ndEd), John Wiley And Sons.
- Finch C.F. (1984), Food Preparations, MacDonald and Evans Ltd. Plymouth.
- McGee, H (1984): Food and Cooking, Charles Scribers and Sons, New York.
- Achayya, K.T.:(1998) A Historical Dictionary Of Indian Foods, Oxford Publishing Co.
- 10.Belitz, H.D. and Grosch W., (1999): Food Chemistry, (2nded), Springer, New York

NAD-II-3 T

Subject: Food Microbiology

Theory 40 Hours

Food Microbiology:

- Basic Concept, History of Food Microbiology
- Role of Microbiology in Biotechnology
- Role of Microorganisms in Fermented Food:
 - Fermented Baked Preparations
 - Fermented Vegetable Foods
 - Fermented Soya Bean Products
 - Fermented Dairy Products
 - Other Fermented Food Preparations
 - Economically Important Fermentation Products
 - Other Uses of Microbes in Industry

Occurrence and Growth of Microorganisms in Foods:

- Introduction, Microbiology of Air, Water and Soil
- Sources of Foods Contamination
- Factors affecting the growth of Microorganisms :
 - Nutrition, Oxygen, Temperature,Moisture Requirement - The Concept of Water Activity, Osmotic Pressure, Hydrogen Iron Concentration –Ph , Light,
- Control and Destruction of Microorganisms

Food Hazards of Microbial Origin:

- Introduction, Types of Food Borne Diseases,
- Food Borne Intoxications - Staphylococcal Poisoning, Bacillus Cereus Poisoning & Botulism,
- Food Borne Infections – Salmonellosis, Shigellosis(Bacillary Dysentery), Vibrio Parahaemolyticus Gastroenteritis, Enter Pathogenic Escherichia Coli Diarrhoea, Hepatitis A & Shellfish Poisoning,
- Food Borne Toxic Infections - Clostridium Perfringens Gastroenteritis,Enterotoxigenic

Escherichia Coli Gastroenteritis, Cholera, Listeriosis, Yersinia Enterocolitica Gastroenteritis & Campylobacter Jejuni Diarrhoea,

- Mycotoxins – Aflatoxicosis, Deoxynivalenol Mycotoxicosis, Ergotism,
- Food Borne Diseases due to Naturally Occurring Toxicants - Lathyrism, Veno-Occlusive Diseases (Vod), Epidemic Dropsy

Food Spoilage:

- Introduction, Factors Responsible for Food Spoilage, Chemical Changes due to Spoilage,
- Spoilage of Different Foods –
 - Meat,
 - Poultry and Poultry Products
 - Fish and Other Sea foods
 - Fruit and Vegetables
 - Cereals and Cereal Products
 - Milk and Milk Products
 - Soft Drinks, Fruit Juices, and Fruit Preserves
 - Miscellaneous Products

Food Contaminants:

- Introduction, Food Contamination, Naturally Occurring Toxicants in Animal Foods and Plant Foods
- Anti-Nutritional Factors in Foods
- Environmental Contaminants -Biological Contaminants, Pesticide Residues, Veterinary Drug Residues, Heavy Metals & Miscellaneous Contaminants

NAD-II-4 T

Subject: Food Safety

Theory 40 Hours

Food Adulteration:

- Introduction, Food Adulteration
- Food Commonly Adulterated
 - Common Adulterants,
 - Classification of Adulterants,
 - Harmful effects of Adulterants
 - Methods for Detection of some Adulterants

Food Safety:

- Introduction, Factors Affecting Food Safety - Physical Hazard, Biological Hazard & Chemical Hazard, Microorganisms in Foods: Bacteria, Fungi, Yeasts, Moulds, Viruses, Parasites. Recent Concerns of Food Safety: Prions, Concerns of Genetically Modified Foods, Concern of Dioxin-Contaminated Foods
- Natural toxins in food- An overview, Regulatory concerns.
- Food laws and regulations – concepts and trends in Food Legislation.

- International and Federal standards – WHO, FAO, Codex, ISO series. Food laws in India, Governing bodies- Bureau of India standards (BIS), AGMARK, Food Safety and Standards Act, 2006 (FSSAI), Prevention of Food Adulteration Act (PFA), Milk and Milk Products order (MMPO), Meat Food Products Order (MFPO), Fruits Products order (FPO). Food policies, Food certification, Nutritional labelling
- Exposure, estimation, toxicological requirements.
- Safety aspects of water and beverages such as soft drinks, tea, coffee, cocoa.
- Safety assessment of food contaminants and pesticide residues.
- Safety evaluation of heat treatments and related processing techniques

Food Regulations

- Standards and Quality Control: Introduction,
- The Prevention of Food Adulteration Act 1954,
- Compulsory National Legislations
- Voluntary Based Product Certifications.
- **HACCP :**
 - Food Regulations – Standards and Quality Control,
 - The HACCP Status in India.
 - A Food Safety Assurance System:
 - Need for HACCP,
 - Benefits of HACCP,
 - Principle of HACCP,
 - Guidelines for Application of HACCP Principles
 - **Food Preservation, Food Packaging, Food labelling, Food Additives**

Suggested Readings:

- Frazier, C. and Westhoff D. C. Food Microbiology, 4th ed., 1988 New York.
- Pelezar, M. (1988) Microbiology V ed., McGraw Hill, N. Y.
- James, M. Jay. Modern Food Microbiology 4th ed., CBS Publishers, New Delhi
- Frobisher M. et. Al. (1974) Fundamentals of Microbiology -9th ed., W.Savenders Co.
- Baanwart, G.J. (1987) Basic Food Microbiology CBS Publishers, New Delhi

NAD-II-1 P

Food Science

Practical: 45 Hours

PRACTICALS:

- Sensory Evaluation of Food – Score Card Preparation
- Study of preparation variables and quality factors of products from the following food commodities
- Cereal cookery:
- Preparation of different types of rice to study the effect on cooking time and volume of water

absorbed.

- Factors affecting gluten formation
- Pulses and legumes
- Effects of various methods of cooking and processing on characteristics of pulses.
- Preparation of soya milk and tofu.
- Milk and egg
 - Preparation of chana
 - Preparation of khoa
 - Studying the textural characteristics of curds prepared using different milk (cow, buffalo and dairy milk)
- Flesh foods
 - Determining the storage stability of eggs stored at – room temperature, refrigerated temperature and fresh eggs
 - Preparation of products to determine the functionality of egg in cookery
- Sugar and jaggery
 - Preparation of fondants
 - Preparation of sugar and jaggery based Indian sweets.

NAD-II-4 & 5 T

Electives

One week Workshop and Exams have to be conducted at the end of workshops at College level.

SEMESTER III

Sr. no	Subject Code	Theory	Subjects	Credits
1	NADIII-1T	Paper 1	Food Service Management	4
2	NADIII-2 T	Paper 2	Therapeutic Nutrition -I	6
3	NADIII-3 T	Paper 3	Community Nutrition	4
4	NADIII-1 PI	Practical I	Food Service Management	2
5.	NADIII- PII	Practical II	Therapeutic nutrition-I	2
6	NADIII- 4T	Elective 1		2
7	NADIII P2		Dissertation (Data collection and analysis)	2
Total				22

** NOTE: Choose 2 electives (from List of Electives) amounting to total of 2 CREDITS each*

NAD-III-1T Food Service Management

Theory 45 Hours

Institutional Food Management

- Evolution of food service industry
- Principles of Management
- Functions of Management
- Organization Chart
- Leadership

Management of Spaces

- Kitchen Spaces
- Storage Spaces
- Service Spaces

Equipment

- Catering Equipment
- Selection of Equipment
- Equipment Design, Installation and Operation
- Purchasing Equipment
- Care and Maintenance of Equipment

Food Management

- Characteristic of foods
- Food Purchasing
- Menu Planning
- Food Production
- Food Service
- Dishwashing

Financial Management

- Definition and Scope
- Cost Concepts

- Cost Control
- Pricing

Personnel Management

- Introduction
- Recruitment, Selection and Induction
- Training and Development

Hygiene, Sanitation and Safety

- Hygiene and Sanitation
- Safety
- **Food Standards in India**

Suggested Readings:

- Sethi Mohini. 2nd Edition. (2016) Institutional Food Management, New Age International Publishers.
- Sethi M. and Malhan S.– 3rd Edition (2015) – Catering Management An Integrated Approach. New Age International Publishers.
- Arora R. K. (2007). Food Service and Catering Management. A.P.H. Publishing Corporation, New Delhi.
- Kinton R. and Ceserani V. (1992). The Theory of Catering. ELBS with Hodder and Stoughton.
- Scanlon N.L. (2007). Catering Management. John Wiley and Sons, Inc.

NAD-III-1 P Food Service Management

Food service management

Quantity Cooking: Basic Principles

- Market Survey
- Analysis of the relationship between the purchased amount, edible portion and cooked weight of foodstuffs
- Standardized Recipe

Planning Meals for Institutional Feeding:

- Planning a Mid-Day Snack for preschool Children.
- Planning Meals for College Canteen
- Planning meals for College Hostel Mess
- Planning meals for Working Women Hostel.

Planning and Organization for Industrial Catering:

- Planning Meals for Industrial Canteen.
- Planning Meals for Railway Base Kitchen.

Catering for Special Occasions and Events:

- Planning Meals for a Birthday party.
- Planning Meals for a Cocktail party.
- Planning Meals for a Convention/ Conference.

- Visit to a food service establishment to study its planning and functioning

NAD-III-2 T Clinical Nutrition-I

Theory 45 Hours Therapeutic Diets:

- Basic Concept
- Therapeutic Adaptation of Normal Diet
- Factors Considered
- Routine Hospital Diets
- Mode of feeding methods
- Role of dietitian in the Hospital and Community
- Patient Care and Counseling

Diet in Weight Imbalance and Counseling:

- Obesity and Underweight
 - Causes
 - Health Risk
 - Dietary Treatment
 - Psychotherapy

Addition of all related conditions with reference to age groups, types, Pathophysiology, Nutritional Assessments

Diet, Nutrient and Drug Interaction:

- Effect of drugs on ingestion, digestion, absorption and metabolism of nutrients.
- Effect of food, nutrients and nutritional status on drug dosage and efficacy.

Diet in Fever and Infection:

- Nutrition and Infection
- Metabolic changes during Infection
- Typhoid fever
- Tuberculosis
- HIV Infection and AIDS

Anemia

- Resulting from Acute Hemorrhage
- Nutritional anemia
- Sickle cell anemia
- Thalassemia
- Pathogenesis and dietary management in the above conditions
- Addition of B6, Cu deficiency Anemia, anemia in pregnancy and basic lab investigations related to anemia

Food Intolerances and Food Allergy:

- Adverse food reactions
- Treatment and Management
- Prevention
- Addition of definition, Causes, Pathophysiology, CMPA, Nutritional Assessments and MNT

Nutritional Requirement for Special Conditions

- Introduction, Calamity and emergency management, Nutritional requirements for extreme environments,

- Health Hazards associated with high altitude, Nutritional requirements in high altitude,
- Nutritional requirements in cold and polar and hot environment, Nutritional requirements for space missions, Nutritional considerations in brief for Military, naval personnel etc
- Starvation in emergencies arising out of drought, floods, earthquakes, locust, war, wrong policies and poverty – historical perspectives
- Effect of inflation: short medium and long term emergencies on food & nutrient intake. Precautions against food shortage
- Food needs at national level during emergencies, major nutritional deficiency diseases in emergencies, mobilization of local resources, general fund distribution, mass and supplementary feeding, therapeutic feeding,

Diet in Diseases of Gastro Intestinal Tract and Counseling:

- Upper GI Tract Disorders
 - Disorders of Esophagus
 - Disorders of Stomach
- Lower GI Tract Disorders
 - Common Intestinal Disorders
 - Disorders of Small Intestine
- Intestinal Brush Border Enzyme Deficiencies
- Inflammatory Bowel Diseases
- Disorders of Large Intestine

Suggested Readings:

- Mahan L. K., Escott- Stump, S. and Raymond J. L. (2012): “Krause’s Food and the Nutrition Care Process”, 13th Edition, Elsevier.
- Ross, A.C., Caballero B., Cousins R. J., Tucker K.L. and Ziegler T. (2014) Modern Nutrition in Health and Disease. Wolters Kluwer Health/ Lippincott Williams and Wilkins. Ed 11th
- Garrow, J. S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics. 10th Edition, Churchill Livingstone.
- Nix Staci (2013) William’s Basic Nutrition and Diet Therapy. Elsevier Ed. 14th.
- Antia F. P.: Clinical Dietetics and Nutrition, 3rd ed., Oxford University, Press, Delhi, Reprinted in 1989.
- Hui, Y. H.: Human Nutrition and Diet Therapy, Wadsworth Health ScL Divs. 1983.
- Karran, S. J. and K. G. M. M. Alberti (ed): Practical Nutritional Support, John Wiley and Sons. Inc. N. Y. 1980.
- Modern Nutrition in Health and Disease 10th edition by Maurice E. Shils
- Alfred H.Katz, Prevention and health, the Haworth, Press, New York 1999
- Williams S. R.: Essentials of Nutrition and Diet Therapy, 4th ed., Mosby College Pub. S. Louis, 1986.
- Thomas, B.: Manual of Dietetic Practice, 1996.

NAD-III- 2 P Therapeutic Nutrition I

Standardization of portion sizes for different food preparations.

Routine Hospital Diets

- To plan a Clear Liquid diet.
- To plan a Full Liquid Diet.
- To plan a Soft Diet.

Diet In Weight Imbalance And Counseling:

- To plan a diet for Obesity.
- To plan a diet for Underweight.

Diet In Fever:

- To plan a diet for Typhoid fever.
- To plan a diet for Tuberculosis.
- To plan a diet for HIV Infection and AIDS.

To plan a diet for Nutritional Anemia

Diet in Diseases of Gastro Intestinal Tract and Counseling:

- To plan a diet for Peptic Ulcer.
- To plan a diet for Lactose Intolerance.
- To plan a diet for Coeliac Disease.
- To plan a diet for Constipation.
- To plan a diet for Diarrhea.
- To plan a diet for Ulcerative Colitis.

NAD-III-3 T Community Nutrition

Theory 45 Hours

Public Nutrition:

- Concept
- Scope
- Future Projections
- Health Care
- Role Of Public Nutritionists In Health Care Delivery

Nutritional Problems in India:

- Protein Energy Malnutrition
- Micronutrient Deficiencies
- Vitamin Deficiencies

Population Dynamics:

- Demography, Demographic Transition and Demographic Cycle
- Population Structure
- Vital Statistics and Implications of Vital Statistics in Population Growth
- Population Policy
- Relationship between Fertility, Nutrition and Quality of Life

Assessment of Nutritional Status:

- Population Sampling
- Anthropometry
- Clinical Assessment
- Biochemical Assessment
- Dietary Assessment
- Nutritional Assessment in PEM, VAD, IDD,IDA

Nutrition Monitoring And Nutrition Surveillance

- Nutrition Monitoring And Its Current Programmes
- Nutrition Surveillance System

Nutrition Policy and Programmes:

- Integrated Child Development Services (ICDS) Programme
- Nutrient Deficiency Control Programme
- Supplementary Feeding Programme
- Food Security Programme
- Self-Employment and Wage Employment Schemes

Strategies to Combat National Nutritional Problems

- Introduction
- Diet Or Food Based Strategies
- Nutrient Based Strategies
- Immunization

Nutrition and Health Education:

- Definition
- Importance
- Nutrition Education Methods
- Teaching aids used in Nutrition Education
- Mass communication media used in Nutrition Education
- Nutrition Education through Educational Institutions
- Role of Nutrition Education Programs in Eradication of Malnutrition

Suggested Reading:

- Suryatapa Das.:Text book of Community Nutrition, Academic Publishers.
- Elizabeth Eilender.: Public Health and Community Nutrition Paperback – September 28, 2016, Momentum press Health.
- Dr. Jaysheela Manohar.: Food and Community Nutrition., Indian books and Periodicals

NAD-III-4**Electives**

One week Workshop and Exams have to be conducted at the end of Postings/ Lectures/workshops on following Topics

PRACTICAL

MSc-III- P Dissertation Data Collection and Entry.

SEMESTER IV

Sr. no	Subject Code	Theory	Subjects	Credits
1	NADIV-1T	Paper 1	Therapeutic Nutrition –II	4
2	NADIV-2T	Paper 2	Nutraceuticals and Functional Food	4
3	NADIV-PI	Practical	Therapeutic Nutrition –II	2
4	NADIV-PII	Practical	Master Dissertation – Part II – Evaluation	10
5	NADIV-3	Elective 1		2
6		Internship		10
Total				32

** NOTE: Choose 2 electives (from List of Electives) amounting to total of 2 CREDITS each*

NAD-IV-1 T Clinical Nutrition –II

Theory 50 Hours

Diet in Liver Diseases and Counseling:

- Hepatitis
- Cirrhosis of Liver
- Hepatic coma
- Diseases of Gall Bladder
- Diseases of Pancreas

Diet in Kidney Diseases and Counseling:

- Glomerulonephritis
- Nephrotic Syndrome
- Acute Renal Failure,
- Chronic Renal Failure
- End Stage Renal Diseases
- Urolithiasis

Nutrition in Eating Disorders and Counseling: shifted to 3rd Sem)

- Introduction
- Anorexia Nervosa
- Bulimia Nervosa
- Binge Eating Disorders

Nutrition and Neurological Disorders and Counseling:

- Parkinson's disease
- Alzheimer's disease

- Epilepsy
- Migraine
- Multiple Sclerosis
- Neurotrauma
- Spine trauma
- Feeding problems of patients with neurological disorders

Diseases of Metabolic Disorder and Counseling:

- Diabetes Mellitus
- Gout

Diet in Cardiovascular Diseases and Counseling:

- Coronary Heart Diseases (CHD)
 - Prevalence
 - Risk Factors
 - Pathophysiology
- Dyslipidemia
- Atherosclerosis
- Hypertension & Hypotension
- Angina Pectoris
- Myocardial infarction
- Congestive Cardiac Failure

Diet in Cancer and Counseling:

- Risk factors
- Metabolic Alterations and Nutritional Problems related to Cancer
- Nutritional requirements of Cancer patients related to Cancer Therapy
- Cancer Prevention

Sports Nutrition: (shifted to Sem 2)

- Introduction
- Evaluation and growth of sports nutrition
- Importance of carbohydrate loading,
- Pre-game and post-game meals,
- Approaches to the management of fitness and health:
- Nutrition, exercise, physical fitness and health--- their inter relationship.
- Parameter of fitness and Fitness tests
- Significance of physical fitness and nutrition in prevention and management of weight control regimes.
- Nutrition guidelines for maintenance of health and fitness.
- Nutritional requirements of exercise:
- Dietary supplements and Ergogenic aids

Suggested Readings:

- Mahan L. K., Escott- Stump, S. and Raymond J. L. (2012): “Krause’s Food and the Nutrition Care Process”, 13th Edition, Elsevier.
- Ross, A.C., Caballero B., Cousins R. J., Tucker K.L. and Ziegler T. (2014) Modern Nutrition in Health and Disease. Wolters Kluwer Health/ Lippincott Williams and Wilkins. Ed 11th
- Garrow, J. S., James, W.P.T. and Ralph, A. (2000): Human Nutrition and Dietetics. 10th Edition,

Churchill Livingstone.

- Nix Staci (2013) William's Basic Nutrition and Diet Therapy. Elsevier Ed. 14th.
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- Hui, Y. H.: Human Nutrition and Diet Therapy, Wadsworth Health ScL Divs. 1983.
- Karran, S. J. and K. G. M. M. Alberti (ed): Practical Nutritional Support, John Wiley and Sons. Inc. N. Y. 1980.
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- Alfred H.Katz, Prevention and health, the Haworth, Press, New York 1999
- Williams S. R.: Essentials of Nutrition and Diet Therapy, 4th ed., Mosby College Pub. S. Louis, 1986.
- Thomas, B.: Manual of Dietetic Practice, 1996.

NAD-IV- 2 T Nutraceuticals and Functional Foods

Theory: 45 Hours

Unit 1: Introduction to Functional Foods and Nutraceuticals: Definition, History and Classification, Perceived Effects of Functional Foods

Unit 2: Introduction to Probiotics, Prebiotics and Synbiotics. Probiotics: Taxonomy and Important Features of Probiotic Microorganisms, Health Effects of Probiotic Microorganisms

Unit 3: Probiotics in Various Foods Quality Assurance of Probiotics and Safety

Unit 4: Prebiotics: Non Digestible Carbohydrates/ Oligosaccharides, Prebiotics: Dietary Fiber, Prebiotics, Resistant Starch, Prebiotics: Gums

Unit 5: Polyphenols: Flavonoids, Catechins, Isoflavones, Tannins, Phytoestrogens, Phytosterols, Glucosinolates

Unit 6: Pigments: Carotenoids, Lycopene, Curcumin, Organosulphur Compounds

Unit 7: Introduction to Anti-nutritional Factors, Enzymes, Protease inhibitors, Amylase inhibitors, Phytates, Saponins, Haemagglutinins

Unit 8: Active Biodynamic Principles in Spices, Active Biodynamic Principles in Condiments, Active Biodynamic Principles in Other Plant Materials, Non Nutrient Effect of Specific Nutrients

Suggested Readings:

- Wildman, R. E. (2016). Handbook of Nutraceuticals and Functional Foods. CRC Press
- Gibson, G. R. and Williams, M. C. (2001). Functional Foods Concept to Product. CRC Press.
- Vатtem, D.A. and Maitin V.(2016). Functional Foods, Nutraceuticals and Natural Products, Concepts and Applications. DEStech Publications, Inc
- Gupta, R. C. (2016). Nutraceuticals: Efficacy, Safety and Toxicity. Academic Press.

NAD-IV P I Therapeutic Nutrition –II
Theory 45 Hours

Diet In Liver Diseases And Counseling:

- To plan a diet for Hepatitis.
- To plan a diet for Cirrhosis of Liver.
- To plan a diet for Hepatic coma.
- To plan a diet for Cholelithiasis and Cholecystitis.
- To plan a diet for Pancreatitis.

Diet in Kidney Diseases and Counseling:

- To plan a diet for Nephrotic Syndrome.
- To plan a diet for Acute Renal Failure.
- To plan a diet for End Stage Renal Diseases.
- To plan a diet for Urolithiasis.

Diseases of Metabolic Disorder and Counseling:

- To plan a diet for IDDM.
- To plan a diet for NIDDM.
- To plan a diet for Gout.

Diet in Cardiovascular Diseases and Counseling:

- To plan a diet for Dyslipidemia.
- To plan a diet for Hypertension.
- To plan a diet for Myocardial infarction.

To plan a diet for Cancer.

NAD - IV-3 Electives

Theory: 15 hours

- One week Workshop and Exams have to be conducted at the end of Postings/ Lectures/workshops on following Topics:

NAD - IV- P II

Master Dissertation – Part II – Evaluation

Presentation of Final results and evaluation

LIST OF ELECTIVES

Sl.No.	Elective	Credit
1.	Computer Skills	2
2.	Communication Skills	2
3.	NSS (I,II,III,IV)	2
4.	Leadership skills	2
5.	Library dissertation	2
6.	General Psychology	2
7.	Personality Development	2
8.	Counselling	2
9.	Critical Appraisal	2
10.	Health education and health promotion	2

<p>1. Computer Skills Introduction to Information Technology Introduction to MS Office: MS Word, MS Excel, MS PowerPoint Presentation Skills Internet</p> <ul style="list-style-type: none"> ▪ Search Strategies ▪ Email and Email etiquettes <p>Online survey development tools</p>	<p>2. Communication skills Introduction and definition of communication Process and types of communication Models of communication Essentials of effective communication</p>
<p>3.1 NSS I UNIT 1: Introduction and Basic Concepts of NSS (4)</p> <ul style="list-style-type: none"> • History, philosophy, aims & objectives (1) • Emblem, flag, motto, song, badge (1) • Organizational structure, roles & responsibilities of various NSS functionaries (2) <p>UNIT 2: NSS Programmes and Activities (10)</p> <ul style="list-style-type: none"> • Concept of regular activities, special camping, day camps (3) • Basis of adoption of village/slums, methodology of conducting survey (2) • Financial pattern of the scheme (1) • Other young prog./schemes of GoI (2) • Coordination with different agencies (1) • Maintenance of the diary (1) <p>UNIT 3: Understanding Youth (5)</p> <ul style="list-style-type: none"> • Definition, profiles, categories of youth (2) • Issues, challenges and opportunities of youth (2) • Youth as an agent of social change (1) <p>UNIT 4: Health, Hygiene & Sanitation (7)</p> <ul style="list-style-type: none"> • Definition, needs and scope of health education (1) • Food and nutrition (1) • Safe drinking water, water borne diseases and sanitation (SBA) (2) • National Health Programme (2) • Reproductive Health (1) <p>UNIT 5: Volunteerism and Shramdaan (7)</p> <ul style="list-style-type: none"> • Indian Tradition of volunteerism (1) • Needs & importance of volunteerism (2) • Motivation and constraints of volunteerism (2) • Shramdaan as part of volunteerism (2) 	<p>3.2 NSS II UNIT 1: Importance and Role of Youth leadership (6)</p> <ul style="list-style-type: none"> • Meaning and types of leadership (2) • Qualities of good leaders; traits of leadership (2) • Importance and role of youth leadership (2) <p>UNIT 2: Life Competencies (11)</p> <ul style="list-style-type: none"> • Definition and importance of life competencies (2) • Communication (3) • Inter Personal (3) • Problem-solving and decision-making (3) <p>UNIT 3: Social Harmony and National Integration (9)</p> <ul style="list-style-type: none"> • Indian history and culture (2) • Role of youth in peace-building and conflict resolution (5) • Role of youth in Nation Building (2) <p>UNIT 4: Youth Development Programmes in India (9)</p> <ul style="list-style-type: none"> • National Youth Policy (3) • Youth development programmes at the National level, State level and voluntary sector (4) • Youth-focused and Youth-led Organizations (2)

3.3 NSS III

UNIT 1: Citizenship (7)

- Basic Features of Constitution of India (2)
- Fundamental Rights and Duties (2)
- Human Rights (1)
- Consumer awareness and legal rights of consumer (1)
- RTI (1)

UNIT 2: Family and Society (6)

- Concept of family, community, (PRIs & other community-based organizations) and society (2)
- Growing up in the family- dynamics and impact (1)
- Human Values (1)
- Gender Justice (2)

UNIT 3: Community Mobilization (9)

- Mapping of community stakeholders (3)
- Designing the message in the context of the problem and culture of community (1)
- Identifying methods of mobilization (3)
- Youth-adult partnership (2)

UNIT 4: Environment Issues (11)

- Environment conservation, enrichment and sustainability (2)
- Climate change (2)
- Waste management (2)
- Natural resource management (5)

UNIT 5: Project Cycle Management(10)

- Project Planning (2)
- Project Implementation (3)
- Project monitoring (2)
- Project evaluation: impact assessment(3)

UNIT 6: Documentation and Reporting (7)

- Collection and analysis of data (3)
- Preparation of documentation/ reports (2)
- Dissemination of documents/reports (2)

UNIT 7: Additional Life Skills (7)

- Positive Thinking (1)
- Self Confidence and Self Esteem (2)
- Setting Life Goals and working to achieve them (2)
- Management of Stress including Time Management (2)

3.4 NSS IV

UNIT 1: Youth Health and Yoga (15)

- Healthy lifestyles (yoga as a tool), substance abuse, HIV, home nursing, first aid (8)
- Yoga: history, concept, misconceptions, traditions, impacts (5)
- Yoga as preventive, promotive and curative method (2)

UNIT 2: Youth and Crime (7)

- Sociological and psychological factors influencing youth crime (2)
- Peer mentoring in preventing crimes (1)
- Awareness about anti-ragging (1)
- Cyber crime and its prevention (2)
- Juvenile Justice (1)

UNIT 3: Civil/ Defense (5)

- Positive Thinking (1)
- Self Confidence and Self esteem (2)
- Setting Life Goals and working to achieve them (2)
- Management of Stress including Time Management (2)

UNIT 4: Entrepreneurship Development (8)

- Definition & Meaning (1)
- Qualities of good entrepreneur (2)
- Steps/ ways in opening an enterprise (3)
- Role of financial and support service institutions (2)

UNIT 5: Resource Mobilization (3)

- Writing a Project Proposal (2)
- Establishment of SFUs (1)

UNIT 6: Disaster Management (7)

- Introduction to Disaster Management, classification of disasters (4)
- Role of youth in disaster management (3)

<p>4. Leadership Skills SWOC Analysis Leadership Qualities and Challenges Motivation Ethics and responsibilities Communication Management Team Building</p>	<p>5. Library Dissertation Conducting a systematic literature review on the topic given Submission of the dissertation (5000 words) in bind</p>
<p>6. Health education and Health Promotion Introduction to health education and health promotion: definition and principles</p> <ul style="list-style-type: none"> • Health promotion needs assessment • Health promotion • Health Education and Health Promotion • Role of theory in health education and promotion • Alma Ata Declaration • Theories of health education • Health Communication • Communication process • Types of communication • Functions of health communication • Health education • Approaches • Models of health education • Contents of health education • Practice of health education • Health belief model • Child to Child Approach 	<p>7. Personality Development</p> <ul style="list-style-type: none"> • Personality development • Personality development • Types of personality • Influencing factors • Leadership qualities • Five factor model • Freud’s tripartite theory • Developmental stage theories • Motivation and confidence
<p>8 .Counselling</p>	<p>9.Critical Appraisal</p>

COMPETENCY BASED CURRICULUM FOR POSTGRADUATE DIPLOMA COURSE IN OPHTHALMOLOGY (D.O.M.S)

PREAMBLE:

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

The purpose of this programme is to standardize Ophthalmology teaching at post graduate level throughout the country so that it will benefit in achieving uniformity in post graduate and undergraduate teaching as well as result in creating competent ophthalmic surgeons with appropriate expertise.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board of the Academic Committee has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

GOALS:

The goals of postgraduate training course would be to train a MBBS doctor who will

- Practice efficiently and effectively, backed by scientific knowledge and skill base with sufficient understanding of basic sciences, recent advances and clinical applications related to the specialty and to be able to integrate this knowledge into clinical practice.
- Practice Evidence Based Medicine (EBM) in the field of Ophthalmology.
- Exercise empathy and caring attitude and maintain high ethical standards.
- Practice his specialty ethically, keeping in mind the requirement of the patient, community and people at large.
- Plan and advice measures for the promotive, preventive, curative and rehabilitative aspects of health and diseases in the specialty of Ophthalmology.
- Should be able to demonstrate his cognitive skills in the field of Ophthalmology and its ancillary branches during the formative and summative evaluation process.
- Play the assigned role in implementation of National Programs for Control of Blindness.
- Continue to evince keen interest in continuing education in the specialty irrespective of whether he / she is in a teaching institution or is a practicing surgeon.
- Demonstrate competence in basic concepts of research methodology and writing thesis and research papers.
- Be a motivated ‘teacher’ – defined as a specialist keen to share his/her knowledge and skills with colleague or a junior or any learner.

OBJECTIVES

The clinical Post graduate training programmes are intended at developing in a student a blend of qualities that are of a clinical specialist, a teacher and a researcher. The following objectives are laid out to achieve the goals of the course. These objectives are to be achieved by the time the candidate completes the course. These programmes are organized such that a post graduate student should possess the following qualities, knowledge and skills:

1. Knowledge
2. Skills
3. Human values, ethical practice and communication abilities.

1. Knowledge:

- a. At the completion of the course, candidate should demonstrate sound knowledge of clinical manifestations of common ophthalmic diseases, including emergency situations and investigative procedures to confirm the diagnosis.
- b. Demonstrate comprehensive knowledge of various modes of treatment, both medical and surgical.
- c. Be aware of his or her own limitations to the application of the specialty in situations which warrant referral to more qualified centers or individuals.
- d. Periodically self assess his or her performance and keep abreast with ongoing advances in the field and apply the same in his /her practice.

2. Skills:

- a) On the completion of the course, the candidate shall be able to offer to the community, the current quality of 'standard of care' in ophthalmic diagnosis as well as therapeutics, medical or surgical, in most of the common and easily managed situations at the District or Secondary level of health service.

b) He/She should be able to plan the educational programmes for health professionals and be familiar with modern methods of teaching and evaluation.

c) Apply research and epidemiological methods during his / her practice. The candidate shall be able to present or publish work done by him/her.

3. Human values, Ethical practice and Communication abilities:

- Adopt ethical principles in all aspects of his/her practice; professional honesty and integrity are to be fostered. Care is to be delivered irrespective of the social status, caste, creed or religion of the patient.
- Develop communication skills, in particular the skill to explain various options available in management and to obtain a true informed consent from the patient.
- Provide leadership and get the best out of his/her team in a congenial working atmosphere.
- Apply high moral and ethical standard while carrying out human or animal research.
- Be humble and accept the limitations in his/her knowledge and skill and to ask for help from colleagues when needed,
- Respect patient's rights and privileges including patient's right to information and right to seek a second opinion.

Basic practices for post graduates before initiations of course

- A. Good clinical practice- post graduates should develop good clinical practices which is essential for training for clinical research that involve human participants.**
- B. BLS/ACLS – post graduates should undergo BLS/ACLS course so they will be skillful to manage cases in emergencies.**
- C. NPTEL- all post graduates should undergo the BCBR course and clear NPTEL exams.**

PROGRAMME OBJECTIVES

- a. The student should possess basic knowledge of the structure, function and development of the human body as related to ophthalmology, of the factors which may disturb these mechanisms and the disorders of structure and function which may result thereafter.
- b. The student should be able to practice and handle most day-to-day problems independently in ophthalmology. The student should recognize the limitations of his/her own clinical knowledge and know when to seek further help.
- c. The student should understand the effects of environment on health and be familiar with the epidemiology of at least the more common diseases in the field of ophthalmology.
- d. The student should be able to integrate the preventive methods with the curative and rehabilitative measures in the comprehensive management of the disease.
- e. The student should be familiar with common eye problems occurring in rural areas and be able to deal with them effectively.
- f. The student should also be made aware of Mobile Ophthalmic Unit and its working and components.
- g. The student should be familiar with the current developments in Ophthalmic Sciences.

- h. The student should be able to plan educational programmes in Ophthalmology in association with senior colleagues and be familiar with the modern methods of teaching and evaluation.
- i. The student should be able to identify a problem for research, plan a rational approach to its solution, execute it and critically evaluate his/her data in the light of existing knowledge.
- j. The student should reach the conclusions by logical deduction and should be able to assess evidence both as to its reliability and its relevance.
- k. The student should have basic knowledge of medico-legal aspects of medicine.
- l. The student should be familiar with patient counseling and proper consent taking.

SUBJECT SPECIFIC COMPETENCIES

A post graduate student upon successfully qualifying in the D.O.M.S. examination should be able to:

- a) Offer to the community, the current quality of ‘standard of care’ in ophthalmic diagnosis as well as therapeutics, medical or surgical, in most of the common situations encountered at the level of health services.
- b) Periodically self assess his or her performance and keep abreast with ongoing advances in the field and apply the same in his/her practice.
- c) Be aware of her/his own limitations to the application of the specialty in situations, which warrant referral to more qualified centers or individuals.
- d) Apply research and epidemiological methods during his/her practice. The post graduate student should be able to present or publish work done by him/her.

- e) Contribute as an individual/group towards the fulfillment of national objectives with regard to prevention of blindness.
- f) Effectively communicate with patients or relatives so as to educate them sufficiently and give them the full benefit of informed consent to treatment and ensure compliance.

At the end of the course, the student should have acquired knowledge in the following:

A. Cognitive domain

Basic Medical Sciences:

- Attain understanding of the structure and function of the eye and its parts in health and disease.
- Attain understanding and application of knowledge of the structure and function of the parts of Central Nervous System and other parts of the body with influence or control on the structure and function of the eye.
- Attain understanding of and develop competence in executing common general laboratory procedures employed in diagnosis and research in Ophthalmology.

1. Clinical Ophthalmology:

Given adequate opportunity to work on the basis of graded responsibilities in outpatients, inpatient and operation theatres on a rational basis in the clinical sections from the day of entry to the completion of the training programme, the students should be able to:

- Acquire scientific and rational approach to the diagnosis of ophthalmic cases presented.
- Acquire understanding of and develop inquisitiveness to investigate to establish cause and effect of the disease.

- To manage and treat all types of ophthalmic cases.
- To competently handle and execute safely all routine surgical procedures on lens, glaucoma, lid, sac, adnexa, retina and muscle anomalies.
- To competently handle all ophthalmic medical and surgical emergencies.
- To be familiar with micro-surgery and special surgical techniques.
- To demonstrate the knowledge of the pharmacological (including toxic) aspects of drugs used in ophthalmic practice and drugs commonly used in general diseases affecting the eyes.

2. Refraction:

- Acquire competence in assessment of refractive errors and prescription of glasses for all types of refraction problems.
- Acquire basic knowledge of manufacture and fitting of glasses and competence of judging the accuracy and defects of the dispensed glasses.

3. Ophthalmic super-specialties:

Given an opportunity to work on a rotational basis in various special clinics of sub-specialties of ophthalmology, if possible, the student should be able to:

- Examine, diagnose and demonstrate understanding of management of the problems of neuro-ophthalmology and refer appropriate cases to neurology and neuro-surgery.
- Examine, diagnose and demonstrate understanding of management of (medical and surgical) complicated problems in the field of (a) lens, (b) glaucoma, (c) cornea, (d) retina, (e) pediatric ophthalmology, (f) oculoplasty, (g) uvea, and (I) genetic problems in ophthalmology.
- To demonstrate understanding of the manufacture, and competence in prescription and dispensing of contact lenses and ocular prosthesis.

4. Ophthalmic pathological/microbiological/biochemical sciences

- Be able to interpret the diagnosis in correlation with the clinical data and

routine materials received in such cases.

5. Community Ophthalmology

Eye camps may be conducted where the PG students are posted for imparting training according to a set methodology. The community and school surveys may also be conducted by the post graduate students. The post graduate students are given an opportunity to participate in surveys, eye camps. They should be able to guide rehabilitation workers in the organisation and training of the blinds in art of daily living and in the vocational training of the blind leading to gainful employment.

6. Research :

- Recognise a research problem.
- State the objectives in terms of what is expected to be achieved in the end.
- Plan a rational approach with appropriate controls with full awareness of statistical validity of the size of the material.
- Spell out the methodology and carry out most of the technical procedures required for the study.
- Accurately and objectively record results and observation made.
- Analyze the data with the aid of an appropriate statistical analysis.
- Interpret the observations in the light of existing knowledge and highlight in what ways the study has advanced existing knowledge on the subject and what further remains to be done.
- Write a thesis in accordance with the prescribed instructions.
- Write at least one scientific paper as expected of International Standards from the material of this thesis.

B. Affective Domain:

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.

C. Psychomotor domain

At the end of the course, the student should acquire following clinical skills:

Essential diagnostic skills:

I. Examination techniques along with interpretation

1. Slit lamp Examination

- i. Diffuse examination
- ii. Focal examination
- iii. Retroillumination – direct and indirect
- iv. Sclerotic scatter
- v. Specular reflection
- vi. Staining modalities and interpretation

2. Fundus evaluation

- Direct/Indirect ophthalmoscopy
- Fundus drawing
- 3-mirror examination of the fundus
- 78-D/90-D/60-D examination
- Amsler's charting

II. Basic investigations along with their interpretation

1. Tonometry

Tonometry - Applanation/Indentation/Non-contact

2. Gonioscopy

Gonioscopy grading of the anterior chamber angle

3. Tear/ Lacrimal function tests

- i. Staining- fluorescein and Rose Bengal
- ii. Schirmer test/tear film break up time
- iii. Syringing
- iv. Dacrocystography

4. Corneal

- Corneal scraping and cauterization
- Smear preparation and interpretation (Gram's stain /KOH)
- Media inoculation
- Keratometry - performance and interpretation
- Pachymetry
- Corneal topography - if available

5. Colour Vision evaluation

- Ishihara pseudoisochromatic plates
- Farnsworth Munsell, if available

6. Refraction

- i. Retinoscopy- Streak/ Priestley Smith
- ii. Use of Jackson's cross-cylinder
- iii. Subjective and objective refraction
- iv. Prescription of glasses

7. Diagnosis and assessment of Squint

- i. Ocular position and motility examination
- ii. Synoptophore usage
- iii. Lees screen usage
- iv. Diplopia charting
- v. Assessment of strabismus - cover tests/prisms bars
- vi. Amblyopia diagnosis and treatment
- vii. Assessment of convergence, accommodation, stereopsis, suppression

8. Exophthalmometry

Usage of Hertel's exophthalmometer - proptosis measurement

9. Contact lenses

- Fitting and assessment of RGP and soft lenses
- Subjective verification of over refraction
- Complications arising of contact lens use
- Educating the patient regarding CL usage and imparting relevant knowledge of the complications arising thereon

10. Low Vision Aids

- Knowledge of basic optical devices available and relative advantages and disadvantages of each.
- The basics of fitting with knowledge of availability & cost

III. The post graduate must be well versed with the following investigative modalities although the student may or may not perform it individually.

But, she/he should be able to interpret results of the following tests:

1. Fundus photography
2. Fluorescein angiography
3. Ophthalmic ultrasound A-scan/B scan
4. Automated perimetry for glaucoma and neurological lesions
5. Radiological tests - X rays - Antero posterior/ Lateral view
PNS (Water's view) / Optic canal views
Localisation of intra-ocular and intra-orbital FBs
Interpretations of - CT/ MRI Scans
6. OCT and UBM
7. ERG, EOG, and VEP

IV. Minor surgical procedures – Must know and perform independently

- Conjunctival and corneal foreign body removal on the slit lamp
- Chalazion incision and curettage
- Pterygium excision
- Biopsy of small lid tumours
- Suture removal- skin/conjunctival/corneal/ corneoscleral
- Tarsorrhaphy
- Subconjunctival injection
- Retrobulbar, peribulbar anaesthesia
- Posterior Sub-Tenon's injections
- Artificial eye fitting

V. Surgical procedures

1. Must know and can perform independently

a. Ocular anaesthesia:

- Retrobulbar anaesthesia
- Peribulbar anaesthesia
- Facial blocks- O'Brien / Atkinson/Van lint and modifications
- Frontal blocks
- Infra orbital blocks
- Blocks for sac surgery

2. Must be able to independently perform and deal with complications arising from the following surgeries :

- Lid Surgery - Tarsorrhaphy
 - Ectropion and entropion
 - Lid repair following trauma
 - Epilation
- Destructive procedures
 - Evisceration with or without implant
 - Enucleation with or without implant
- Sac surgery
 - i. Dacryocystectomy
 - ii. Dacryocystorhinostomy
 - iii. Probing for congenital obstruction of nasolacrimal duct
- Strabismus surgery
 - Recession and resection procedures on the horizontal recti.
- Orbit surgery
 - Incision and drainage via anterior orbitotomy for abscess
- Cyclocryotherapy/Cyclophotocoagulation

3. PG Students should be well conversant with use of operating microscope and must be able to perform the surgeries listed below competently under the same:

- Cataract surgery
 - i. Standard ECCE (extracapsular cataract extraction; first year) with or without IOL implantation
 - ii. Small incision ECCE with or without IOL implantation
 - iii. Phacoemulsification with PC IOL implantation
 - iv. Intracapsular cataract extraction
 - v. Secondary AC or PC IOL implantation
- Vitrectomy/Scleral buckling
 - i. Intra-vitreous and intra-cameral (anterior chamber) injection techniques and doses of drugs for the same, particularly for endophthalmitis management.
 - ii. Needs to know the basis of open sky vitrectomy (anterior segment) as well as management of cataract surgery complications.
 - iii. Assisting vitrectomy and scleral buckling procedures
- Ocular surface procedures
 - i. Pterygium excision with modifications
 - ii. Conjunctival cyst excision/foreign body removal
 - iii. Corneal foreign body removal
 - iv. Conjunctival flap/ peritomy
- Glaucoma
 - Trabeculectomy
- Corneal
 - i. Repair of corneo - scleral perforations
 - ii. Corneal suture removal
 - iii. Application of glue and bandage contact lens

4. Should have performed/assisted the following microscopic surgeries

i. Keratoplasty

Therapeutic and optical

ii Glaucoma surgery

Pharmacological modulation of trabeculectomy

Trabeculotomy

Goniotomy

Glaucoma valve implant surgery

5. Desirable to be able to perform or should have assisted following laser procedures

- Yag Capsulotomy
- Laser iridotomy
- Focal and Panretinal photocoagulation

6. Should have assisted/knowledge of Keratorefractive procedures

Operations:

The PG is provided with an opportunity to perform operations both extra-ocular and intra-ocular with the assistance of the senior post graduate students and/or under the direct supervision of a faculty member. The student is provided with an opportunity to learn special and complex operations by assisting the senior post graduate student or the faculty in operations of cases of the specialty and be responsible for the postoperative care of these cases.

In **first phase**, the post graduate student is given training in preparations of cases for operation, pre-medication, regional anaesthetic blocks and assists the operating surgeon during the operations.

In the **final phase**, the post graduate student operates independently assisted by senior postgraduate student or a faculty member. She/he is required to be proficient in some operations and show familiarity with others.

Syllabus

Course contents:

These are only broad guidelines and are illustrative, there may be overlap between sections.

THEORY

I. Basic Sciences:

1. Orbital and ocular anatomy

i. Gross anatomy

ii. Histology

iii. Embryology

2. Ocular Physiology

3. Ocular Pathology

Gross pathology, Histopathology, Basics of general pathology

4. Ocular Biochemistry

General biochemistry, biochemistry applicable to ocular function

5. Ocular Microbiology

General Microbiology, specific microbiology applicable to the eye

6. Immunology with particular reference to ocular immunology

7. Genetics in ophthalmology

8. Community Eye Health

II. Optics

a. Basic physics of optics

b. Applied ophthalmic optics

c. Applied optics including optical devices

d. Disorders of Refraction

III. Clinical Ophthalmology

i. Disorders of the lids

ii. Disorders of the lacrimal system

- iii. Disorders of the Conjunctiva
- iv. Disorders of the Sclera
- v. Disorders of the Cornea
- vi. Disorders of the Uveal Tract
- vii. Disorders of the Lens
- viii. Disorders of the Retina and vitreous
- ix. Disorders of the Optic Nerve and Visual Pathway
- x. Disorders of the Orbit
- xi. Glaucoma
- xii. Neuro-ophthalmology
- xiii. Paediatric ophthalmology
- xiv. Ocular involvement in systemic disease
- xv. Immune ocular disorders
- xvi. Strabismus and Amblyopia
- xvii. Ocular oncology
- xviii. Ocular trauma
- xix. Community ophthalmology
- xx. Visual rehabilitation
- xxi. Lasers in ophthalmology
- xxii. Ocular therapeutics

DRUGS USED IN OPHTHALMOLOGY:

1. Antibiotics
2. Antihistaminic
3. Local anaesthetics
4. Corticosteroids
5. Cycloplegics and mydriatics
6. Antiviral agents
7. Antifungal agents
8. Tear substitutes
9. Anti VEGF agents
10. Antiglaucoma agents

CLINICAL

Essential Clinical skills – instrumentation:

Refraction:

- a. Retinoscopy
- b. Subjective and objective refraction
- c. Use of Jackson's cross-cylinder
- d. Auto refractometer

Slit Lamp Examination:

- a. Diffuse examination
- b. Focal examination
- c. Retroillumination - direct & indirect
- d. Sclerotic scatter
- e. Specular reflection
- f. Staining modalities and interpretation

Slit Lamp Accessories:

Applanation Tonometry

Goldman's applanation tonometer

Gonioscopy

- Single mirror / 3 - mirror gonioscope
- Grading of the angle
- Testing for occludability
- Indentation gonioscopy
- Four Mirror Gonioscope

Direct Ophthalmoscopy

- Distant direct Ophthalmoscopy
- Detailed fundus examination
- Use of filters and graticule

Indirect Ophthalmoscopy

- Fundus evaluation including scleral depression
- Fundus drawing capability
- Use of filters provided

Optical Coherence Tomography

- Principle
- Uses

- Interpretation

Slit Lamp Fundus Examination

- 3-mirror examination of the fundus
- 78-D/90-D/60-D examination

Tonometry

- Applanation tonometer
- Indentation (commonly Schiottz)

Keratometry

- Performance & interpretation of keratometry
- Diagnosis of conditions such as keratoconus
- Keratoscopy

Assessment of epiphora

- Jone's dye test
- Syringing - performance & interpretation

Dry eye evaluation

- Schirmer test
- Rose Bengal staining
- Tear film breakup time
- Tear meniscus evaluation

Corneal ulceration

- Taking a corneal scraping
- Inoculation into media
- Evaluation of Gram's stain
- Evaluation of KOH preparation

Colour vision evaluation

- Ishihara pseudoisochromatic plates

Use of Amsler's Grid

- Instructing in the use of and interpretation of the chart.

Fundus photography & fundus fluorescein angiography (FFA, FAG)

- Performance and interpretation of FFA
- Performance of indirect fluorescein angiography

Diagnosis & assessment of Squint

- Ocular position and motility examination
- Versions, ductions and vergences
- Convergence facility estimation
- Cover / Uncover / Alternate cover test
- Use of prism bars or free prisms in assessment of squint

- Use of Bagolini's striated glasses / red filters / Maddox rod
- Use of Worth's four dot test
- Use of major amblyoscope
- Use & interpretation of the Hess chart / Lees' screen
- Use of synoptophore

Exophthalmometry

- Measurement of proptosis or exophthalmos

Use and evaluation of ophthalmic ultrasound

- A- Scan ultrasound with biometry
- B- Scan ultrasound examination

Perimetry

- Kinetic Goldmann Perimetry
- Static computerized perimetry
- Interpretation of common field defects

Radiology

Interpretation of plain skull films:

- PA-20 (Caldwell's view)
- PNS (Water's view)
- Lateral
- Submentovertical
- Optic canal views

Localisation of intra ocular and intra orbital foreign bodies

Interpretation of CT – Scans of Orbit and Eye

Contact Lenses

- a. Assessment
- b. RGP fitting
- c. Soft lens fitting
- d. Troubleshooting

Low Vision aids

- a. The basics of fitting with knowledge of availability & cost.

RESEARCH

Essential Research Skills

1. Record keeping

- a. The ability to maintain records as scientifically as possible
- b. Knowledge of computer software is helpful

2. Basic statistical knowledge
 - a. Ability to undertake clinical & basic research
 - b. Descriptive and Inferential statistics
 - c. Ability to publish results of one's work
3. Ability to constructively criticize publications in the field.
4. Presentation: Ability to present one's work effectively at various scientific conferences.

MISCELLANEOUS

A. Community Ophthalmology

- a. Ability to organize institutional screening
- b. Ability to organize peripheral eye screening camps
- c. Knowledge and ability to execute guidelines of (NPCB) National Program for Control of Blindness Prevention of Blindness.

B. Organisational capabilities

- a. Ability to organize meetings, seminars and symposia
- b. Ability to get along with colleagues and work as a team with the other members of the department.
- c. Ability to interact with and work as team with other disciplines that may exist in the same hospital.

C. Teaching

- a. The ability to pass on skills acquired to one's juniors, theoretical, procedural and surgical

TEACHING AND LEARNING METHODS

Teaching Methodology:

The theoretical knowledge is imparted to the post graduate student through distinct courses of lecture demonstrations, seminars, symposia and inter- and intradepartmental meetings.

The students are exposed to recent advances through discussions in journal clubs and participation in CMEs, and symposia.

The post graduate students are imparted clinical training in several ways:

1. Group Discussion

The junior post graduate students may present the symposium to their senior postgraduates where it is fully discussed before finally being discussed in front of the faculty or senior eye specialists. A free and fair discussion is encouraged. These discussions enable the post graduate students to prepare for a general discussion in the class.

2. Clinical Case discussion

a. Bedside discussion on the rounds and outpatient teaching take their toll with patient management. Therefore in addition to these, clinical case discussions should form part of a department's schedule at a fixed time every week. This could range from 1-2 hours and could be held at least once a week. The choice and manner of presentation and discussion varies widely and is left to the discretion of the department. Every effort should be made to include as wide a variety of cases as possible over three years with multiple repetitions. Problem oriented approach is better as it aids in decision making skills.

b. In addition to bedside teaching rounds, at least 5-hr of formal teaching per week are necessary.

c. Consultant case presentation is another approach which should be encouraged as it aids in solving complex problems and also is forum for discussion of interesting cases.

d. Case discussions on the patient's records written by the student is to be encouraged as it helps exercise the student's diagnostic and decision making skills. It also helps the consultant in critical evaluation of the student's progress academically.

e. Case presentation at other in-hospital multidisciplinary forums.

f. The postgraduate students shall be required to participate in the teaching and training programme of undergraduate students and interns.

g. Department should encourage e-learning activities, Clinico-Pathological Conferences and Inter Departmental Meetings (with Neuro-Medicine, Dermatology and Paediatrics departments once in a month.)

3. Seminars

Seminars should be conducted at least once weekly. The duration should be at least one hour. The topics selected should be repeated once in 3 years so as to cover as wide a range of topics as possible. Seminars could be individual presentations or a continuum (large topic) with many post graduate students participating.

4. Journal clubs

Journals are reviewed in particular covering all articles in that subject over a 6 months period and are discussed by the post graduate student under the following headings.

1) Aim

2) Methods

3) Observations

4) Discussions and

5) Conclusions

The post graduate student to whom the journal is allotted presents the journal summaries to the senior postgraduates. They are expected to show their understanding of the aspects covered in the article and clarify any of the points raised in the article, offer criticisms and evaluate the article in the light of known literature.

5. A postgraduate student of a postgraduate diploma course in broad specialities/super specialities would be required to present one poster presentation, to read one paper at a national/state conference and to present one research paper which should be published/accepted for publication/sent for publication during the period of his postgraduate studies so as to make him eligible to appear at the postgraduate diploma examination.

6. Out-Patients: For the first six months of the training programme, post graduate students may be attached to a faculty member to be able to pick up methods of history taking and ocular examination in ophthalmic practice. During this period the post graduate student may also be oriented to the common ophthalmic problems.

After 6 months, the clinical post graduate student may work

independently, where he receives new and old cases including refractions and prescribes for them.

7. Wards: Each post graduate student may be allotted beds in the in-patient section depending upon the total bed capacity and the number of the post graduates. The whole concept is to provide the post graduate student increasing opportunity to work with increasing responsibility according to seniority. A detailed history and case record is to be maintained by the post graduate student.

Relevance of beds and admissions in Ophthalmology has really gone down at present, as most of the surgical and special investigative procedures are being performed on out-patient basis. Most of the teaching has to be imparted in out-patients department and special Clinics.

8. Rotations: Specialty clinics

The student may rotate in the following subspecialty clinics:

- Anterior segment and cataract
- Glaucoma
- Oculoplastics
- Paediatric ophthalmology and strabismus
- Retina and Uvea
- Cornea, Contact lens and low vision
- Neuroophthalmology
- Refractive Clinic

9. Practicals in Ocular Histopathology

The post graduate students may be provided with fully stained slides of the ocular tissues along with relevant clinical data and discuss the diagnosis and differential diagnosis on the basis of the information provided

10. Attend accredited scientific meetings (CME, Symposia, and Conferences).

11. Additional lecture sessions on basic sciences, biostatistics, research methodology, teaching methodology, hospital waste management, health economics, medical ethics and legal issues related to ophthalmology practice are suggested.

12. Additional e-learning sessions – contact lens fitting and refractive surgeries

13. Additional simulation based learning – laser capsulotomy and pan retinal photocoagulation

14. Maintenance of log book: Log books shall be checked and assessed periodically by the faculty members imparting the training.

During the training programme, patient safety is of paramount importance; therefore, skills are to be learnt initially on the models, later to be performed under supervision followed by performing independently; for this purpose, provision of surgical skills laboratories in medical colleges is mandatory.

EDUCATIONAL STRATEGIES:

Patient based learning - PBL

Laboratory based learning - LBL

Self-directed learning – SDL

Group Discussion – GD

DOAP session - Demonstration- Observation - Assistance - Performance

Cognitive Domain:

Basic Medical Sciences:

1. Clinical Ophthalmology - GD and Patient based learning
2. Refraction – Lecture and GD and PBL
3. Ophthalmic sub-specialties: PBL
4. Ophthalmic pathological/microbiological/biochemical sciences – Lecture, Laboratory based learning
5. Community Ophthalmology- outreach activities
6. Research – SDL

Psychomotor Domain : PBL

I. Examination techniques along with interpretation

1. Slit lamp Examination
2. Fundus evaluation

II. Basic investigations along with their interpretation:

1. Tonometry

2. Gonioscopy
3. Tear/ Lacrimal function tests
4. Corneal
5. Colour Vision evaluation
6. Refraction
7. Diagnosis and assessment of Squint
8. Exophthalmometry
9. Contact lenses
10. Low Vision Aids

III. Investigative modalities - may or may not perform it individually: should be able to interpret results :DOAP SESSION:

1. Fundus photography
2. Fluorescein angiography
3. Ophthalmic ultrasound A-scan/B scan
4. Automated perimetry for glaucoma and neurological lesions
5. Radiological tests - X rays - Antero posterior/ Lateral view PNS (Water's view) / Optic canal views
Localisation of intra-ocular and intra-orbital FBs Interpretations of -USG/ CT/ MRI Scans
6. OCT and UBM
7. ERG, EOG, and VEP

IV. Minor Surgical Procedures – Must know and perform independently - PBL

- Conjunctival and Corneal foreign body removal on the slit lamp
- Chalazion incision and curettage
- Pterygium excision
- Biopsy of small lid tumours
- Suture removal- skin/conjunctival/corneal/ corneoscleral
- Tarsorrhaphy
- Subconjunctival injection
- Retrobulbar, parabolbar anaesthesia
- Posterior Sub-Tenon's injection
- Artificial eye fitting

V. SURGICAL PROCEDURES – GD, PBL

AFFECTIVE OBJECTIVES

1. Should be able to function as a part of a team, develop an attitude of cooperation with colleagues, and interact with the patient and the clinician or other colleagues to provide the best possible diagnosis or opinion.
2. Always adopt ethical principles and maintain proper etiquette in dealings with patients, relatives and other health personnel and to respect the rights of the patient including the right to information and second opinion.
3. Develop communication skills to word reports and professional opinion as well as to interact with patients, relatives, peers and paramedical staff, and for effective teaching.
4. Participate in charity work through screening and operating eye camps.
5. Role models – eye donation, glaucoma awareness.

Skill or competency objectives – simulation

1. Orbit dissection
2. Suturing techniques
3. Fundoscopy
4. Cataract surgery simulation
5. Laser capsulotomy and PRP simulation

IMPLEMENTATION – PLANNING

IN FIRST PHASE,

OT: The Post graduate student is given training in preparations of cases for operation, pre-medication and regional anaesthetic blocks, the student assists the operating surgeon during the operations.

In OPD: In the first six months, the Post graduate students may be attached to a faculty member to be able to pick up methods of history taking and ocular examination in ophthalmic practice. During this period the Post graduate student may also be oriented to the common ophthalmic problems.

After six months , the post graduate student may work independently, where he/she receives new and old cases including refractions and prescribes for them. The post graduate students are attached to a senior post graduate student and faculty member whom they can consult in case of difficulty.

IN FINAL PHASE

OT: In the final phase, the post graduate student operates independently assisted by senior post graduate student or a faculty member. She/he is required to be proficient in some operations and show familiarity with others.

OPD: Each post graduate student may be allotted beds in the in-patient section depending upon the total bed capacity and the number of the post graduates. The whole concept is to provide the post graduate student increasing opportunity to work with increasing responsibility according to seniority. A detailed history and case record is to be maintained by the post graduate student.

Additional Teaching-Learning :

Lecture sessions on basic sciences, biostatistics, research methodology, teaching methodology.

Lecture : health economics, Medical ethics and legal issues related to ophthalmology practice.

Workshop: Hospital waste management,

Days	Clinical 9.00am to 1.00pm	Academic 3.00pm to 5.00pm
Monday	OPD	Group Discussion
Tuesday	Operation theatre	Case Presentation
Wednesday	OPD	Journal Club/ Debate session once a month
Thursday	Operation theatre	Seminar/Symposium
Friday	Grand Rounds/ OPD	skill Lab
Saturday	Operation theatre	Simulation center

ASSESSMENT:

FORMATIVE ASSESSMENT, ie, during the training

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self directed learning and ability to practice in the system.

GENERAL PRINCIPLES

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills. The Internal Assessment should be conducted in theory and clinical examination.

1. Internal evaluation:

During the course of two years, the department will conduct two tests. One of them will be at the end of first year.

The other test will be a preliminary examination held three months before the final examination. The test may include the written papers, practicals / clinicals and viva-voce. Records and marks obtained in such tests will be maintained by the head of the department and will be sent to the University when called for.

Results of all evaluations should be entered into P.G's logbook / dairy and departmental file for documentation purposes. Main purpose of periodic examination and accountability is to ensure clinical expertise of students with practical and communication skills and balance broader concept of diagnostic and therapeutic challenges.

2. Maintenance of Log Book:

Every candidate shall maintain a Log book/work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc Special mention may be made of the presentations by the candidate as well as details of clinical or laboratory procedures, if any, conducted by the candidate. All the procedures performed by the post graduate students should be entered in the Log book. All the daily activities including the ward rounds and the routine procedures performed on day to day basis should be entered in the Log book and it should be verified and signed by the faculty member. The Log book shall be scrutinized and certified by the Head of the Department and Head of the Institution, and presented in the University practical/clinical examination.

Quarterly assessment during the DOMS training should be based on following educational activities:

1. Journal based / recent advances learning
2. Patient based /Laboratory or Skill based learning -
3. Self directed learning and teaching
4. Departmental and interdepartmental learning activity
5. External and Outreach Activities / CMEs

The student to be assessed periodically as per categories listed in postgraduate

student appraisal form (Annexure I)

SUMMATIVE ASSESSMENT, i.e., assessment at the end of training

The summative examination would be carried out as per the Rules given in **POSTGRADUATE MEDICAL EDUCATION REGULATIONS, 2000.**

The Post Graduate examination shall be in two parts:

1. Theory Examination:

The examinations shall be organized on the basis of ‘Grading’ or ‘Marking system’ to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training. Obtaining a minimum of 50% marks in ‘Theory’ as well as ‘Practical’ separately shall be mandatory for passing examination as a whole. The examination for DOMS shall be held at the end of 2nd academic year. An academic term shall mean six month's training period.

SCHEME OF EXAMINATION:

Candidates will be allowed to appear for examination only if attendance (Minimum 80%) and internal assessment are satisfactory and dissertation is accepted.

1. Theory: 300 Marks

There shall be **three** papers, each of three hours duration. Total marks of each paper will be 100. Questions on recent advances may be asked in any or all the papers. The format of each paper will be same as shown below.

Type of Questions	No. of Questions	Marks for each question	Total Marks
Short essay	10	10	100
Grand Total			100

Paper I :

1. Basic Sciences : Anatomy; Physiology; Pathology; Microbiology; Biochemistry
2. Optics and Refraction.
3. Ocular motility, Strabismus, Paediatric Ophthalmology
4. Ocular Pharmacology
5. Instrumentation and Investigations in Ophthalmology

Paper II :

1. Clinical ophthalmology covering Diseases of the Eye: Disorders of Conjunctiva, Cornea, Sclera, Uvea, Lens, Glaucoma, Retina, Optic nerve.
2. Clinical ophthalmology covering Diseases of the Adnexa: Disorders of Lids, Lacrimal system, Orbit.

Paper III :

1. Surgical Ophthalmology
2. Community Ophthalmology
3. Neuro-ophthalmology
4. Systemic ophthalmology
5. Recent Advances
- 6.

Note: The distribution of chapters/ topics shown against the papers is suggestive only and may overlap or change.

2. Clinical/Practical and oral/viva voce examination
Clinical Examination: 200 Marks

To elicit competence in clinical skills and to discuss differential diagnostic therapeutic aspects.

Type of Cases	Number of Cases	Marks for each Case	Total
Long Case	01	100	100
Short Case	02	25	50
Fundus Case	01	25	25
Refraction Case	01	25	25
GRAND TOTAL			200

Viva- Voce Examination: 100 Marks

Oral/Viva voce Examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject and shall include:

1) Viva-voce examination – **[80 Marks]**

All examiners will conduct viva – voce conjointly on the candidates' comprehension, analytical approach, expression and interpretation of data.

Viva- voce shall include questions on the following topics:

- a. Surgical instruments displayed
- b. Pathology slides and Pathology gross specimens
- c. Drugs, X-rays, USG/OCT/CT/MRI Scans, etc.
- d. Visual fields and other ophthalmic diagnostic charts / Indirect ophthalmoscopy drawings / Hess screen charts
- e. General ophthalmology
- f. Community ophthalmology

2) Pedagogy Exercise and Log Book – **[20 marks]**

- i. Candidate is asked to make a presentation on a topic assigned before the beginning of clinical examination **10 Marks.**
- ii. Review of Log Book. **10 Marks**

D. Maximum marks

Maximum marks for DOMS. in Ophthalmology	Theory	Practical	Viva	Grand Total
	300	200	100	600

Recommended Reading:

Books (latest edition)

1. Ophthalmic Surgery: Principles and Techniques. Blackwell Science. Albert DM.
2. Principles and Practice of Ophthalmology. Albert DM, Jakobiec. W B Saunders
3. Principles & Practice of Ophthalmology. Gholam A Paymen
4. The Current American Academy of Ophthalmology Basic and Clinical Science Course (13 volumes)
5. Duke Elder’s Practice of Refraction. Abrams D. Churchill Livingstone.
6. Text book of Ophthalmology. Yanoff and Duker
7. Retina. Stephen J Ryan:
8. Ophthalmic Ultrasound: Sandra Byrne and Ronald Green.
9. Cornea: Fundamentals, Diagnosis, and Management. Krachmer JH, Mannis MJ, Holland EJ. Mosby Elsevier.
10. Ophthalmology. Yanoff N, Duker JS. Mosby Elsevier.
11. Review of Ophthalmology. Friedman NJ, Kaiser PK, Trattler WB. Elseview Saunders, Philadelphia.
12. Corneal Transplantation. Vajpayee RB. Jaypee Brothers Medical Publishers (P) Ltd, New Delhi.
13. Fundamentals of Clinical Ophthalmology Series. Coster D. Cornea. Blackwell

Publishing Limited.

14. The Contact Lens Manual. A practical guide to fitting. Gasson A, Morris A J. Butterworth Heinemann Elsevier.
15. Steinert's cataract surgery.
16. Shields Text book of glaucoma
17. Smith and Nozik : Uvea
18. Rootman's diseases of the orbit
19. Eyelid, conjunctival and orbital tumors. An atlas and textbook. Shields JA, Shields CL. Philadelphia: Lippincott Williams & Wilkins.
20. Intraocular tumors. An atlas and textbook. Shields JA, Shields CL.
21. Pediatric Ophthalmology. Taylor and Hoyt: Saunders Ltd.
22. Management of Strabismus and Amblyopia. Pratt-Johnson and Tilson: Thieme Verlag.
23. Handbook of Pediatric Eye and Systemic disease. Wright, Spiegel and Thompson.
24. Binocular Vision and Ocular Motility. Theory and Management of Strabismus. Von Noorden GK. Mosby.
25. Surgical Management of Strabismus. Helveston:
26. Strabismus: A Decision Making Approach. Von Noorden and Helveston:
27. Thyroid Eye Diseases. Char DR. Williams and Wilkins, Baltimore.
28. A Manual of Systematic Eyelid Surgery. Collin JRO (ed). Churchill Livingstone, Edinburgh.
29. Refractive Surgery. Agarwal A, Agarwal A, Jacob Soosan. Jaypee.
30. LASIK Complications, Prevention and management. Gimbel HV, Penno EEA. Slack Inc.
31. Management of Complications of Refractive Surgery. Alio JL, Azar DT. Springer.
32. Quality of Vision: Essential Optics for the Cataract and Refractive Surgeon. Holladay JT. Slack Inc.
33. Ocular Pharmacology: Havener
34. Anatomy: Wolff's Anatomy of the Eye and Orbit
35. Physiology: Adler's Physiology of the Eye
36. Textbook of Ophthalmology (2 volumes). Easty DL, Sparrow JM. Oxford Oxford Medical Publications.
37. The Eye. Basic Sciences in Practice. Forrester JV, Dick AD, McMenemy PG, Lee WR. W B Saunders.
38. A Stereoscopic Atlas of Macular Diseases: Diagnosis and Treatment. Gass JDM.
39. Neuroophthalmology. Glaser JS. Lippincott Williams & Wilkins. .
40. Clinical Ophthalmic Pathology. Harry J, Misson G. Butterworth/Heinemann.
41. Inherited Retinal Diseases. A Diagnostic Guide. Jimenez Sierra JM, Ogden TE, Van Boemel GB. Mosby.
42. Clinical Ophthalmology. Kanski JJ. Butterworth/Heinemann.

- 43. ABC of Resuscitation. Colquhoun, M. C., Evans, T. R., Handley, A. J. BMJ Publishing Group.
- 44. Walsh and Hoyt's Clinical Neuroophthalmology (5 volumes). Miller NR, Newman NJ, Williams and Wilkins.
- 45. The human eye. Oyster CW Sinauer Associates. Sunderland. Massachusetts
- 46. Paediatric Ophthalmology. Taylor D. Blackwell Science.
- 47. Decision Making in Ophthalmology. Van Heuven WAJ, Zwann J. Mosby.
- 48. Parsons' Diseases of the eye. Sihota and Tandon.
- 49. Wills Eye Manual
- 50. International Council of Ophthalmology Residency Curriculum available at <http://www.icoph.org/>

Journals

03-05 international Journals and 02 national (all indexed) journals

Annexure I

**Postgraduate Students Appraisal Form
Pre / Para /Clinical Disciplines**

Name of the Department/Unit :

Name of the PG Student :

Period of Training : FROM.....TO.....

Sr.No. PARTICULARS		Not Satisfactory	Satisfactory	More Than Satisfactory	Remarks
		1 2 3	4 5 6	7 8 9	
1. Journal based / recent advances learning					
2. Patient based /Laboratory or Skill based learning					
3. Self directed learning and teaching					

4. Departmental and interdepartmental learning activity					
5. External and Outreach Activities / CMEs					
6. Thesis / Research work					
7. Log Book Maintenance					

Publications Yes/ No

Remarks* _____

***REMARKS:** Any significant positive or negative attributes of a postgraduate student to be mentioned. For score less than 4 in any category, remediation must be suggested. Individual feedback to postgraduate student is strongly recommended.

SIGNATURE OF ASSESSEE

SIGNATURE OF CONSULTANT

SIGNATURE OF HOD

☎: 0831-2470362

Web: <http://www.kledental-bgm.edu.in>

FAX: 0831-2470640

E-mail: principal@kledental-

Sl. No.	Particulars	Information
1	Name of the program	Preclinical Crown and Bridge training procedures for Preclinical Prosthodontic students
2	Program organized by Department	Department of Prosthodontics, VKIDS
3	Department / Association / Cell involved	Department of Prosthodontics, VKIDS
4	Date	25/09/23
5	Duration	3 hours
6	Location	Preclinical Prosthodontics Lab, Department of Prosthodontics
7	Objective of the program	To acquire knowledge about rehabilitation of partially edentulous conditions by means of fixed partial denture. To learn the basic skills involved in tooth preparation for Crown and Bridge procedures. To have adequate hands on exercise in the Preclinical setup.
9	No. of Students Participated	47
10	No. of Teachers Participated	4 Teachers

A Constituent unit of KLE Academy of Higher Education & Research Deemed-to-be-University/s of the UGC Act, 1956)
Nehru Nagar, Belagavi- 590010 INDIA
Accredited 'A+' grade by NAAC (3rd Cycle) & Placed in Category 'A' by MHRD (GoI)

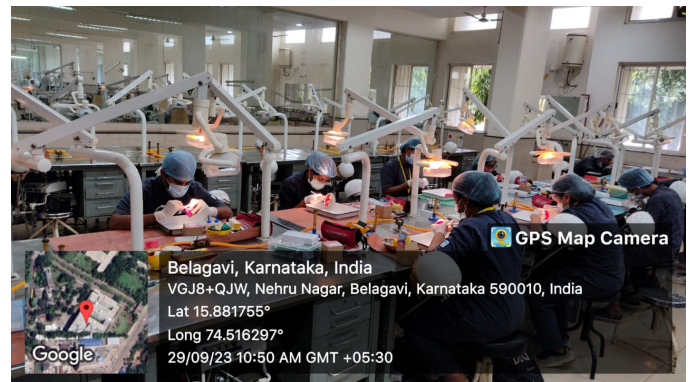
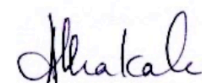
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PHOTOGRAPHS

Principal
KLE VK Institute of Dental Sciences
Belagavi



KLE V.K. Institute of Dental Sciences

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Date : 9.06.2023

Early Clinical Exposure Time table			
Sl no.	Department Name	Dates	Time
1	Oral Medicine and Radiology	12/09/2023	1:30 to 4:30 pm
		15/09/2023	10:00 to 12:30 am
2	Periodontics	25/09/2023	1:30 to 4:30 pm
		26/09/2023	1:30 to 4:30 pm
3	Pedodontics	3/10/2023	1:30 to 4:30 pm
		6/10/2023	10:00 to 12:30 am
4	Orthodontics	9/10/2023	10:00 am to 4:30 pm
5	Oral Surgery	16/10/2023	10:00 am to 4:30 pm
6	Prosthodontics	9.06/2023	10:00 to 12:30 am

Dr Alka Kale MDS, Ph.D

Principal

KLE VK Institute of Dental Sciences

Belagavi

Ordinance Governing
FIRST BHMS PROFESSIONAL COURSE
COMPETENCY BASED DYNAMIC CURRICULUM

(Applicable from Batch 2022-2023 onwards for 5 years or until further notification
by National Commission for Homoeopathy whichever is earlier)



Accredited 'A' Grade by NAAC (2nd Cycle)
Placed in Category 'A' Grade by MHRD (GoI)

**KLE ACADEMY OF HIGHER EDUCATION AND
RESEARCH**

JNMC Campus, Nehru Nagar, Belagavi-590 010. Karnataka, INDIA.

Phone: +91 0831-2444444, 2493779 FAX: +91 0831-2493777

E-mail: info@kledeemeduniversity.edu.in Website: <http://www.kledeemeduniversity.edu.in>

VISION

To be an outstanding KAHER of excellence, ever in pursuit of newer horizons, to build self-reliant global citizens through assured quality educational programs.

MISSION

- To promote sustainable development of higher education consistent with statutory and regulatory requirements.
- To plan continuously provide necessary infrastructure, learning resources required for quality education and innovations.
- To stimulate to extend the frontiers of knowledge through faculty development and continuing education programs.
- To make research a significant activity involving staff, students and society.
- To promote industry / organizations, interaction/ collaborations with regional national/international bodies.
- To establish healthy systems for communications among all stakeholders for vision oriented growth.
- To fulfill the national's obligations rural health missions.

OBJECTIVES

The objectives are to realize the following at KAHER and its constituent institutions:

- To implement effectively the programs through creativity and innovations in teaching, learning and evaluation.
- To make existing programs more careers oriented through effective system of review and redesign of curriculum.
- To impart spirit of enquiry and scientific temperament among students through research oriented activities
- To enhance reading and learning capabilities among faculty and students and inculcate sense of lifelong learning.
 - To promulgate process for effective, continuous objective oriented student performance evaluation
 - To ordinate periodic performance of the faculty.
- To incorporate themes to build values, Civic responsibilities & sense of national integrity.
- To ensure that the academic, career and personal counseling are in-built into the system of curriculum delivery.
- To strengthen, develop and implement staff and student welfare programs
- To adopt and implement principles of participation, transparency and accountability in governance of academic and administrative activities.
- To constantly display sensitivity and respond to changing educational, social and community demands.
- To promote public-private partnership.

INSIGNIA



The Emblem of the **KAHER** is a philosophical Statement in Symbolic.

The Emblem...

A close look at the emblem unveils a pillar, a symbol of the "University of Excellence" built on strong values & principles.

The Palm and the Seven Stars...

The Palm is the Palm of the teacher- the hand that acts, promises & guides the students to reach for the Seven Stars...

The Seven Stars Signify the "Saptarishi Dnyanamandal", the Great bear-a constellation made of Seven Stars in the sky, each signifying a particular Domain. Our culture says: The true objective of human birth is to master these Knowledge Domains.

The Seven Stars also represent the Saptarishis, the founders of KLE Society whose selfless service and intense desire for "Dnyana Dasoha" laid the foundation for creating the knowledge called KLE Society.

Hence another Significance of the raised palm is our tribute to these great Souls for making this KAHER Possibility.

Empowering Professionals...

"Empowering Professionals", inscription at the base of the Emblem conveys that our Organization with its strength, maturity and wisdom forever strive to empower the student community to become globally competent professionals. It has been a guiding force for many student generations in the past, and will continue to inspire many forth coming generations.

NOTIFICATION

CONTENTS		
Sl. No.	Topics	Page Nos.
1.	Preamble	
2.	Goals	
3.	Programme Outcomes	
4.	Regulations Governing I BHMS Course	
5.	Deriving Competencies of the Homoeopathic Medical Graduate	
6.	Glossary of terms used in the template	
7.	Organon of Medicine and Homoeopathic philosophy and Fundamentals of Psychology	
8.	Psychology	
9.	Anatomy, Histology and Embryology	
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11.	Homoeopathic Pharmacy	
12.	Homoeopathic Materia Medica	
13.	Homoeopathic Repertory and Case Taking	
14.	Yoga for Health Promotion	

PREAMBLE TO THE COMPETENCY BASED DYNAMIC CURRICULUM

The National Commission for Homoeopathy (NCH) has undertaken major revisions in the educational regulations in the last year and has devised a new Syllabus to ensure that the student who completes the homoeopathic undergraduate course grows into a homoeopathic physician who is informed and capable of performing as a professional with competency to deliver services as required for addressing the health needs of the person and society at large. It is based on the premise that a correct adherence to homoeopathic principles and knowledge imparted will enable the physician to deliver results in all aspects of health, viz. preventive promotive, curative and rehabilitative.

There is a significant change in the approach and contents in the newly designed curriculum, with the intention of making it more coherent for the present and future needs of society. The designing of curriculum is based on the sound theories of educational methodology as applicable for the health professionals' education, and therefore, the outcomes are quite transparent and achievable.

The Homoeopathic Educational Board (HEB) is obliged by the NCH Act 26 (b) to “develop a competency based dynamic curriculum for Homoeopathy at all levels in accordance with the regulations made under this Act, in such manner that it develops appropriate skill, knowledge, attitude, values and ethics among the graduates, postgraduate and super-speciality students and enables them to provide healthcare, to impart medical education and to conduct medical research”.

Competency based medical education (CBME) has been around in the medical world for more than three decades. It has undergone several revisions and adaptations through this period which has placed the NCH in an advantageous position to learn from the varied experiences of curriculum formulation, implementation and assessment.

It should be emphasized that the switch over to CBME involves a sea change in the understanding of the processes and outcomes for which all stakeholders need to be adequately sensitized and the teachers trained to minimize the difficulties inevitable in any transition. The following four pillars need a special mention to grasp the nature of the change being brought about (Frank Jason R, et al 2010).

1. The focus is on ensuring that the end user of the health care services is benefited. Hence it is important that the outcomes of the training are defined in clear terms so that the teacher, the student and the community are aware of what can be expected from the training.
2. The second logical focus is on bringing the abilities of the physician to the level when the outcomes defined above are realized. This involves the definition of the competencies required in the discharge of various functions of the physician. This

would involve certain generic competencies such as problem solving or effective communication and certain specific ones related to the subject of study like. Anatomy, Materia Medica or others. This coupling of the outcome and abilities leads automatically to the third pillar.

3. We have been used to consider all training as time bound as the BHMS course is 5 1/2 years duration. But when we realize that the rate of mastering different abilities would vary from student to student, we should de-emphasize the fixed period of training and instead look at how the student can be helped to master the specific competency.
4. The fourth pillar becomes the student herself/himself. The entire education and training become learner centred and hence the teacher takes a great effort in defining the outcomes, competencies, teaching and learning methods and most important of all, assessment which is predominantly formative and hence intends to shape the evolving capacities of the learner.

While formulating the competency based dynamic curriculum (CBDC) for the homoeopathy undergraduate, we must bear in mind the central role that homoeopathy philosophy and the principle of holistic care plays in the therapeutic actions of the homoeopathic interventions. This is a distinctive aspect which has hardly received the attention it deserves despite Hahnemann's clear recommendations in the first six Aphorisms of the Organon. The revised syllabus has brought this change and the formulation of the competency-based curriculum provides an opportunity to incorporate this approach at all levels of teaching and training. The implications lie in bringing about a sensitive and effective integration (horizontal/vertical/spiral) of all aspects of the syllabus throughout the five and half years of the undergraduate course.

There are five compelling factors that form the fulcrum to drive the change (Harris Peter, et al, 2010):

1. Design of curriculum: This needs careful attention due to its novelty. Homoeopathy, as a holistic discipline resting on the foundations of philosophy, needs a holistic approach from the first year itself. Several novel situations will need to be envisaged and catered to. And yet, a number of issues will remain. This is the dynamic nature of the enterprise, and we must be prepared to accept the well-known adage: Change, the only constant!
2. Teacher training: Our teachers have discharged the role of information providers and the teaching-learning process calls for a transformation in the role of the teacher (Sidhu Navdeep S. et al 2022). The future will need them to wear multiple hats and hence they will need to develop competencies viz. planner, facilitator, assessor, education manager, role model, etc, to be effective for these roles.
3. Assessment: Assessment practices must be based on a robust platform of validity, reliability, and objectivity, so that the tools of assessment blend fluidly

with the academic flow. In this background, the focus is to shift the assessment approach from the monopoly of summative assessment to a significant allowance for formative assessment, which are supportive for learning and correction on-the-go.

4. Student issues: Along with the parents and the community, a significant re-orientation is called for while changing it from that of a 'last-minute' sprinter to a long range 'racer'! All stakeholders should be on the same page so that the processes can operate in a well-oiled manner. Glitches are to be expected when a largely 'rights' based social mind set has to shift gears to adopt a competency oriented one. Understanding that change needs patience and good will go a long way to make the latter orientation a way of life.
5. Systems: All educational systems from the colleges to universities need to incorporate the multiple changes within their systems. We are used to consider results as 'pass' and 'fail' with the latter carrying the stigma. While there is an expressed need to wish to cater to all categories of learners – fast, normal, slow – the need to bring about changes in the systems is not so readily accepted. The institutions need to develop as 'learning organisations' that spur the 'growth mind-set' of its members – the teachers, students, and all those who are in the loop of curricular or co-curricular management.

GOALS

NATIONAL GOALS:

At the end of undergraduate program, the medical student should be able to:

- a. Recognize the strength of homoeopathy, its applicability and limitations in health care of society and the individual.
- b. Learn the integration of medical services for effective delivery of health care.
- c. Recognize the purpose of the National Health Policy and "Health for all" as a national goal and health right of all citizens and undergo training to achieve the realization of this social responsibility
- d. Achieve competence in the practice of homoeopathy with holistic approach, encompassing promotive, preventive, curative and rehabilitative aspects of common diseases.
- e. Develop a scientific temper, acquire educational experience for proficiency in profession and promote healthy living based on the tenets of homoeopathy.
- f. Become an exemplary citizen by observing medical ethics and fulfilling social and professional obligations so as to respond to national aspirations.
- g. Develop skills to perpetuate homoeopathy & practice it with zeal so that it stands parallel to other scientific healing methods.

INSTITUTIONAL GOALS:

In consonance with the national goals, each homoeopathic medical institution should evolve institutional goals to define the kind of trained homoeopathic professionals they intend to produce. The undergraduate students coming out of a homoeopathic medical institute should:

- a. Be competent in clinical diagnosis and homoeopathic management of the health problems of the individual and the community, commensurate with his/her position as a member of the health team at the primary, secondary or tertiary levels, using his/her clinical skills based on history, physical examination and relevant investigations.
- b. Be competent to use homoeopathic medicines scientifically for health problems in preventive, promotive, curative palliative and rehabilitative mode.
- c. Appreciate the rationale for the use of different therapeutic modalities & engage in cross-referral when required in the interest of the patient.
- d. Be able to appreciate the socio-psychological, cultural, economic and environmental factors affecting health and develop a humane attitude towards patients in discharging professional responsibilities.
- e. Be able to identify community health problems and learn to work to resolve these

- by understanding, designing, instituting corrective steps as per homoeopathic principles and evaluating outcome of such measures.
- f. Develop sensitivity to environmental sustainability and engage in community work towards achieving it with responsibility and commitment.
 - g. Be trained in critical thinking, evidence-based practice and possess research aptitude and documentation skills necessary in professional work.
 - h. Possess the attitude for lifelong learning and be ready to develop competencies as and when conditions of practice demand it.
 - i. Be familiar with the basic factors which are essential for the implementation and integration of the National Health Programmes with homoeopathy including practical aspects of the following: (i) Family Welfare and Mother and Child Health (MCH) (ii) Sanitation and water supply (iii) Prevention and control of communicable and non- communicable diseases (iv) Immunization (v) Health Education.
 - j. Acquire basic management skills in the area of human resources, materials and resource management related to homoeopathy in health care delivery, general and hospital management, principal inventory skills and counseling.
 - k. Be able to work as an active and responsible partner in health care teams and acquire proficiency in communication skills with colleagues, patients and the community at large.
 - l. Be competent to work in a variety of health care settings.
 - m. Develop personal characteristics and attitudes required for professional life such as personal integrity, sense of responsibility and dependability and ability to relate to or show concern for other individuals.

GOALS OF THE LEARNER

Towards attaining the goals of this program, the homoeopathic graduate must be able to function in the following roles appropriately and effectively:

- a. Clinician who understands and provides holistic preventive, promotive, curative, palliative and rehabilitative care with compassion.
- b. Leader and member of the health care team and system with capabilities to collect, analyse, synthesize and communicate health data.
- c. Communicator with patients, families, colleagues and community.
- d. Lifelong learner committed to continuous improvement of skills and knowledge.
- e. Professional, who is committed to excellence, is ethical, responsive and accountable to patients, community and profession.

PROGRAMME OUTCOMES:

At the end of the course of the undergraduate studies, the homoeopathic physician must

- 1) Develop the knowledge, skills, abilities and confidence as a primary care homoeopathic practitioner to attend to the health needs of the community in a holistic manner
- 2) Correctly assess and clinically diagnose common clinical conditions prevalent in the community from time to time
- 3) Identify and incorporate the socio-demographic, psychological, cultural, environmental & economic factors affecting health and disease in clinical work
- 4) Recognize the scope and limitation of homoeopathy in order to apply Homoeopathic principles for curative, prophylactic, promotive, palliative, and rehabilitative primary health care for the benefit of the individual and community
- 5) Be willing and able to practice homoeopathy as per medical ethics and professionalism.
- 6) Discern the scope and relevance of other systems of medical practice for rational use of cross referrals and role of life saving measures to address clinical emergencies
- 7) Develop the capacity for critical thinking, self reflection and a research orientation as required for developing evidence based homoeopathic practice.
- 8) Develop an aptitude for lifelong learning to be able to meet the changing demands of clinical practice
- 9) Develop the necessary communication skills and enabling attitudes to work as a responsible team member in various healthcare settings and contribute towards the larger goals of national health policies such as school health, community health and environmental conservation.

Deriving Competencies of the Homoeopathic Medical Graduate

Seven broad dimensions of practice were identified in which all actions of the homoeopathic physician in the context of our health care system could be classified (Englander, et al, 2013). The definitions of these terms in our medical and social context are as follows:

Table 1: Dimensions of Practice of the Homoeopathic Physician

	Dimensions of Practice of the Homoeopathy Physician	Definition
1.	Knowledge of Homoeopathy Practice	Demonstrates knowledge of established and evolving biomedical, clinical, epidemiological and social-behavioral sciences, as well as the application of this knowledge to patient care using homoeopathy as a means of intervention.
2.	Patient Care	Provides patient-centered, individualized care that is compassionate, appropriate, and effective for the treatment of health problems and the promotion of health.
3.	Interpersonal and Communication Skills	Demonstrates interpersonal and communication skills that result in the effective exchange of information and collaboration with patients, families, and health professionals.
4.	Professionalism	Demonstrates a commitment to carrying out professional responsibilities and an adherence to ethical principles.
5.	Practice based learning and Improvement	Demonstrate the ability to investigate and evaluate one's care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning.
6.	Health care systems	Demonstrate an awareness of and responsiveness to the larger context and system of health care in the country, as well as the ability to call effectively on other resources in the system to provide optimal health care.
7.	Scholarship	Demonstrate the qualities required to sustain lifelong personal and professional growth.

Table 2: Generic competencies relevant to the functioning of the physician

Areas	Cognitive	Personal	Interpersonal	Community
	Analytical	Self-reflection	Empathetic	Ethical awareness
	Synthetic	Self-Awareness	Leadership	Community awareness
	Objective	Safety compliane	Team work	Safety awareness
	Organizing and Planning	Lifelong learning	Collaboration	
	Problem Solving	Compassion	Respect for Privacy and autonomy	
	Information gathering	Personal integrity	Communication skills -oral and written	
	Documentation	Healthy coping mechanisms	Executive ability	
	Information managemnt	Flexibility		
	Creative thinking	Dealing with uncertainty		
	Holistic approach			
	System based thinking			

Glossary of terms used in the template.

Goals

These are broad outcomes expected of a student at the end of the course of studies. These are to be contrasted with Objectives/Outcomes which are more specifically and narrowly defined.

Programme

A range of learning experiences offered to students in a formal manner over a period of one- to-four years leading to certificates/ diplomas/ degrees. Examples:BA (Economics) BSc (Physics). All possible formal degree Programmes are identified by UGC. BHMS is one such Programme

Programme Outcome

Programme Outcomes (POs) are what knowledge, skills and attitudes a graduate should have at the time of graduation. The Programme Outcomes of professional disciplines are identified at national level by the concerned accrediting agency. In this case, it would be the National Commission of Homoeopathy which would be involved.

Course

Course for the purpose of this Manual represents a subject e.g. Anatomy. In homoeopathic education some of the courses extend over several years e.g. Materia Medica. The relevance of this is in the formulation of Course Outcome

Course Outcome

Course Outcomes are statements that describe what students should be able to do at the end of a course. Where a Course extends over a number of years, it is necessary to define distinct Course Outcomes over the entire teaching programme of the subject. These will vary in depth and extent of the coverage of the subject.

Competency

An observable ability of a health professional, integrating multiple components such as knowledge, skills, values, and attitudes. Since competencies are observable, they can be measured and assessed to ensure their acquisition.

Generic competency:

Professional performances are denoted by certain demonstrable attributes that the learners imbibe and internalise as reflex activities. These are the abilities of the professional that characterise the quality and level of performance. The generic competencies therefore are the abilities that a basic homoeopathic doctor would be trusted to have acquired as a consequence of his / her learning. The examples include Information gathering, problem identification, etc. The generic competencies therefore refer to the overall frames of abilities.

Subject area:

Subject area is a chunk of content in a given subject. It could be a chapter, topic, sub-topic, etc.

Millers Levels:

Miller's Pyramid is a diagrammatic representation of the convergence of learning. It maps the pathway of learning to show a person gains the ability and competence in a series of increasingly progressive phases of learning.



The broad base of this pyramid - 'Knows' – has the ability to recall facts and ideas that form the bedrock of professional requirements. 'Knows How' is the next phase of learning, where the students gains the insight into the relationships between the various units of 'knows' and can relate them meaningfully to reach the 'knows how' capacity. These phases would largely be in the Cognitive Domain of Bloom's Taxonomy of Learning Objectives.

Learning is not just about knowing and knowing how, but also to enable that the 'know how' is put into practice. This is the third phase of Miller's Pyramid – the 'Shows How'. During this phase of learning, the student is able to demonstrate the reasoning ability that he / she has acquired in controlled or real situations. This ability also includes the psychomotor dimension of Bloom's Taxonomy. The summit of pyramid, i.e., 'Does' also includes the emotional aspect of learning in the form of values, attitudes, communication, etc, that denote the 'Affective Domain' of Bloom's Taxonomy.

The Miller's Pyramid is a valuable tool to represent the increasing levels of competencies that the students need to acquire, and also a framework to assess the level of competency that is achieved. Interestingly, the framework focuses on what the learner would be doing, rather than on what the teacher would be doing.

Specific competency:

Specific competencies are the abilities that the student is expected to acquire in a focused area of expertise, which could be a discipline-based knowledge, a skill, an attitude, or a combination of these.

Specific Learning Objectives / Outcomes:

Specific Learning Objectives / Outcomes (SLOs) describe what students should know or be able to do at the end of a learning session, that they couldn't do before. These

are written and communicated in a 'low context communication style', that is to say, whoever reads the SLO would have the same understanding that the person who wrote it had. That is, there would be no communication gap.

That is the reason why the SLOs are written specifically and exclusively as units of learning in one of the domains of Bloom, and further at one of the levels of Guilbert. This will ensure that the learning that is expected is clearly communication among all those who refer to it, including those who set the assessment and evaluate the student performance. Further, the SLOs are ALWAYS written with an ACTIVE verb, so as to make the statement observable and measurable.

Bloom's domain:

Bloom's Taxonomy of Educational Objectives is a tool for classifying learning under the categories of 'knowledge', 'skill', and 'attitude / value / communication', represented by the technical terms 'Cognitive', 'Psychomotor', and 'Affective' domains respectively. Each of these domains distinguish the dimension of learning in a particular area. The importance of such classification is that it offers a clear model for both teaching and students' assessment.

Guilbert's level:

Guilbert's Hierarchy is a tool that describes the various levels of learning that can be mapped and managed in the Bloom's domains of learning – cognitive, psychomotor, and affective. This tool also has the additional benefit to identify the appropriate teaching – learning methods / media, and also the assessment strategies.

In the 'knowledge' domain Guilbert's approach to learning proceeds from recall of facts to understanding / interpreting the different sets of data, and finally to the ability to make decisions and solve problems on the basis of the understanding / interpretation. This simple three-step process builds a sequential order of learning; it clearly brings out that decisions shall be made NOT on the basis of facts alone, but through a process of understanding and interpretation.

The 'skill' domain builds the learning from the stage of observing and imitation to gaining control over the skills and culminating in automatism of the skill. In simple terms, any skill will be learnt initially by observing its performance, and imitating the same in the sequential order. In the next phase, the learner tries to gain control over the skill initially under the supervision, and ultimately will be able to perform it independently.

Learning in the affective domain proceeds from the stage where the learner is open and receptive to the stimulus or trigger situation, responding to it in a desirable manner, and finally internalising the responses.

Priority of learning:

The priority of learning is represented as 'Must know', 'Desirable-to-know', and 'Nice-to-know'. Prioritisation is a critical component of curriculum design because it classifies the learning outcomes on the basis of their importance and usefulness for the ultimate professional standards. The priority of learning is objectively assigned by a formula that gives weightage on the basis of 'frequency and impact' of the learning for professional needs.

TL Method / Media:

The teaching-learning (TL) methods and media are the vehicles that enable the acquisition of stated outcomes. Teaching method is simply 'what the teacher does or what the teacher enables the students with', such as giving a lecture, conducting a demonstration, or facilitating a group discussion. Teaching-learning media is 'what the teacher or the students use' to enable the learning; with examples such as a board, or projector, or model, or specimen, among others.

The teaching-learning methods and media are specific to the domains and levels in the domains. It must also be remembered that learning is a continuum, and a range of methods and media would be appropriate in the different phases in the continuum of learning.

Assessment:

Assessment of learning is an important component of curriculum. This measures the performance of the students in comparison to the expected outcomes of learning. Therefore the learning outcomes must be stated and communicated clearly and objectively to all the stakeholders of education. Assessment strategy is based on the domain and the level of domain in which the outcome is to be measured. Assessment could be judgemental for the extent and quality of outcomes, when it is called 'assessment of learning', or it could also be supportive for learning, when it is called as 'assessment for learning'. There are two major approaches to assessment – formative, and summative. The tools of assessment are provided in the annexure.

Formative Assessment:

Formative assessment is NOT judgemental, in that it does not brand the learner as 'pass' or 'fail'. The formative assessments measure the extent and quality of learning with reference to the expected learning outcomes, so that the students can be given feedback to improve on their performance. The formative assessments promote mastery learning, that is to say, each student achieves the stated level of mastery of performance because of the feedback and support. Formative assessment is also called as continuous assessment.

Summative Assessment:

Summative assessment has the mandate to judge the achievement of the learner at the end of a period of learning, and label him / her as 'pass' or 'fail', assign a rank, approve for eligibility to be promoted or eligibility to be admitted to a course. These

assessment also serve as quality check to ensure that those who are being certified conform to a minimum standard of professional competence.

Integration:

Integration of learning is an essential requirement for aligning various data points of knowledge and skills for getting a holistic understanding and enabling a unified performance. Integration can be achieved at various dimensions and at various levels.

The dimensions of integration could be temporal in the form of Horizontal, Vertical, or Spiral. Horizontal integration is the alignment of learning on a longitudinal timeline, where the comparable contents of various subjects in the same term or year are integrated, for example the structure from anatomy, function from physiology, symptoms from materia medica, and rubrics from repertory in the pre-clinical phase of BHMS.

Vertical integration is seen in the subjects that build on the pre-existing knowledge and skills of another subject. For example, the integration between the basic sciences such as anatomy, physiology, and biochemistry for the para-clinical learning such as in pathology, and the integration of basic and para-clinical skills into clinical learning.

Spiral integration is where a subject is recurring at various levels in the same course. For example, materia medica is learnt from the first to final BHMS, and the focus of the subject is not the same in each year. There would be iteration of the same knowledge from different perspectives and capabilities across the different phases of BHMS.

The levels of integration represent the increasing approximation of knowledge from different subjects, so as to reach an approximation of fusion. The attempt to integration may begin with arranging the comparable contents of different subjects at the same cross sections of timeline. Further, there could be positioning the content of one subject into another subject to bring some kind of co-existence. Still further, the contents can be seamlessly merged to create an aligned learning content. Such integrative efforts can bring about holistic learning for a meaningful homeopathic capacity-building.

Understanding the Competencies Table & Using The Competencies Table
(Reference – F.No-3-90/2022/NCH/HEB/HEB Notice- Circular / 13099-13107; Dated: 14 Feb 2023; Page no18-26)

REGULATIONS GOVERNING BHMS COURSE
NATIONAL COMMISSION FOR HOMOEOPATHY

NOTIFICATION

New Delhi, the 6th December, 2022

F. No. 3-34/2021/NCH/HEB/CC/10758.—In exercise of the powers conferred by sub – section (1) and clauses (h), (i), (q), (s) and (t) of sub-section (2) of section 55 of the National Commission for Homoeopathy Act, 2020 (15 of 2020) and in supersession of Homoeopathy (Degree course) B.H.M.S. Regulations, 1983, except as respects thing done or omitted to be done before such supersession, the Commission hereby makes the following regulations, namely: -

1. **Short title and commencement.** – (1) These regulations may be called National Commission for Homoeopathy (Homoeopathy Graduate Degree Course – Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Regulations- 2022.
(2) They shall come into force on the date of their publication in the Official Gazette.
2. **Definitions.**- (1) In these regulations, unless the context otherwise requires, -
 - (i) “Act” means the National Commission for Homoeopathy Act, 2020 (15 of 2020);
 - (ii) “Annexure” means an Annexure appended to these regulations;
 - (iii) “Appendix” means an Appendix appended to these regulations;
 - (iv) “Commission” means the National Commission for Homoeopathy constituted under section 3 of this Act;
 - (v) “Electives” means the course of study devised to enrich the educational expression of the student.(2) Words and expressions used herein and not defined but defined in the Act shall have the same meanings as respectively assigned to them in the Act.
3. **Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course.**- The Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) shall produce Graduates, having profound knowledge of Homoeopathy with contemporary advancement in the field, supplemented with knowledge of scientific and technological advancement in modern health science and related technology along with extensive practical training, be able to function as an efficient holistic health care practitioner in health care service in the urban and rural areas.
4. **Eligibility criteria for admission and manner of admissions.** -(1) The eligibility for admission in Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) Course shall be, namely:-
 - (a) the candidate shall have passed 10+2 or its equivalent examination from any recognised Board with Physics, Chemistry, Biology and have obtained minimum of fifty percent. marks taken together in Physics, Chemistry and

Biology/Biotechnology in case of student belonging to general category and forty percent. marks in case of student belonging to the Scheduled Castes, Scheduled Tribes and Other Backward Classes:

Provided that in respect of person with disability specified under the Rights of Persons with Disabilities Act, 2016 (49 of 2016), the qualifying marks in the examinations shall be forty-five percent. in case of General category and forty percent. in case of the Scheduled Castes, Scheduled Tribes and Other Backward Classes.

- (b) Biology/Biotechnology studied as Additional Subject at 10+2 level also shall not be considered for such admission:
 - (c) Candidate passed 10+2 from Open School or as Private candidate shall not be eligible to appear for National Eligibility-cum-Entrance Test.
 - (d) No candidate shall be considered for admission in Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) Course unless the candidate attains the age of seventeen years on or before the 31st day of December of the year of admission in the first year of the Course;
- (2) There shall be a uniform Entrance Examination for all Homoeopathy Medical Institution namely National Eligibility-cum- Entrance Test (NEET) for admission to under-graduate course in medical institution in each academic year and shall be conducted by an authority designated by the National Commission for Homoeopathy:

Provided that for foreign national candidate, any other equivalent qualification approved by the Central Government may be allowed for admission and sub- regulation (2) of regulation 4 shall not be applicable in this behalf.

- (3) No candidate obtaining less than marks at 50th percentile in the National Eligibility-cum- Entrance Test for undergraduate course conducted for the said academic year shall be considered for such admission:

Provided that the candidate belonging to the Scheduled Castes, Scheduled Tribes and Other Backward Classes obtain marks not less than 40th percentile and the candidate belonging to person with the disability as specified under the Rights of Persons with Disabilities Act, 2016 (49 of 2016) obtains the marks not less than 45th percentile in case of General category and not less than 40th percentile in case of the Scheduled Castes, Scheduled Tribes and Other Backward Classes shall be considered for admission.

Provided further that the Commission may, in consultation with the Central Government lower the marks required for admission to

undergraduate course for candidate belonging to respective category and marks so lowered by the Commission shall be applicable for that academic year.

- (4) An All-India common merit list as well as State-wise merit list of the eligible candidate shall be prepared on the basis of the marks obtained in the National Eligibility-cum-Entrance Test conducted for the academic year and the candidate within the respective category shall be considered for admission to undergraduate course from the said merit list.
- (5) The seat matrix for admission in the Government institution, Government-aided institution and private Institution shall be fifteen percent. for all-India quota and eighty-five percent. for the State quota and Union territory quota as the case may be:

Provided that, -

- (a) the all India quota for the purpose of admission to the Deemed University both Government and private shall be hundred percent.;
- (b) The university and institute having more than fifteen percent. all India quota seat shall continue to maintain that quota;
- (c) five percent. of the annual sanctioned intake capacity in Government and Government aided institution shall be filled up by candidate belonging to persons with disability as specified under the provisions of the Rights of Persons with Disabilities Act, 2016 (49 of 2016)

Explanation.- For the purposes of this regulation, the specified disability contained in the Schedule to the Rights of Persons with Disabilities Act, 2016 (49 of 2016) specified in Appendix "A" and the eligibility of candidate to pursue a course in Homoeopathy with specified disability shall be in accordance with the guidelines specified in Appendix "B".

- (6) The designated authority for counseling of State and Union territory quota for admission to undergraduate course in medical institution in State and Union territory including institution established by the State Government, University, Trust, Society, Minority Institution, Corporation or Company shall be the respective State or Union territory in accordance with the applicable rules and regulations of the concerned State or Union territory, as the case may be.
- (7) (a) The counselling for admission to Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) course for seats under all India quota as well as the all-medical institution established by the Central Government shall be conducted by the authority designated by the Central Government in this behalf;

(b) The counselling for admission to Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) Course for hundred percent. seats of Deemed University both Government and Private shall be conducted by the authority designated by the Central Government, in this behalf.

(8) The admission shall be done;-

(a) through counseling except foreign nationals;

(b) by any means other than manner specified in these regulations shall not be approved and any institution found admitting the students in contravention of the provisions of these regulations shall be denied permission for taking admission for subsequent academic year;

(c) the medical institution shall have to submit the list of admitted students in the format decided by the Commission on or before six p.m. on the cutoff date for admission decided by it from time to time for verification;

(d) the medical institution shall approve the admission of the candidate except foreign national who has been allotted seat through counseling (Central, State or Union territory, as the case may be).

(9) The candidate who fails to obtain the minimum eligibility marks as referred to under sub- regulation (3) shall not be admitted to undergraduate course in the said academic year.

(10) No authority or medical institution shall admit any candidate to the under-graduate course in contravention of the criteria or procedure specified in these regulations and any admission made in contravention of these regulations shall be cancelled by the Commission forthwith.

(11) The authority or medical institution which grants admission to any student in contravention of the provisions of these regulations shall be dealt as specified under the Act.

(12) The medical institution shall send the list of admitted students to the Commission within one month of his admission and the Commission may verify the medical institution to ensure the compliance of the provisions of the regulations at any time.

5. **Duration of Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course** -The duration of the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course shall be five years and six months as specified in the table below, namely:-

Table-1

Seria l Numb er	Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course	Duration
(1)	(2)	(3)
(1)	First Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)	Eighteen Months;
(2)	Second Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)	Twelve Months;
(3)	Third Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)	Twelve Months;
(4)	Fourth (Final) Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)	Twelve Months;
(5)	Compulsory Rotatory Internship	Twelve Months.

6. **Degree to be awarded.** -The candidate shall be awarded Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Degree after passing all the examinations and completion of the laid down course of study extending over the laid down period and the compulsory rotatory internship extending over twelve months.
7. **Pattern of study.** -The Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course shall consist of main programme and electives and the pattern of study shall follow the following manner, namely:-
- (1) Main programme :-
- (a) after admission, the student shall be inducted to the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course through a Foundation Programme not less than ten working days/sixty hours based on the 'Content for Foundation programme' which intends to introduce newly admitted student to Homoeopathy system of medicine and skills required to make him well aware of the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course he is going to undergo for next five years and six months.
 - (b) during the Foundation Programme, the student of Homoeopathy shall learn history of Homoeopathy, get oriented with development of homoeopathic science across the globe, understanding on improvising interpersonal

communication skills, management of stress and time, basic life support and first-aid along with other subjects as per syllabus specified in Annexure -I

- (c) total teaching hours for first professional session shall be not less than two thousand one hundred and six (2106) while for second, third and fourth professional session, a minimum of one thousand four hundred and four (1404) hours teaching in each professional session to complete.
- (d) working hour may be increased by the University or medical institution as per requirement to complete the stipulated period of teaching and requisite activity.

Explanation. - For the purposes of this sub-regulation, -

- (a) "Lectures" means Didactic teaching such as classroom teaching,
- (b) Non – lecture includes Practical or Clinical and Demonstrative teaching and the Demonstrative teaching includes Small group teaching or Tutorials or Seminars or Symposia or Assignments or Role play or Drug Picture presentation or Pharmacy training or Laboratory training or Dissection or Field visits or Skill lab training or Integrated learning or Problem based learning or Case based learning or Early clinical exposure or Evidence based learning etc. as per the requirement of the subject and in Non-lectures, the Clinical or Practical part shall be seventy percent. and demonstrative teaching shall be thirty per cent.
- (e) new department and subject like fundamentals of Psychology, Yoga, essentials of Modern Pharmacology and Research Methodology and Biostatistics are introduced in degree course to provide holistic and integrated knowledge of the health science along with development of research aptitude.
- (f) the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course shall consist of following Departments/Subjects, namely : -

Table 2

Seria l Numb er	Name of Department
(1)	(2)
1	Homoeopathic Materia Medica;
2	Organon of Medicine and Homoeopathic Philosophy and Fundamentals of Psychology;
3	Homoeopathic Pharmacy;
4	Homoeopathic Repertory and Case Taking;
5	Human Anatomy;
6	Human Physiology and Biochemistry;
7	Forensic Medicine and Toxicology;
8	Pathology and Microbiology;
9	Community Medicine, Research Methodology and Biostatistics;
10	Surgery;
11	Gynaecology and Obstetrics;
12	Practice of Medicine with Essentials of Pharmacology;
13	Yoga for health promotion;

(g) The following subjects shall be taught in first professional session as per the syllabus laid down by Homoeopathy Education Board and approved by the Commission, namely:-

Table-3

Seria l Numb er	Subject Code	Subje ct
(1)	(2)	(3)
1	HomUG-HMM-I	Homoeopathic Materia Medica;
2	HomUG-OM-I	Organon of Medicine and Homoeopathic philosophy and Fundamentals of Psychology;
3	HomUG-R-I	Homoeopathic Repertory and case taking;
4	HomUG-HP	Homoeopathic Pharmacy;
5	HomUG-AN	Human Anatomy;
6	HomUG-PB	Human Physiology and Biochemistry;
7	HomUG-Yoga I	Yoga for health promotion.

(h) The second professional session shall ordinarily start after completion of first professional examination and the following subjects shall be taught as per the syllabus laid down by the Homoeopathy Education Board and approved by Commission, namely: -

Table-4

Serial Number	Subject Code	Subject
(1)	(2)	(3)
1.	HomUG-HMM-II	Homoeopathic Materia Medica;
2.	HomUG-OM-II	Organon of Medicine and Homoeopathic Philosophy;
3.	HomUG-R-II	Homoeopathic Repertory and case taking;
4.	HomUG-FMT	Forensic Medicine and Toxicology;
5.	HomUG-Path M	Pathology and Microbiology;
6.	HomUG-Sur-I	Surgery;
7.	HomUG-ObGy-I	Gynecology & Obstetrics;
8.	Hom-UG PM-I	Practice of Medicine;
9.	HomUG-Yoga-II	Yoga for health promotion.

(i) The third professional session shall ordinarily start after completion of second professional examination and following subjects shall be taught as per the syllabus laid down by Homoeopathy Education Board and approved by the Commission, namely: -

Table-5

Serial Number	Subject Code	Subject
(1)	(2)	(3)
1	HomUG-HMM-III	Homoeopathic Materia Medica;
2	HomUG-OM-III	Organon of Medicine and Homoeopathic Philosophy;
3	HomUG-R-III	Homoeopathic Repertory and case taking;
4	HomUG-PM-II	Practice of Medicine ;

5	HomUG-Mod.Pharm	Essentials of Pharmacology;
6	HomUG-Sur-II	Surgery;
7	HomUG-ObGy-II	Gynecology and Obstetrics;
8.	HomUG-CM-I	Community Medicine ;
9.	HomUG-Yoga -III	Yoga for health promotion;

- (j) The fourth professional session shall ordinarily start after completion of third professional examination and following subject shall be taught as per the syllabus laid down by Homoeopathy Education Board and approved by the Commission, Namely:-

Table-6

Seria l Numb er	Subject Code	Subje ct
(1)	(2)	(3)
1	HomUG-HMM-IV	Homoeopathic Materia Medica;
2	HomUG-OM-IV	Organon of Medicine and Homoeopathic Philosophy;
3	HomUG-R-IV	Homoeopathic Repertory and case taking;
4	HomUG-PM-III	Practice of Medicine;
5	HomUG-CM- RM-Stat-II	Community Medicine, Research Methodology and Biostatistics;
6	HomUG-Yoga - IV	Yoga for health promotion.

- (k) Clinical training. -Clinical training of the student shall start from the first professional session after second term and subject related clinical training shall be provided in the attached hospital by the concerned faculty and department in non-lecture hour as per the requirement of the subject as mentioned below-
- (i) During first professional session, clinical training shall be provided in Outpatient Department (OPD), Inpatient Department (IPD), community and peripheral clinics and clinical exposure may also be arranged through appropriate audio-visual media or simulated patient.
 - (ii) Students shall be placed in Hospital Pharmacy to get familiar with prescription patterns, medicine names, dosage, dispensing of medicines etc.

- (iii) During second, third and fourth professional session, clinical training shall be provided through the specialty Outpatient Department (OPD) and Inpatient Department (IPD), peripheral Outpatient Departments (OPDs) and community posting wherein teacher of the above departments shall be consultant. The students shall be involved in screening patients in Outpatient Department (OPD); case taking, analysis, evaluation and totality of symptoms, clinical examination, repertorisation and investigation including Radiology, Hematology and Pathology Laboratory and prescription writing.
- (iv) Training/ orientation on add on therapy: Training for Yoga, Physiotherapy and diet and nutrition shall be provided to the student by the concerned professional.
- (v) Clinical training shall be on rotation basis as per the non-lecture/clinical batches and in accordance with the clinical/ non-lecture teaching hour stipulated for the following subjects, namely: -
 - (A) Homoeopathic special and general Outpatient Department (OPD) and Inpatient Department (IPD), peripheral Outpatient Department (OPD), community Outpatient Department (OPD), with compulsory repertorisation through software.
 - (B) Practice of Medicine: Outpatient Department (OPD), Inpatient Department (IPD) and specialty clinics like Pediatrics, Pulmonology, Cardiology, Nephrology, Gastroenterology, Dermatology, Psychiatry, Oncology or any other, functioning under the department, in attached hospital/Super specialty hospital with Memorandum of Understanding (MoU).
 - (C) Surgery: Eye, Ear Nose Throat (ENT), Dental Outpatient Department and any other related specialty clinics; Operation Theater Unit, Preparation room, postoperative recovery room, Sterilization, wound care & infection control, bio- waste management and any specialty units in the attached hospital/Super specialty hospital with Memorandum of Understanding (MoU).
 - (D) Gynecology and Obstetrics: Outpatient Department (OPD), Inpatient Department (IPD), Labour room, procedural room, and other related specialty clinics for reproductive, mother & child health, if any.

- (E) Department of Community Medicine will provide training through specialty clinics, adopted villages /health programmes i.e. awareness camps, campaigns and public health programs and Inpatient Department (IPD) for waste management, prophylaxis and health education programs. Inpatient Department (IPD) Nutritional assessment and diet requirement of cases admitted in Inpatient Department (IPD) shall be determined by the dietitian of the Hospital. Awareness about nutritional disorders and balanced diet shall be included in the training programme.
 - (F) Clinical Outpatient Department (OPD), Inpatient Department (IPD) and clinics functioning under School Health programme .
- (vi) Clinical training for the fourth professional session shall be provided in Outpatient department (OPD), Inpatient department (IPD), and Physiotherapy room in accordance with the requirement of subject, and shall be on rotation basis as per the non- lecture/clinical batches and also in accordance with the clinical/ non-lecture teaching hour stipulated for the following subjects, namely: -
- (A) General and special Homoeopathic Outpatient Department (OPD) and Inpatient Department (IPD)
 - (B) Emergency/Casualty department in hospital
 - (C) Skill lab in hospital;
 - (D) Practice of Medicine: Outpatient Department (OPD), Inpatient Department (IPD) and specialty clinic (Pediatrics, Pulmonology, Cardiology, Nephrology, Gastroenterology, Dermatology, Psychiatry, Oncology) functioning under the department if any, in attached hospital /Super speciality hospital with Memorandum of Understanding (MoU).
- (2) Electives- (a) It constitutes an optional course of study devised to enrich the educational experience of the student and each discipline has distinctive requirements not adequately covered by the regular courses.
- (b) The Electives shall be conducted as an online programme by the Commission:
- (i) Each student from first professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course to third professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course shall opt two electives in each academic year.
 - (ii) The electives shall start from the second term of first professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course.
 - (iii) One elective shall be compulsory in each professional year

for student and he may select any one elective from the list provided by the Commission for a particular professional year.

- (iv) Completion of two electives shall be compulsory for passing the respective academic year.
- (v) Each elective may vary in terms of duration of the academic year but shall be available and divided into component of approximately two or more hours and the content or presentation shall be hosted on the online portal of the commission.
- (vi) Each component shall comprise an audio-visual component in the form of lecture/demonstration, some suggested reading material/activity and an assessment.
- (vii) The student may progress from one component to the next after satisfactorily completing each assessment.
- (viii) At the end of each elective, the commission shall issue an elective completion certificate online to the student and the certificate, having the grade, shall be submitted to the medical institution authority as proof of completing the electives and same shall be sent to affiliating university.
- (ix) The student who fails to complete the electives shall not be allowed to appear in annual university examination.
- (x) The commission shall provide a unique number to the student to log in the portal.

8. Methodology for supplementing modern advancement, research and technology in Homoeopathy(SMART-Hom.)-

- (1) To accomplish the supplementation of modern advancement, scientific and technological developments in Homoeopathy System of Medicine, all the thirteen departments as mentioned in table 2 of regulation 7, shall be supplemented, enriched and updated with relevant and appropriate advancement or development in the area of diagnostic tools, conceptual advancement and emerging areas as under-
 - (a) Innovations or advancement or new development in basic sciences like Biology, Chemistry, Physics, Mathematics, Microbiology, Bioinformatics, Molecular biology etc.;
 - (b) Diagnostic advancements;
 - (c) Pharmaceutical technology including quality and standardization of drugs, drug development etc.;
 - (d) Teaching, Training methods and Technology;
 - (e) Research Methods, Parameters, Equipment and Scales etc.;
 - (f) Technological automation, software, artificial Intelligence, digitalisation, documentation etc.;
 - (g) Biomedical advancements;
 - (h) Medical equipment;
 - (i) Any other innovations, advancement, technologies and development useful for understanding, validating, teaching, investigation, diagnosis, treatment, prognosis, documentation, standardisation and conduction of research in Homoeopathy.
- (2) There shall be multidisciplinary Core Committee constituted by the Commission for the purpose of supplementation of modern advancement, scientific and technological developments in Homoeopathy, that identify the advancement and developments that are suitable and appropriate to include in anyone or multiple departments.
- (3) There shall be an Expert Committee for each department constituted by Commission, to define and suggest the method of adaptation and incorporation of the said advancement and developments and also specify the inclusion of the same at undergraduate or postgraduate level and the expert committee shall develop detailed methodology for usage, standard operating procedure and interpretation as required.
- (4) Teaching staff, practitioner, researcher, student and innovator etc. may send his suggestions through a portal specified by National Commission for Homoeopathy regarding supplementation of modern advancement, scientific and technological development in Homoeopathy and suggestion

shall be placed by Homoeopathy Education Board before core committee for consideration.

- (5) The modern advancement shall be incorporated with due interpretation of the said advancement based on the principles of Homoeopathy, supported by the studies and after five years of inclusion of such advancement in syllabus, they shall be considered as part of Homoeopathy syllabus.
- (6) Once Core Committee approves the recommendations of the Expert Committee, National Commission for Homoeopathy shall direct the Homoeopathy Education Board, to include the same in curriculum of undergraduate or postgraduate course as specified by the Expert Committee and the Commission shall issue guidelines or if required to conduct orientation of teacher for incorporation of the recommended modern advancement or scientific and technological development.
- (7) (a) There shall be a Core Committee for each department comprising of the following persons, namely -
 - (i) President, Homoeopathy Education Board–Chairman;
 - (ii) four experts from Homoeopathy (one expert from Materia Medica, Organon of Medicine, Repertory and Practice of Medicine)–members;
 - (iii) one expert (either retired or in service) each from Central Council for Research in Homoeopathy (CCRH), National Institute of Homoeopathy (NIH), pharma industry, public health – member;
 - (iv) one educational technologist–member;
 - (v) Member of Homoeopathy Education Board-Member Secretary:

Provided that the core committee may co-opt an expert as per the needs and with permission of the Commission.

- (b) Terms of reference. – (i) The term of the Committee shall be three years;
 - (i) The committee shall meet at least twice in a year.
 - (ii) The committee shall identify any modern advancement, scientific and technical development as specified in the sub-regulation (1) of regulation for; -
 - (A) understanding of validating conduction of research activities in Homoeopathy;
 - (B) diagnosis or prognosis in a specific clinical condition and treatment;
 - (C) teaching and training;
 - (D) health care services through Homoeopathy.
 - (iii) The committee shall ensure the applicability of the identified modern advancements or scientific and

technical development to basic principles of Homoeopathy with the help of the four expert members of Homoeopathy.

- (iv) The Core Committee shall identify and recommend suitable expert for the Expert Committee to develop methodology for identification of modern advancement or development.
 - (v) The Core Committee shall suggest the application of the advancements or developments in terms of its usage in specific department or to incorporate in under-graduate or post-graduate syllabus etc. as the case may be.
 - (vi) The Core Committee shall identify the outdated part of the modern science and technology and suggest the Commission to replace it with the appropriate modern advancements.
- (8) (a) There shall be an expert committee for each department consisting of the following persons namely:-
- (i) Subject Expert as recommended by Homoeopathy Education Board– Chairman;
 - (ii) Two experts from relevant Homoeopathy subjects, one from under graduate (UG) and one from post graduate (PG) – members;
 - (iii) One expert from relevant modern subject–member;
 - (iv) One expert from teaching technology –member;

Provided that the Expert Committee may co-opt concerned expert in accordance to the selected area with the permission of the Commission.

(b) Terms of reference. –

- (i) the term of the Expert Committee shall be three years;
- (ii) The Expert Committee shall meet as many times as per the direction of the Commission;
- (iii) The Expert Committee shall work on the suggestion from the core committee and decide how to incorporate it in the syllabus, its mode of teaching (i.e., lecture/non-lecture) and the assessment with the help of educational technologist, experts;
- (iv) The Expert Committee shall first understand the application of modern advancement that are identified to incorporate and its relevance to the basic principles of Homoeopathy;
- (v) The Expert Committee shall also identify the need of advance technology in Homoeopathy particular to that vertical and identify the suitable technology and recommend its usage along with the standard operating

procedure or methodology;

- (vi) The Expert Committee shall suggest Core Committee regarding the modern advancement and technology to be included at undergraduate or post graduate level.

9. General guidelines for examinations, results and re-admission.-

- (1) The University or agencies empowered by the Commission shall conduct examination for the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Course.
- (2) The examining body shall ensure the minimum number of hours for lectures or demonstrations or practical or seminars etc. in the subject in each Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) examination as specified in these regulations are followed, before allowing medical institution to send the student for university examination.
- (3) The examining body shall ensure that the student of the medical institution, who does not fulfill the criteria laid down in these regulations are not sent for the university examination.
- (4) Each student shall be required to maintain at least seventy five percent. attendance in each subject in theory/lecture hours/ practical and clinical / non-lecture hours separately for appearing at examination.
- (5) Where the medical institution is maintaining physical register, it shall be recorded in cumulative numbering method as per Annexure-III and at the end of the course/ term/ part of the course, after obtaining each student signature, the same shall be certified by respective Head of the Department and approved by Head of the institute.
- (6) The approved attendance shall be forwarded to the concerned university.
- (7) Internal assessment examinations to be conducted by medical institution during first, second, third and fourth Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) professional year.
- (8) The weightage of internal assessment shall be ten percent. of the total marks specified for each subject for main university examination and internal assessment shall be in the forms of practical only.
- (9) Internal assessment examination shall include one periodic assessment and one term test in each term of six months.
- (10) It is compulsory for every student to pass with minimum fifty percent. marks in the internal assessment examination prior to filling the final university examination form of the respective professional year and Head of medical institution shall send the marks of internal assessment and term test to the university prior to final examination of any professional year.
- (11) There shall be no separate class for odd batch student (those students who could not keep the term) and the student must

attend the class along with regular batch or with junior batch as applicable.

- (12) To become eligible for joining the Compulsory Rotatory Internship programme, a student must pass all four professional examinations and qualified in six electives and the entire course of Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) including internship shall be completed within a period of maximum ten years.
 - (13) The theory examination shall have ten percent. marks for Multiple Choice Questions (MCQ), forty per cent. marks for Short Answer Questions (SAQ) and fifty percent. marks for Long Explanatory Answer Questions (LAQ) and these questions shall cover the subject widely.
 - (14) Each theory examination shall be of three hours duration.
 - (15) The minimum marks required for passing the examination shall be fifty percent. in theory component and fifty percent. in practical component including practical, clinical, viva-voice, internal assessment and electives wherever applicable separately in each subject.
 - (16) Electives shall be assessed in terms of attendance and assessment by grading as following, namely: -
 - (a) Grading shall be only for two electives per professional session and mentioned in the certificate obtained by the student after online teaching and assessment.
 - (b) Grading shall be mentioned in the University mark sheet of student.
 - (c) The examination branch of the institution shall compile the grade of electives obtained by student and submit to university through the head of institution so that the University shall add the same to final mark sheet of the student
- (17) Grading of electives shall be assessed as following, namely :-
- (a) Electives shall be assessed online by the resource person who has prepared the contents of elective and assessed to the student.
 - (b) The following points shall be taken in to consideration for grading , namely:-
 - (i) Depth of problem definition – 15%
 - (ii) Extent of work undertaken – 20%
 - (iii) Innovation – 15%
 - (iv) Logical and integrated way of presentation – 20%
 - (v) Quality of learning derived – 20%
 - (vi) Adequacy of references undertaken – 10%
 - (c) The final grades would be as follows, namely: -
 - (i) “A” – Excellent (above 70%)

- (ii) "B" – Good (above 60 %)
 - (iii) "C" – Average (around 50%)
 - (iv) "D" – below average (around 40%)
 - (v) "E" – Poor (below 40%)
- (d) The student shall have to secure at least 'C' grade in all the electives in order to pass the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course.
- (18) The examining body shall hold examinations on such date and time as the examining body may determine and the theory and practical examination shall be conducted on the center approved by the examining body.
- (19) There shall be a regular examination and a supplementary examination in a year and the supplementary examination shall be conducted within three months of declaration of results of regular examination including issuance of mark sheets.
- (20) A candidate obtaining sixty percent. and above marks shall be awarded first class in the subject and seventy five percent. and above marks shall be awarded distinction in the subject.
- (21) The award of class and distinction shall not be applicable for supplementary examination.
- (22) For non-appearance in an examination, a candidate shall not have any liberty for availing additional chance to appear at that examination.
- (23) Any Diploma/Degree qualification, at present included in Schedule II and Schedule III of the Homoeopathy Central Council Act 1973 (59 of 1973) where nomenclature is not in consonance with these regulations shall cease to be recognised medical qualification when granted after commencement of these regulations. However, this clause will not apply to the students who are already admitted to these courses before the enforcement of these regulations.
- (24) (a) No person shall be appointed as an external or internal examiner or paper setter or moderator in any of the subjects of the Professional examination, leading to and including the final Professional examinations for the award of the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) degree unless he has taken at least three years previously, a M.D.(Hom.) degree of a recognised university or an equivalent qualification in the particular subject as per recommendation of the Commission on teachers' eligibility qualification and has had at least three years of teaching experience in the subject concerned in a college affiliated to a recognised university at a faculty position.
- (b) Non-medical scientist engaged in the teaching of medical students as full time teacher, may be appointed examiner in his concerned

subject provided he possess requisite Post Graduate qualification and three-year teaching experience of medical students after obtaining his postgraduate qualifications:

Provided further that the fifty percent. of the examiner (Internal and External) shall be from the medical qualification stream.

- (c) A university having more than one college shall have separate set of examiner for each college, with internal examiner from the concerned college.
- (d) In a state where more than one affiliating university is existing, the external examiner shall be from other university.
- (e) External examiner shall rotate at an interval of two years.
- (f) Any fulltime teacher with teaching experience of not less than three years in a concerned subject in a Homoeopathic Medical Institution shall be appointed internal / external examiner by rotation in his subject.

10. University examination. – (1) First Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination:

- (a) The student shall be allowed to appear for the First Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination provided that he has required attendance as per clause (4) of regulation 9 of head of the medical institution.
- (b) The process of conduction of examination and declaration of the results of First Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) shall be completed between seventeen to eighteen Months from the date of admission.
- (c) In order to be declared as "Passed" in First Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination, a candidate shall have to pass all the subjects of university examination including the internal assessments examination.

(2) Second Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Examination:

- (a) No candidate shall be allowed for the Second Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination unless he has passed all the subjects of First Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination and has required attendance as specified in sub section (4) of regulation 9.
- (b) The process of conduction of examination and declaration of results of Second Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination shall be completed between twenty nine to thirty Months from the date of admission.
- (c) In order to be declared "Passed" in the Second Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)

examination, a candidate shall have to pass all the subjects of university examination including the internal assessment examination.

(3) Third Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Examination:

(a) No candidate shall be allowed for the Third Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination unless he has passed all the subjects of the Second Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination and has required attendance as specified in sub section (4) of regulation 9.

(b) The process of examination conduction and results of Third Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) shall be completed between forty one to forty two month from the date of admission.

(c) In order to be declared as "Passed" in the Third Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination, a candidate shall have to pass all the subjects of university examination including the internal assessment examination.

(4) Fourth Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) Examination:

(a) No candidate shall be allowed for the Fourth Bachelor of Homoeopathic Medicine and Surgery examination unless he has passed all the subjects of Third Bachelor of Homoeopathic Medicine and Surgery examination and has required attendance as specified in sub section (4) of regulation 9.

(b) The process of conduction of examination and declaration of result of Third Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) examination shall be completed between fifty three to fifty four Month from the date of admission.

(c) In order to be declared as "Passed" in the Fourth Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) examination, a candidate shall have to pass all the subjects of University examination including the internal assessment examination.

Result : (a) The examining body shall ensure to publish the results within one month from the last date of examination so that student can complete the course in five and half year after admission.

(b) Who passes in one or more subjects need not to appear in that subject or those subjects again in the subsequent examinations if the candidate passes the whole examination within four chances including the original examination.

(c) Notwithstanding contained in the foregoing regulations, the student shall be allowed the facility to keep term on the following conditions:

- (i) The candidate shall pass First Bachelor of Homoeopathic Medicine and Surgery examination in all the subjects at least one term of six months before he is allowed to appear at the Second Bachelor of Homoeopathic Medicine and Surgery examination.
- (ii) The candidate shall have to pass the Second Bachelor of Homoeopathic Medicine and Surgery examination at least one term of six months before he is allowed to appear at the third Bachelor of Homoeopathic Medicine and Surgery examination.
- (iii) The candidate must pass the Third Bachelor of Homoeopathic Medicine and Surgery examination at least one term of six months before he is allowed to appear at the Fourth Bachelor of Homoeopathic Medicine and Surgery examination.

(d) The student who has not passed any of the four professional examinations even after exhausting all four attempts, shall not be allowed to continue his Course:

Provided that in case of any unavoidable circumstances, the vice Chancellor of the concerned university may provide two more chances in any one of four professional examination.

(e) The examining body may under exceptional circumstances, partially or wholly cancel any examination conducted by it under intimation to the commission and arrange for conducting re-examination in those subjects within a period of thirty days from the date of such cancellation.

(f) The university or examining authority shall have the discretion to award grace marks not exceeding to ten marks in total if a student fails in one or more subjects.

11. **Assessment.**-Assessment of students shall be in the form of Formative and Summative Assessments as under-

(1) Formative Assessment. - Student shall be assessed periodically to assess his performance in the class, determine the understanding of Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) course material and his learning outcome in the following manner, namely:

-

(a) Periodical Assessment shall be carried out in practical and at the end of teaching of a topic or module or a particular portion of syllabus and the following evaluation method may be adopted as appropriate to the content, namely:-

Table -7

Serial Number	Evaluation Method
(1)	(2)
1.	Practical/Clinical Performance;
2.	Viva Voce;
3.	Open Book Test (Problem based);
4.	Summary Writing (Research Papers or Synopsis);
5.	Class Presentations; Work Book Maintenance;
6.	Problem based Assignment;
7.	Objective Structured Clinical Examination (OSCE), Objective Structured Practical Examination (OPSE), Mini Clinical Evaluation Exercise (Mini-CEX), Direct Observation of Procedures (DOP), Case Based Discussion(CBD)
8.	Extra-curricular activities, (Social work, Public awareness, Surveillance or Prophylaxis activities, Sports or Other activities which may be decided by the Department);
9.	Small Project.

- (b) (i) First Bachelor of Homoeopathic Medicine and Surgery(B.H.M.S.) course : There shall be minimum three periodical assessments for each subject (ordinarily at 4th, 9th, and 14thmonth) and two term test (ordinarily at 6th and 12th month) followed by final University examination.
- (ii) Second, Third and Fourth Bachelor of Homoeopathic Medicine and Surgery(B.H.M.S.) course: There shall be minimum two periodical assessments at 4th and 9th month and one term examination at 6th month followed by final university examination.
- (iii)The scheme and calculation of assessment shall be as per the following tables, namely:-

Table-8

[Scheme of Assessment (Formative and Summative)]

Serial Number	Professional Course	Duration of Professional Course			
		(3)			
		First Term	Second Term	Third Term and University exam	
(1)	(2)	(a)	(b)	(c)	
(1)	First Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S).	First PA and First TT-1	Second PA and Second TT-2	Third PA	First Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Exam (FUE)
		First Term	Second Term and University exam		
(2)	Second Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S).	First PA and First TT-1	Second PA	Second Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) exam (FUE)	
(3)	Third Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S).	First PA and First TT	Second PA	Third Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) exam (FUE)	
(4)	Fourth (Final) Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S).	First PA and First TT	Second PA	Fourth (Final) Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) exam (FUE)	

PA: Periodical Assessment; TT: Term Test; FUE: Final University Examinations; B.H.M.S: (Bachelor of Homoeopathic Medicine and Surgery).

(2) Summative Assessment. –

- (a) Final University examinations conducted at the end of each professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) course shall be the Summative Assessment.
- (b) There shall be double evaluation system and shall be no provision for reevaluation.
- (c) There shall be two examiners (one internal and one external) for university practical/clinical/viva voce examinations for hundred marks and it shall increase to four (two internal and two external) for two hundred marks.
- (d) During supplementary examination for two hundred marks, if students are less than fifty then examination can be conducted by one internal and one external examiner but if students are more than fifty, then four examiners are required (two internal and two external examiner).
- (e) While declaring the result of Summative Assessment, Internal Assessment component shall be considered as per the distribution of marks pattern provided in Table-10, Table-12, Table-14 and Table-16.

12. The Profession wise Subjects, Number of Papers, Teaching Hours and Marks Distribution shall be as specified in the Tables below namely: -

Table -09

First Year Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)			
(3 terms)			
Subject	Number of teaching hours		
(1)	(2)		
	Lectures	Non-Lectures	Total
	(a)	(b)	(c)
Hom UG-OM-I	180	100	280
Hom UG-AN	325	330	655
Hom UG-PB	325	330	655
Hom UG-HP	100	110	210
Hom UG-HMM-I	120	75	195
Hom UG-R-I	21	-	21
HomUG-Yoga-I	-	30	30
Total	1071	975	2046
<i>Foundation Course=10 Working days (60hours) Teaching Hours :2046</i>			

Table – 10

Marks distribution First Year Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)									
Seri al Num ber	Subje ct Code	Pape rs	Theor y	Practical or Clinical Assessment					Gran d Total
(1)	(2)	(3)	(4)	(5)					(6)
				Practical /Clinical	Viva	IA	Electives grade	Sub total	
				(a)	(b)	(c)	(d)	(e)	
1	HomU G- OM-I	1	100	50	40	10	Elective I- Elective II-	10 0	200
2	HomU G- AN	2	200	100	80	20		20 0	400
3	HomU G- PB	2	200	100	80	20		200	400
4	HomU G- HP	1	100	50	40	10		100	200
5	HomU G- HMM- I	1	100	50	40	10		100	200
Grand Total									140 0

Table-11

Second Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). (2 terms) Teaching hours=1404				
Serial Number	Subject Code	Number of teaching hours		
(1)	(2)	(3)		
		Lectures	Non-Lectures	Total
		(a)	(b)	(c)
1	HomUG-HMM-II	150	30	180
2	HomUG-OM-II	150	30	180
3	HomUG R-II	50	30	80
4	HomUG-FMT	120	50	170
5	HomUG-Path-M	200	80	280
7	HomUG-PM-I	80	92	172
8	Hom UG Sur- I	92	60	152
9	Hom UG ObGy- I	100	60	160
10	HomUG-Yoga-II	-	30	30
		942	462	1404

Table-12

Marks distribution of Second Year Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S)									
Serial Number	Subject Code	Papers	Theory	Practical Clinical	Practical or Clinical Assessment				
					(6)				
(1)	(2)	(3)	(4)	(5)	Viva	Electives Grade	IA	Sub Total	Grand Total
					(a)	(b)	(c)	(d)	(e)
1.	HomUG-HMM-II	1	100	50	40	Electives I- Electives II-	10	100	200
2.	HomUG-OM-II	1	100	50	40		10	100	200
3.	HomUG-FMT-I	1	100	50	40		10	100	200
4.	HomUG-Path M	2	200	100	80		20	200	400
Grand Total									1000

Table-13

Third Professional Bachelor of Homoeopathic Medicine and Surgery(B.H.M.S). (2 terms) Teaching hours=1404				
Serial Number	Subject Code	Number of teaching hours		
		(3)		
(1)	(2)	Lectures	Clinical/ Practical	Total
		(a)	(b)	(c)
1	HomUG- -HMM-III	15 0	50	200
2	HomUG-OM-III	15 0	50	200
3	HomUG-R-III	10 0	50	150
4	HomUG-PM-II	12 0	10 0	220
5	Hom UG Sur- II	12 0	10 0	220
6	Hom UG ObGy- II	11 0	79	189
7	HomUG-CM	10 0	60	160
8	Hom.UG-Mod. Phar-I	45	-	45
9	HomUG Yoga-III		20	20
	Grand Total	89 5	50 9	1404

Table-14

Marks Distribution of Third Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Subjects								
Serial No	Subject Code	Pape rs	Theory	Practical or Clinical Assessment			Grand Total	
(1)	(2)	(3)	(4)	(5)			(6)	
				Practical or Clinical	Viva	Electives grade	IA	Sub Total
				(a)	(b)	(c)	(d)	(e)

1	<i>HomUG-HMM- III</i>	1	100	50	40	Elective I- Elective II-	1 0	100	200
2	<i>HomUG-OM-III</i>	2	200	100	80		2 0	200	400
3	<i>Hom-UG-R-III</i>	1	100	50	40		1 0	100	200
4	<i>Hom-UG Sur-II</i>	2	200	100	80		2 0	200	400
5	<i>Hom-UG ObGy-II</i>	2	200	100	80		2 0	200	400
6	<i>Hom-UG-CM</i>	1	100	50	40		1 0	200	200
								Grand Total	1800

Table-15

Fourth Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) (2 terms)				
Teaching hours=1404				
Serial number	Subject Code	Number of teaching hours		
(1)	(2)	(3)		
		Lectures	Non-Lectures	Total
		(a)	(b)	(c)
1	HomUG-HMM-IV	200	83	283
2	HomUG-OM-IV	100	75	175
3	HomUG-R-IV	60	120	180
4	HomUG-PM-III	300	300	600
5	HomUG-CM II including RM-stat	71	75	146
6	HomUG-Yoga-II	-	20	20
	Total	731	673	
Grand Total				1404

Table-16

Marks Distribution of Fourth Professional Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Subjects)								
Serial Number	Subject Code	Papers	Theory	Practical or Clinical Assessment				Grand Total
(1)	(2)	(3)	(4)	(5)				(6)
				Practical or Clinical	Viva	IA	Sub Total	
				(a)	(b)	(c)	(d)	
1	HomUG-HMM-IV	2	200	100	80	20	200	400
2	HomUG-OM-IV	1	100	50	40	10	100	200
3	HomUG-R-IV	1	100	50	40	10	100	200

							0	
4	HomUG-PM-III	3	300	10 0	80	20	20 0	500
5	HomUG- CM-RM-STAT	1	100	50	40	10	20 0	200
6	HomUG- Ess. of Pharmacol ogy	1	5 0		40	10	50	100
	Grand Total							1600

13. **Migration of students during the study:** -(1) The student may be allowed to take migration to continue his study in another medical institution after passing the first professional examination, but the student who fails in such examination shall not be considered for transfer and mid-term migration.
- (2) For migration, the students shall have to obtain the mutual consent of both Medical Institution and University and it shall be against the vacant seat.
- (3) Migration from one Medical Institution to other is not a right of a student.
- (4) Migration of students from the Medical Institution to another Medical Institution in India shall be considered by the Commission only in exceptional cases on compassionate ground, if following criteria are fulfilled and routine migrations on other grounds shall not be allowed;
- (a) Medical Institution at which the student is studying present and Medical Institution to which migration is sought are recognised as per provisions of Commission.
- (b) The applicant shall submit his application in the Form- 3 for migration, complete in all respects, to the Medical Institution within a period of one month of passing (declaration of result) the first professional Bachelor of Homoeopathic Medicine and Surgery examination.
- (c) The applicant shall submit an affidavit stating that he shall pursue twelve months of prescribed study before appearing at second professional Bachelor of Homoeopathic Medicine and Surgery examination at the transferee college, which shall be duly certified by the Registrar of the concerned University in which he is seeking transfer and the transfer shall be effective only after receipt of the affidavit.
- (d) Migration during internship training shall be allowed on extreme compassionate grounds and the migration shall be allowed only with the mutual consent of the medical institution at which the student is studying at present and the medical institution one to which migration is sought are recognised as per provisions of Commission.
- (5) All applications for migration shall be referred to the Commission by medical institution and no medical institution shall allow migration without the approval of the Commission.
- (6) The Commission reserves the right not to entertain any application except under the following compassionate grounds, namely: -
- (a) death of a supporting guardian;
- (b) illness of candidate causing disability supported by medical grounds certified by a recognized hospital;
- (c) disturbed conditions as declared by concerned

Government in the area where the college is situated.

- (7) A student applying for transfer on compassionate ground shall apply in Form 3.

14. Compulsory Rotatory Internship Training. - There shall be compulsory rotatory internship training ,followingly :-

- (1) (a) Each candidate shall be required to undergo compulsory rotatory internship including internship orientation and finishing programme within one year from passing of fourth Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) examination.
 - (b) Ordinarily the internship training shall commence on first working day of April for regular batch students and first working day of September for supplementary batch students.
 - (c) The student shall be eligible to join the compulsory internship programme after passing all the subjects from First to Fourth (Final) Professional examination including six electives and after getting Provisional Degree Certificate from respective Universities and provisional registration Certificates from respective State Board or Council for Compulsory Rotatory Internship.
- (2) During internship, the interns belonging to institute of the Central Government, State Government or Union territory as the case may be, and all the private homoeopathic medical colleges/institutions shall be eligible to get the stipend at par with other medical systems under respective Government and there shall not be any discrepancy between medical systems.
 - (3) (a) Migration during internship shall be issued with the consent of both the medical institution and university; in the case where migration is between the medical institution of two different Universities.
 - (b) If migration is only between medical institution of the same university, the consent of both the medical institution shall be required.
 - (c) Migration shall be accepted by the university on the production of the character certificate issued by the institute or medical institution and the application forwarded by the medical institution and university with a 'No Objection Certificate' as the case maybe.
 - (4) The objective of the orientation programme shall be to introduce the activity to be undertaken during the internship.
 - (a) The interns shall attend an orientation programme regarding internship and it shall be the responsibility of the teaching institution to conduct the orientation before the commencement of the internship.
 - (b) The orientation shall be conducted with an intention to make the intern to acquire the requisite knowledge as following , namely:-

- (i) Rules and Regulations of the Medical Practice and Profession,
 - (ii) Medical Ethics;
 - (iii) Medico legal Aspects;
 - (iv) Medical Records;
 - (v) Medical Insurance;
 - (vi) Medical Certification;
 - (vii) Communication Skills;
 - (viii) Conduct and Etiquette;
 - (ix) National and State Health Care Programme;
 - (x) Project work.
- (c) The orientation workshop shall be organised at the beginning of internship and an e- log book shall be maintained by each intern, in which the intern shall enter date-wise details of activities undertaken by him/her during orientation.
- (d) The period of orientation shall be for three days prior to date of commencement of internship.
- (e) The manual for conducting the orientation as prescribed from time to time by the National Commission for Homoeopathy shall be followed.
- (5) (a) There shall be a finishing programme for three days at the completion of internship.
- (b) This programme is designed for the interns and will consist of ten sessions spread over a period of three days. The program may include both online and offline modes of training. It is aimed to enlighten the interns on various career opportunities available after successful completion of the program and how to equip themselves to meet the requirements and fulfill their dreams.
- (c) After successful completion of this training the student will be able to:
- (i) list the various career opportunities available after successful completion of the degree program.
 - (ii) identify their Strengths and Weaknesses;
 - (iii) choose a career of their choice;
 - (iv) enumerate the requirements to be met to become a successful professional;
 - (v) demonstrate positive outlook and attitude towards the profession;
 - (vi) exhibit better skills in communication, problem solving, writing, team building, time management, decision making etc.;
 - (vii) demonstrate ethical and professional values and be a compassionate and caring citizen / professional.

- (6) The finishing programme shall be as follows, namely:-
- (a) Job opportunities after successful completion of the program
 - (b) Study opportunities in India and abroad after successful completion of the program
 - (c) Entrepreneurship opportunities after successful completion of the program
 - (d) Research opportunities after successful completion of the program
 - (e) Public Service opportunities after successful completion of the program
 - (f) Training and awareness about Competitive exams
 - (g) Self analysis to choose the right option
 - (h) Building Interpersonal & Soft Skills including Interview skills, Leadership skills, Resume writing skills, problem solving and decision making skills
 - (i) Certificate writing and prescription writing and medico-legal issues relevant to the profession
 - (j) Loan assistance and other scholarship facilities available for establishment and study.
 - (k) Ethical / Professional and Social responsibilities after successful completion of internship
- (7) Activities during Internship shall consist of clinical work and project work.
- (a) (i) Clinical work in the Outpatient Department (OPD)s/ medical institution hospital/ memorandum of understanding hospital/ Primary Health Centre or Community Health Centre or Research institute of Central Council for research in Homoeopathy or Rural Hospital or district hospital or civil Hospital or any government hospital of modern medicine or homoeopathy medicine or National Accreditation Board and for Hospital accredited private hospital of Homoeopathy.
 - (ii) The daily working hours of intern shall be not less than eight hour and the intern shall maintain an e-log book/log book containing all the activities undertaken by him/her during internship.
 - (iii) The medical institution shall opt any one of the Option as specified below for completion of internship and the same shall be mentioned in its prospectus.
 - (A) Option I shall be divided into clinical training of ten months in the Homoeopathy hospital attached to the college and two months in Primary Health Centre or Community Health Centre or Research institute of Central Council for Research in Homoeopathy or Rural Hospital or District Hospital or Civil Hospital or any Government Hospital of Modern Medicine or Homoeopathy Medicine or National Accreditation Board

for Hospital accredited private hospital of Homoeopathy.

- (I) The interns shall be posted in any of the following centers where National Health Programs are being implemented and these postings shall be to get oriented and acquaint with the knowledge of implementation of National Health Programmes in regard to,-
 - (a) Primary Health Centre;
 - (b) Community Health Centre or Civil Hospital or District Hospital;
 - (c) Any recognized or approved Homeopathy Hospital or Dispensary;
 - (d) In a clinical unit/hospital of Central Council for Research in Homoeopathy.
- (II) All the above institutions mentioned in clauses (a) to (d) shall have to be recognised by the concerned University or Government designated authority for providing such training.
- (III) During the two months internship training in Primary Health Centre or Research institute of Central Council for Research in Homoeopathy or Rural Hospital or Community Health Centre or District Hospital or any recognized or approved hospital of Modern Medicine or Homoeopathy Hospital or Dispensary, the interns shall:-
 - (1) get acquainted with routine of the Primary Health Centre and maintenance of their records;
 - (2) get acquainted with the diseases more prevalent in rural and remote areas and their management;
 - (3) involve in teaching of health care methods to rural population and also various immunization programmes;
 - (4) get acquainted with the routine working of the medical or non-medical staff of Primary Health Centre and be always in contact with the staff in this period;
 - (5) develop research aptitude;
 - (6) get familiarized with the work of maintaining the relevant register like daily patient register, family planning register, surgical register, etc. and take active participation in different Government health schemes or programmes;
 - (7) participate actively in different National Health

Programmes implemented by the State Government.

- (IV). The record of attendance during two months in Primary Health Center (PHC)/Community Health Center (CHC)/Dispensary must be maintained by the interns according to his posting and should be certified by the Medical Officer/Deputy medical superintendent/ Research officer/Resident Medical Officer (RMO)/Faculty/Outpatient department in-charge, where student undergone the training and shall be submitted to and counter signed by the principal of medical institution on monthly basis.
- (B) Option II shall consists of clinical training of twelve months in Homoeopathy hospital attached to the medical institution and the record of attendance during twelve months in hospital attached to medical institution shall be maintained by the intern according to his posting and shall be certified by the Medical Officer/Deputy medical superintendent/ Research officer/ Resident Medical Officer (RMO)/Faculty/ Outpatient Department (OPD) in-charge, where the intern undergo the training and shall also be submitted to and counter signed by Dean/ Principal of medical institution on monthly basis.
- (V) Division of Clinical work during posting in Option I and Option II. The clinical work during internship shall be conducted as per the following table, namely:-

Table-17

(Distribution of Internship duration)			
Serial Number	Departments	Option I	Option II
(1)	(2)	(3)	(4)
1.	Practice of Medicine Outpatient Department including Psychiatry and Yoga, Dermatology, and related specialties and respective section of Inpatient Department	two month;	three months;
2.	Surgery Outpatient Department including Operation theatre, related specialties and Ophthalmology, Ear Nose Throat(ENT) and respective section of Inpatient Department	two month;	two months;
3.	Gynecology and Obstetrics Outpatient Department, related specialties including Operation theatre, and respective section of Inpatient Department	two month;	two months;
4.	Pediatric Outpatient Department related specialties including Neonatal Intensive Care Unit, and respective section of Inpatient Department	one month;	two months;
5.	Community Medicine Outpatient Department, related specialties including Rural/Public Health /Maternal and Child Health and respective section of Inpatient Department	two month;	two months;
6.	Casualty	one month;	one month;
7.	Primary Health Centre or Community Health Centre or Research institute of Central Council for Research in Homoeopathy or Rural Hospital or District Hospital or Civil Hospital or any Government Hospital of Modern Medicine or Homoeopathy Medicine or NABH (National Accreditation Board for Hospitals) accredited private hospital of Homoeopathy	two month;	

(D)The intern shall undertake the following activities in respective department in the hospital attached to the College, namely: -

- (1) The intern shall be practically trained in practice of medicine to acquaint with and to make him competent to deal with following, namely: -
 - (a) all routine works such as case taking, investigations, diagnosis and management of patients with homoeopathic medicine;
 - (b) routine clinical pathological work such as hemoglobin estimation, complete haemogram, urine analysis, microscopic examination of blood parasites, sputum examination, stool examination, interpretation of laboratory data and clinical findings and arriving at a diagnosis and all pathological and radiological investigations useful for monitoring the status of different disease conditions;
 - (c) training in routine ward procedure and supervision of patients in respect of his diet, habits and verification of medicine schedule.
- (2) The intern shall be practically trained in Surgery to acquaint with and to make him competent to deal with following, namely:-
 - (a) Clinical examination, diagnosis and management of common surgical disorders according to homoeopathic principles using homoeopathic medicines;
 - (b) Management of certain surgical emergencies such as fractures and dislocations, acute abdomen;
 - (c) Intern shall be involved in pre-operative and post-operative managements;
 - (d) Surgical procedures in ear, nose, throat, dental problems, ophthalmic problems;
 - (e) Examinations of eye, ear, nose, Throat and Refractive error with the supportive instruments in Out-Patient Department; and
 - (f) Practical training of a septic and antiseptic techniques, sterilization;
 - (g) Practical use of local anesthetic techniques and use of anesthetic drugs;
 - (h) Radiological procedures, clinical interpretation of X-ray, Intra venous Pyelogram, Barium meal, Sonography and Electro Cardio Gram;
 - (i) Surgical procedures and routine ward techniques such as-
 - (i) suturing of fresh injuries;
 - (ii) dressing of wounds, burns, ulcers and similar ailments;
 - (iii) incision and drainage of abscesses
 - (iv) excision of cysts and;
 - (v) venesection;

- (3) The intern shall be practically trained in Gynecology and Obstetrics to acquaint with and to make him competent to deal with following, namely:-
 - (a) Ante-natal and post-natal problems and their remedies, ante-natal and post-natal care;
 - (b) Management of normal and abnormal labors;
 - (c) Minor and major obstetric surgical procedures;
 - (d) All routine works such as case taking, investigations, diagnosis and management of common gynecological conditions with homoeopathic medicine;
 - (e) Screening of common carcinomatous conditions in women.
- (4) The intern shall be practically trained in pediatrics to acquaint with and to make him competent to deal with following, namely:-
 - (a) Care of newborns along with immunization programme;
 - (b) Important pediatric problems and their homoeopathic management;
- (5) The intern shall be practically trained in Community Medicine to acquaint with and to make him competent to deal with following, namely:-
 - (a) Programme of prevention and control of locally prevalent endemic diseases including nutritional disorders, immunization, management of infectious diseases, etc.;
 - (b) Family Welfare Planning programme;
 - (c) All National Health Programme of Central Government at all levels
 - (d) Homoeopathic prophylaxis and management in cases of epidemic/endemic/pandemic diseases.
- (6) The intern shall be practically trained in Emergency or Casualty management to acquaint with and to make him competent to deal with all emergency condition and participate actively in Casualty section of the hospital for identification of casualty and trauma cases and his first aid treatment and also procedure for referring such cases to the identified hospital.
- (b) The project work shall consist of the following, namely:-
 - (a) Each intern will undertake a project utilizing the knowledge of Research Methodology and Biostatistics acquired in IVth Bachelor of Homoeopathic medicine and Surgery (B.H.M.S)
 - (b) It would be the responsibility of the intern to choose the topic of the subject (clinical/community/education) within the first month of the internship and shall

communicate to guide/mentor allotted by Principal.

- (c) The project shall run through three phases of planning (three months), data collection (three months) and finalization and writing (three months).
- (d) The writing shall be as per the format taught in the course on research methodology and will be minimal one thousand five hundred words and it shall be type written and submitted in a spiral bond form as well as in the electronic format.
- (e) The project shall end with a brief presentation to the IV Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S.) students.
- (f) The principal shall assign a teacher to evaluate the project which will be with respect to the following:
 - (i) Originality of the idea
 - (ii) Scientific methodology followed in formulating the ideas and the designs
 - (iii) Analysis
 - (iv) Results and conclusion
 - (v) Merits of writing
 - (vi) The grades shall range from A (70% and above), B (60 - 70%), C (50-60%) and D (below 50%)

(c) A Certificate shall be awarded to the intern stating the title of the project and grade received.

15. **Electronic Logbook / Logbook.** -(i) It shall be compulsory for an intern to maintain the record of procedures done/assisted/observed by him on day-to-day basis in a specified e- logbook/ logbook as the case may be and the intern shall maintain a record of work, which shall be verified and certified by the concerned Medical Officer or Head of the Unit or Department under whom he is placed for internship.
- (ii) Failure to produce e-logbook/ logbook, complete in all respects certified by the concerned authority to the Dean / Principal / Director at the end of Internship Training Programme, may result in cancellation of his performance in any or all disciplines of Internship Training Programme.
 - (iii) The institution shall retain soft copy of the completed and certified –e log book/ logbook and available for further verification, if required.

16. **Evaluation of Internship program.** -(1) The evaluation system shall assess the skills of an intern while performing the minimum number of procedures as enlisted with an objective that successful learning of these procedures will enable the interns to conduct the same in his/her actual practice.

- (2) The evaluation shall be carried out by respective Head of Department at the end of each posting and the reports shall be submitted to Head of the institute in Form-1.
- (3) On completion of one year of compulsory rotatory internship including submission of project, the Head of the Institute shall evaluate all the assessment reports as specified in Form-1, as provided by Head of the Department at the end of respective posting and if found satisfactory, the intern shall be issued Internship Completion Certificate in Form-2 within seven working days.
 - (4) If performance of an intern is declared as unsatisfactory upon obtaining below fifteen marks as per Form-2 or less than fifty per cent. of marks, in an assessment in any of the Departments, he shall be required to repeat the posting in the respective department for a period of thirty percent. of the total number of days, laid down for that department in Internship Training and posting.
 - (5) The intern shall have the right to register his grievance in any aspect of conduct of evaluation and award of marks, separately to the concerned Head of the Department and Head of the Institution, within three days from the date of completion of his evaluation, and on receipt of such grievance, the Head of the Institution in consultation with the Head of the concerned Department shall redress and dispose of the grievance within seven working days.

17. Leave for interns.-(1) During compulsory rotatory internship of one year, fifteen days of leaves shall be permitted.

(ii) Any kind of absence beyond the period of fifteen days shall be extended accordingly.

18. Completion of internship.-(1) If there is any delay in the commencement of internship or break during internship due to unavoidable conditions, in such cases, internship period shall be completed within maximum period of twenty four months from the date of passing the qualifying examination of Fourth Final Professional Bachelor of Homoeopathic Medicine and Surgery and in such case, the student shall take prior permission from the Head of the institution in writing with all supporting documents thereof;

- (2) It shall be the responsibility of the Head of the institution/college to scrutinise the documents, and assess the genuine nature of the request before issuing permission letter;
- (3) if the student rejoins internship, he shall submit the request letter along with supporting document, in this regard to the head of institution/college.

19. Academic calendar: University, Institution/ College shall prepare academic calendar of a particular batch in accordance with the template of tentative academic calendar specified in Annexure II in these regulations and the same shall be circulated to students, hosted in respective websites,

and followed accordingly.

20. **Tuition fee.** -Tuition fee as laid down and fixed by respective state fee regulation committee as applicable, shall be charged for four and half years study period only and no tuition fee shall be charged for extended duration of study in case of failing in examination or for any other reason and there shall not be any fee for doing internship in the same institute.

Appendix A

(See sub regulation (5) of regulation 4)

SCHEDULE relating to "SPECIFIED DISABILITY" referred to in Clause (zc) of Section 2 of the Rights of Persons with Disabilities Act, 2016 (49 of 2016), provides as under:-

1. Physical disability-

- (a) Locomotor disability (a person's inability to execute distinctive activities associated with movement of self and objects resulting from affliction of musculoskeletal or nervous system or both), including-
 - (i) "Leprosy cured person" means a person who has been cured of leprosy but is suffering from-
 - a) Loss of sensation in hands or feet as well as loss of sensation and paresis in the eye and eye-lid but with no manifest deformity;
 - b) Manifest deformity and paresis but having sufficient mobility in their hands and feet to enable them to engage in normal economic activity;
 - c) Extreme physical deformity as well as advanced age which prevents him/her from undertaking any gainful occupation, and the expression "leprosy cured" shall construed accordingly.
 - (ii) "Cerebral palsy" means a group of non-progressive neurological condition affecting body movements and muscle coordination, caused by damage to one or more specific areas of the brain, usually occurring before, during or shortly after birth.
 - (iii) "Dwarfism" means a medical or genetic condition resulting in an adult height of 4 feet 10 inches (147 centimeters) or less.
 - (iv) "Muscular dystrophy" means a group of hereditary genetic muscle disease that weakens the muscles that move the human body and persons with multiple dystrophy have incorrect and missing information in their genes, which prevents them from making the proteins they need for health of muscles. It is characterized by

progressive skeletal muscle weakness, defects in muscle proteins, and the death of muscle cells and tissues.

- (v) "Acid attack victim" means a person disfigured due to violent assaults by throwing acid or similar corrosive substance.
- (b) Visual impairment-
 - (i) "blindness" means a condition where a person has any of the following conditions, after best correction-
 - a) Total absence of sight, or
 - b) Visual acuity less than 3/60 or less than 10/200 (Snellen) in the better eye with best possible correction, or
 - c) Limitation of the field of vision subtending an angle of less than 10degree.
 - (ii) "Low-vision" means a condition where a person has any of the following conditions, namely:-
 - a) Visual acuity not exceeding 6/18 or less than 20/60 up to 3/60 or up to 10/200 (Snellen) in the better eye with best possible corrections; or
 - b) Limitation of the field of vision subtending an angle of less than 40degree up to 10 degree.
- (c) Hearing impairment-
 - (i) "Deaf" means persons having 70 DB hearing loss in speech frequencies in both ears;
 - (ii) "Hard of hearing" means person having 60 DB hearing loss in speech frequencies in both ears,
- (d) "Speech and language disability" means a permanent disability arising out of conditions such as laryngectomy or aphasia affecting one or more components of speech and language due to organic or neurological causes;
- (e) Intellectual disability a condition characterized by significant limitation both in intellectual functioning (reasoning, learning, problem solving) and in a dative behavior which covers a range of every day, social and practical skills, including-
 - (i) "Specific learning disabilities" means a heterogeneous group of conditions wherein there is a deficit in processing language, spoken or written, that may manifest itself as a difficulty to comprehend, speak, read, write, spell, or to do mathematic calculations and includes such conditions as perceptual disabilities, dyslexia, dysgraphia, dyscalculia, dyspraxia and developmental aphasia.
 - (ii) "Autism spectrum disorder" means a neuro-

developmental condition typically appearing in the first three years of life that significantly affects a person's ability to communicate, understand relationships and relate to others and is frequently associated with unusual or stereotypical rituals or behaviors.

2. "Mental illness" means a substantial disorder of thinking, mood, perception, orientation or memory that grossly impairs judgment, behaviors, capacity to recognize reality or ability to meet the ordinary demands of life, but does not include retardation which is a condition of arrested or incomplete development of mind of a person,
3. Disability caused due to-
 - (a) Chronic neurological conditions, such as-
 - (i) "Multiple sclerosis" means an inflammatory, nervous system disease in which the myelin sheaths around the axons of nerve cells of the brain and spinal cord are damaged, leading to demyelination and affecting the ability of nerve cells in the brain and spinal cord to communicate with each other.
 - (ii) "Parkinson's disease" means a progressive disease of the nervous system marked by tremor, muscular rigidity and slow, imprecise movement, chiefly affecting middle-aged and elderly people associated with degeneration of the basal ganglia of the brain and a deficiency of the neurotransmitter dopamine.
 - (b) Blood disorder-
 - (i) "Hemophilia" means an inherited disease, usually affecting only male but transmitted by women to their male children, characterized by loss or impairment of the normal clotting ability of blood so that a minor wound may result in fatal bleeding,
 - (ii) "Thalassemia" means a group of inherited disorders characterized by reduced or absence of haemoglobin.
 - (iii) "Sickle cell disease" means a hemolytic disorder characterised by chronic anaemia, painful events, and various complications due to associated tissue and organ damage "Hemolytic" refers to the destruction of cell membrane of red blood cells resulting in the release of hemoglobin,
4. Multiple Disabilities (more than one of the above specified disabilities) including deaf, blindness which means a condition

in which a person may have combination of hearing and visual impairments causing severe communication, developmental, and educational problems.

5. Any other category as may be notified by the Central Government from time to time.

Appendix B

(See sub-regulation (5) of regulation 4)

Guidelines regarding admission of students, with "Specified Disabilities" under the Rights of Persons with Disabilities Act, 2016 (49 of 2016), in Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S).

- (1) The "Certificate of Disability" shall be issued in accordance with the Rights of Persons with Disabilities Rules, 2017.
- (2) The extent of "specified disability" of a person shall be assessed in accordance with the guidelines published in the Gazette of India, Extraordinary, Part II, Section 3, Sub-section (ii), vide number S.O. 76 (E), dated the 4th January, 2018 under the Rights of Persons with Disabilities Act, 2016 (49 of 2016).
- (3) The minimum degree of disability should be forty percent. (Benchmark disability) in order to be eligible for availing reservation for persons with specified disability.
- (4) The term 'Persons with Disabilities' (PwD) shall be used instead of the term 'Physically Handicapped' (PH)

TABLE 18

Serial Number	Disability Category	Type of Disabilities	Specified Disability	Disability Range		
				(5)		
(1)	(2)	(3)	(4)	Eligible for Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Course, Not Eligible for	Eligible for Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Course, Eligible for Persons with Disabilities Quota	Not Eligible for Course

				Persons with Disabilities Quota		
1.	Physical Disability	(A) Locomotor disability, including specified disabilities (a to f).	(a) Leprosy cured person* (b) Cerebral Palsy** (c) Dwarfism (d) Muscular Dystrophy (e) Acid attack victims	Less than 40% disability	40-80% disability- Persons with more than 80% disability may also be allowed on case to case basis and their function of incompetency will the aid of assistive devices, if it is being used, to see if its is brought below 80%	More than 80%
			(f) Other* ** such as Amputation, Poliomyelitis, etc.		and whether they possess sufficient motor, ability as required to pursue and complete the Course satisfactorily.	
			<p>* Attention should be paid to loss of sensations in fingers and hands, amputation, as well as involvement of eyes and corresponding recommendations be looked at.</p> <p>** Attention should be paid to impairment of vision, hearing, cognitive function etc. and corresponding recommendations be looked at.</p> <p>*** Both hands intact, with intact sensations, sufficient strength and range of motion are essential to be considered eligible for Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Course.</p>			

	(B) Visual Impairment(*)	(a) Blindness (b) Low Vision	Less than 40% disability (i.e. Category '0 (10%)', I(20%) & II (30%))		Equal to or more than 40% disability (i.e. Category III and above)
	(C)Hearing Impairment@	(a) Deaf (b) Hard of hearing	Less than 40% disability		Equal to or more than 40% disability
		<p>(*) Persons with visual impairment/ visual disability of more than 40% may be made eligible to pursue Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Course and may be given reservation, subject to the condition that the visual disability is brought to a level of less than the benchmark of 40% with advanced low vision aids such as telescopes / magnifier.</p> <p>@ Persons with hearing disability of more than 40% may be made eligible to pursue Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). Course and may be given reservation, subject to the condition that the hearing disability is brought to a level of less than the benchmark of 40% with the aid of assistive devices.</p> <p>In addition to this, the individual should have a speech discrimination score of more than 60%.</p>			
(D) Speech & language		Organic/neurological causes	Less than 40%		Equal to or more than

	disability		disability		40% disability
	<p>For admission to Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). course the Speech Intelligibility Affected (SIA) score shall not exceed 3 (which will correspond to less than 40%) to be eligible to pursue the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course. The individuals beyond this score will not be eligible for admission to the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course.</p> <p>Persons with an Aphasia Quotient (AQ) upto 40% may be eligible to pursue Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S). course but beyond that they will neither be eligible to pursue the Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course nor will they have any reservation.</p>				

2.	Intellectual disability	(a) Specific learning disabilities (Perceptual disabilities, Dyslexia, Dyscalculia, Dyspraxia & Developmental aphasia) #	# Currently there is no quantification scale available to assess the severity of SLD; therefore the cut-off of 40% is arbitrary and more evidence is needed.	Less than 40% disability	Equal to or more than 40% disability but selection will be based on the learning competency evaluated with the help of the remediation/assisted technology/aids/infrastructural changes by the expert panel.	
		(b) Autism spectrum disorders	Absence or Mild Disability, Asperger syndrome (disability of 40-60% as Per ISAA) where the individual is deemed fit for	Currently, not recommended due to lack of objective method. However, the benefit of reservation/quota may be considered in future	Equal to or more than 60% disability or presence of cognitive/intellectual disability and/or if the person is deemed unfit for pursuing Bachelor of Homoeopathic Medicine and	

				<p>Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S).</p> <p>course by an expert panel</p>	<p>after developing better methods of disability assessment.</p>	<p>dSurgery course by an expert panel.</p>
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3.	Mental Behaviour		Mental illness	Absence of mild disability: less than 40% (under IDEAS)	Currently, not recommended due to lack of objective method to establish presence and extent of mental illness. However, the benefit of reservation/quota may be considered in future after developing better methods of disability assessment.	Equal to or more than disability or if the person
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4.	Disability caused due to	(a) Chronic neurological conditions	(i) Multiple Sclerosis	Less than 40% disability	40%80% disability	More than 80% disability
			(ii) Parkinsonism			
		(b) Blood disorders	(i) Hemophilia	Less than 40% disability	40%80% disability	More than 80% disability
(ii) Thalassaemia						
(iii) Sickle cell disease						
5.	Multiple disabilities including deafness blindness		More than one of the above specified disabilities	Must consider all above while deciding in individual cases recommendations with respect to presence any of the above, namely , visual, hearing, speech & language disability, intellectual disability, and mental illness as a component of multiple disabilities.		

				<p>Combining formula as notified by the related Gazette Notification issued by the Govt. of India:</p> $\frac{a+b(90-a)}{90}$ <p>(where a=higher value of disability % and b=lower value of disability % as calculated for different disabilities) is recommended</p> <p>for computing the disability ar when more than one disabling condition is present in a given individual. This formula may be used in cases with multiple disabilities, and recommendations regarding admission and/or reservation made as per the specific disabilities present in a given individual</p>
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Note: For selection under PwD category, candidate shall be required to produce Disability Certificate before his scheduled date of counselling issued by the disability assessment boards as designated by concerned authority of Government of India.

Note: 2- if the seats reserved for the persons with disabilities in a particular category remain unfilled on account of unavailability of candidates, the seats shall be included in the annual sanctioned seats for the respective category.

Annexure –I

Foundation Programme

[See clause (b) of sub-regulation (1) of regulation 7]

BACKGROUND

Homoeopathic medical education in India requires orientation of the new entrants to a basic philosophical orientation, a need to think in an integrated and holistic manner, an ability to function in a team at the bedside and a capacity to invest in a life-long learning pattern. Homoeopathy, though more than 225 years old, is relatively young as a scientific discipline and has attracted several negative community exposure due to a variety of reasons. In India, we are aware that the students who enter the portals of a homoeopathic college rarely do so out of their volition. It is often an exercise as the last choice or one which is adopted as a stepping stone to a 'medical' degree. Hence, the mind-set of the new entrants is rarely informed, positive, and self-affirming.

However, we know that like all medical disciplines, homoeopathy training includes a wide spectrum of domains that involves exposure to human interactions and interpersonal relationships in various settings including hospital, community, clinics etc. The training is intense and demands great commitment, resilience and lifelong learning. It is desirable to create a period of acclimatization and familiarization to the new environment. This would include an introduction to the course structure, learning methods, technology usage, and peer interactions which would facilitate their smooth transition from junior college to homoeopathic college.

This is planned to be achieved through a dedicated 10 days exclusive "Foundation Programme", at the beginning of the BHMS course to orient and sensitize the students to various identified areas.

Goals and Objectives

Broad goals of the Foundation Programme in Homoeopathy include:

1. Orienting the students to various aspects of homoeopathic system of medicine;
2. Creating in them the conscious awareness of the 'Mission' as defined by Master Hahnemann;
3. Equipping them with certain basic, but important skills required for going through this professional course and taking care of patients;
4. Enhancing their communication, language, computer and learning skills;
5. Providing an opportunity for peer and faculty interactions and introducing an orientation to various learning methodologies.

Objectives

- (a) The Objectives of the Foundation

Programme are to: Orient the

learners to:

- (i) The medical profession and the mission of a homoeopath in society
 - (ii) The BHMS Course
 - (iii) Vision and Mission of the institute
 - (iv) Concept of holistic and positive health and ways to acquire and maintain it
 - (v) History of Medicine and Homoeopathy and the status of Homoeopathy in the world
 - (vi) Medical ethics, attitudes and professionalism
 - (vii) Different health systems available in the country
 - (viii) Health care system and its delivery
 - (ix) National health priorities and policies
 - (x) Principles of primary care (general and community-based care)
 - (xi) Concept of mentorship programme
- (b) Enable the learners to appreciate the need to enhance skills in:
- (i) Language
 - (ii) Observation, documentation & understanding of basic medical technologies
 - (iii) Interpersonal relationships and team behavior
 - (iv) Communication across ages and cultures
 - (v) Time management
 - (vi) Stress management
 - (vii) Use of information technology
- (c) Train the learners to provide:
- (i) First-aid/ Emergency management
 - (ii) Basic life support
 - (iii) Universal precautions and vaccinations
 - (iv) Patient safety and biohazard safety
- (d) Impart Language and Computer skills
- (i) Local language programme
 - (ii) English language programme
 - (iii) Computer skills

These may be arranged as per the needs of the particular batch and extra coaching may be continued after the Foundation programme

Content and Methodology

The programme will be run in professional session which must be interactive. The major components of the Foundation Programme include:

1) Orientation Program:

This includes orienting students to all the components mentioned below with special emphasis on the role of Homoeopathy and homoeopath in today's times.

2) Skills Module (Basic):

This involves skill sessions such as Basic Life Support/ Emergency Management, First aid, Universal Precautions and Biomedical Waste and Safety Management that students need to be trained prior to entering the patient care areas.

3) Field visits to Community and Primary Health Centre:

These visits provide orientation to the care delivery through community and primary health centres, and include interaction with health care workers, patients and their families.

4) Professional development including Ethics:

This is an introduction to the concept of Professionalism and Ethics and is closely related to Hahnemann's emphasis on the conduct of a physician. This component will provide students with understanding that clinical competence, communication skills and sound ethical principles are the foundation of professionalism. It will also provide understanding of the consequences of unethical and unprofessional behavior, value of honesty, integrity and respect in all interactions. Professional attributes such as accountability, altruism, pursuit of excellence, empathy, compassion and humanism will be addressed. It should inculcate respect and sensitivity for gender, background, culture, regional and language diversities. It should also include respect towards the differently abled persons. It introduces the students to the basic concept of compassionate care and functioning as a part of a health care team. It sensitizes students to "learning" as a behavior and to the appropriate methods of learning.

5) Enhancement of Language / Computer skills / Learning skills:

These are sessions to provide opportunity for the students from diverse background and language competence to undergo training for speaking and writing English, fluency in local language and basic computer skills. The students should be sensitized to various learning methodologies such as small group discussions, skills lab, simulations, documentation and concept of Self-Directed learning.

Structure of the program for students

Table 19: Foundation Programme			
Serial Number	Topic	Type of activity	Duration hours
(1)	(2)	(3)	(4)
1.	Welcome and Introduction to Vision/Mission of the Institute	Lecture	1
2.	Mission and role of Homoeopathy and a Homoeopath in society including showcasing effects of Homoeopathy	Interactive discussion	3
3.	BHMS Course of study and introducing to first year faculty	Presentation	1
4.	Visit to institution / campus / facilities	Walking tour	2
5.	Concept of Holistic and Positive health	Interactive discussion	2
6.	History of Medicine and Homoeopathy and state of Homoeopathy in the world	Presentation	2
7.	Adult learning principles	Interactive discussion	2
8.	Health care system and delivery	Visit to PHC/ Urban Health Centre and interaction with staff	3
9.	Different health care systems recognized in the country and the concept of pluralistic health care systems	Presentation	1
10.	Primary community care	Interaction	2
11.	Basic life support	Demonstration video and practice	4
12.	Communication – its nature and importance in different social and professional settings	Practical with scenarios and enactment with observation	4
13.	Medical ethics – role in enhancing patient care	Role play	2
14.	Who is professional?	Debate between two sides	2

		on a topic	
15.	Time management	Practical exercise	3
16.	First aid – principles and techniques	Demonstration and presentation	2
17.	National health priorities and policies	Presentation	1
18.	Importance of Mental Health and Hygiene to a medical student in the medical profession Stress management including importance of sports and extracurricular activities	Practical demonstration / video	4
19.	Concept and practice of mentoring	Interactive discussion	4
20.	Constitutional values, equality, gendersensitization and ragging policy	Presentation and Interactive discussion	3
21.	Universal precautions and vaccinations	Presentation followed by discussion	1
22.	Importance of Observation and Documentation in Homoeopathic practice	Practice exercise through video observation	4
23.	Team working	Game and debriefing	2
24.	Patient safety and biomedical hazards	Video and presentation	1
25.	Computer skills	Demonstration and practice of basic use of word, Excel and PPT	2
26.	Language skills	Language labs	2
	TOTAL		60

Annexure -IIPART A

TENTATIVE TEMPLATE OF ACADEMIC CALENDAR

First Professional Bachelor of Homoeopathic Medicine and Surgery
(B.H.M.S).

(18 MONTHS)

Serial Number	DATE / PERIOD	ACADEMIC ACTIVITY
(1)	(2)	(3)
1.	First working day of October	Course commencement
2.	10 working days	Foundation Programme
3	First periodic assessment	January- Internal Assessment (PA-1)
4.	Fourth Week of March	First Terminal Test -Internal Assessment (TT-1)
5	Second periodic assessment	June -Internal Assessment (PA-2)
6.	First week of September	Second Terminal Test -Internal Assessment (TT-2)
7.	Third periodic assessment	November – Internal Assessment – (PA-3)
8.	Second week of February to March	University Examination
9.	<i>First Working Day of April</i>	<i>Start of second professional year</i>
	NOTE.- 1. University / Institution / College shall specify dates and year while preparing academic calendar of that particular batch of students. The same is to be informed to students and displayed in respective websites. 2. Institution/College established in Extreme Weather Conditions may adjust the timings as required by maintaining the stipulated hours of teaching. However, the structure of academic calendar shall not be altered. 3. Academic calendar may be modified according to directions of National Commission for Homoeopathy issued from time to time.	

PART-B

TENTATIVE TEMPLATE OF ACADEMIC CALENDAR

Second/Third/ Fourth Professional Bachelor of Homoeopathic
Medicine and Surgery (B.H.M.S).

(12 MONTHS)

Serial Number	DATE /PERIOD	ACADEMIC ACTIVITY
(1)	(2)	(3)
1.	First working day of April	Course commencement
2.	Fourth week of July	First periodic - Internal Assessment (PT-1)
3.	Fourth week of September	First terminal examination- Internal Assessment (TT-1)
4.	Fourth week of December	Second periodic - Internal Assessment (PT-2)
5.	Third week of February	University Examination
6.	<i>First Working day of April</i>	<i>Commencement of third/fourth/internship professional year</i>
	NOTE. - <ol style="list-style-type: none">1. University/ Institution / College shall specify dates and year while preparing academic calendar of that particular batch of students. The same is to be informed to students and displayed in respective websites.2. Institution / College established in Extreme Weather Condition may adjust the timing as required by maintaining the stipulated hour of teaching and however, the structure of academic calendar shall not be altered3. Academic calendar may be modified according to directions of National Commission for Homoeopathy issued from time to time.	

Annexure-III
GUIDELINES FOR ATTENDANCE
MAINTENANCE
(THEORY/PRACTICAL/CLINICAL/NON-LECTURE
HOURS)

Institutes/colleges offering education in Homoeopathy are recommended to maintain online attendance system. However, in case physical registers are being maintained for recording attendance of various teaching/training activities, the following guidelines are to be followed:

- (1) Attendance is to be marked in cumulative numbering fashion:
 - (a) In case presence, it is to be marked as 1, 2, 3, 4, 5, 6.....soon;
 - (b) In case of absence, it must be marked as 'A';
 - (c) Example: P PPP A P P AA P P P.... may be marked as (1, 2, 3, 4, A, 5, 6, A, A, 7,8,9...).
- (2) Avoid strictly marking 'P' for presence.
- (3) Separate register for theory and practical/clinical/non-lecture activities are to be maintained.
- (4) At the end of term or course or part of syllabus, the last number to be taken as total attendance.
- (5) The total attendance after student's signature is to be certified by respective Head of department (HOD) followed by approval by Principal.
- (6) In case of multiple terms, at the end of course all term attendance is to be summarised and percentage is to be calculated separately for theory and practical including clinical & non- lecture hours.

[Note : *If any discrepancy is found between Hindi and English version, the English version will be treated as final.]

FORM 1

[See sub- regulation (2) and (3) of
regulation 16] (NAME OF THE
COLLEGE AND ADDRESS)

BACHELOR OF HOMOEOPATHIC MEDICINE AND SURGERY
(B.H.M.S) COURSE DEPARTMENT OF.....

CERTIFICATE OF ATTENDANCE AND ASSESSMENT OF INTERNSHIP

(1) Name of the Intern :

(2) Attendance during internship

Period of training From-----to-----

- (a) Number of working days :
- (b) Number of days attended :
- (c) Number of days leave availed :
- (d) Number of days absent :

Assessment of Internship

Serial Number	Category	Marks obtained
(1)	(2)	(3)
1.	General	Maximum 10
(a)	Responsibility and Punctuality	(___) out of 2
(b)	Behavior with sub-ordinates, colleagues and superiors	(___) out of 2
(c)	Documentation ability	(___) out of 2
(d)	Character and conduct	(___) out of 2
(e)	Aptitude for research	(___) out of 2
2.	Clinical	Maximum 20
(a)	Proficiency in fundamentals of subject	(___) out of 4
(b)	Bedside manners & rapport with patient	(___) out of 4
(c)	Clinical acumen and competency as acquired	(___) out of 4
	(i) By performing procedures	
	(ii) By assisting in procedures	(___) out of 4
	(iii) By observing procedures	(___) out of 4
Total Score obtained		(___) out of 30

Performance Grade of marks

Poor < 8, Below average 9-14, Average 15-21, Good 22-25, Excellent 26 and above

Note: An intern obtained unsatisfactory score (below 15) shall be required to repeat one third of the total period of posting in the concerned department.

Date:

Place:

Signature of the Intern
Department and Office Seal

Signature of the Head of the

FORM 2

[See sub-regulations
(3) and (4) of
regulation 16] (NAME
OF THE COLLEGE AND
ADDRESS)

(BACHELOR OF HOMOEOPATHIC MEDICINE AND SURGERY –
(B.H.M.S)) COURSE CERTIFICATE OF COMPLETION OF COMPULSORY
ROTATORY INTERNSHIP

This is to certify that _____ (name of the intern) an intern of ,
_____ (name of the college and address), has
completed his/her Compulsory Rotatory Internship at the _____ (
Name of college, address and place of posting) for one year _____ to
_____ in following departments.

TABLE 20

Serial Number.	Name of the Department	Period of training (From) (dd/mm/yyyy)	Period of training (to) (dd/mm/yyyy)
(1)	(2)	(3)	(4)
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			

During the internship period, the conduct of the student is _____ Date:

Place:

Signature of the Internship in charge /
Principal/Dean/Director with Office seal

Form-3

{See sub – regulation (4) and (7) of regulation 13}

Migration of Mr. / Miss _____ from
_____ Homoeopathic Medical College _____ to
Homoeopathic Medical College

1. Date of admission in First Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course
2. Date of passing First Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) University examination
3. Date of application
4. Number objection certificate from relieving college (enclosed) – Yes/No
5. Number objection certificate from relieving University (enclosed) – Yes/No
6. Number objection certificate from receiving college (enclosed) – Yes/No
7. Number objection certificate from receiving University (enclosed) – Yes/No
8. Number objection certificate from State Government wherein the relieving college is located – Yes/ No
9. Affidavit, duly sworn before First Class Magistrate containing an undertaking that “I will study for full twelve months in existing class of Bachelor of Homoeopathic Medicine and Surgery (B.H.M.S) course in transferred Homoeopathic Medical College before appearing in the IInd Professional University examination” (enclosed) – Yes/No
10. Reasons for migration in brief (please enclose copy of proof) – Yes/No
11. Permanent address: _____”.

ORGANON OF MEDICINE AND HOMOEOPATHIC PHILOSOPHY AND FUNDAMENTALS OF PSYCHOLOGY

TABLE OF CONTENTS:

Sr. no	Title	Page No.
1.	Course Code and Name of Course	
2.	Preamble	
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6.	Number of Teaching Hours	
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1.Course Code and Name of Course

Course Code	Name of Course
HomUG-OM-I	Organon of Medicine and Homoeopathic philosophy and Fundamentals of Psychology.

1. PREAMBLE:

ORGANON OF MEDICINE AND HOMOEOPATHIC PHILOSOPHY

Organon of Medicine with Homoeopathic Philosophy is a central fulcrum around which education and training of a homoeopathic physician revolves. It lays down the foundations of homoeopathic practice, education, training and research. It not only elaborates on the fundamental laws but also how to apply them in practice. It defines the qualities of a healer, guides the homoeopathic physician in inculcating values and attitude and develop skills.

Nature nurtures us. It is well depicted in our science. Therefore, Homoeopathy is in sync with Nature. The need to keep life force within us well balanced with nature is well established in Organon. Hahnemann as an ecologist was well ahead of his time. Philosophically, it connects man and his actions to the dynamic forces available in nature, thus bringing to fore the holistic approach. Lateralization of these concepts helps the student to develop insight into various facets of Life & Living. Organon orients the students to homoeopathy as an Art & Science. Its comprehensive understanding needs a core competency in logic and the concepts of generalization and individualization. Its treatment of disease process and relating to the concept of miasm makes it a study of the process of scientific investigation.

The biggest challenge in teaching-learning of Organon is to first understand the fundamentals according to the Master's writing and then demonstrate them in practice. Quality and real time integration with other subjects helps a student to conceive the holistic perceiving of Man and Materia Medica. The concepts and knowledge required by the Physician with operational knowledge of management of patients and their diseases will need horizontal and vertical integration with Homoeopathic subjects and clinical subjects. First BHMS will need horizontal integration with Anatomy, Physiology, Homoeopathic Pharmacy and Homoeopathic Materia Medica. Organon will have spiral integration with itself and vertical integration with clinical subjects. Second year will need integration with pathology, community medicine, forensic medicine, along with other homoeopathic subjects. Third and fourth year establishes links with clinical subjects, research methodology and pharmacology.

Science is never static. Since the time of Hahnemann, medical science has advanced by leaps and bounds. Since Homoeopathy is based on principles rooted in nature, they would stand the test of time. However, their application in the changing times and circumstances would find newer avenues to heal. This is an opportunity for a homoeopath to connect the current advances while relating with the fundamental laws. Mastering all this will make him a master healer and will move him towards higher purpose of existence.

Psychology

Mind is an invisible dynamic force operating on the body which can be seen and felt with its expressions at multiple levels. While understanding Man it is important to know how he behaves, feels and thinks in general of his life and in different situations.

Health is that balanced condition of the living organism in which the integral, harmonious performance of the vital functions tends to the preservation of the organism ensuring the normal development of the individual. In a similar way, study of mind is an inseparable component of the study of man and is essential for prescribing. Thus mind remains an integral component of Homoeopathic prescribing.

In § 5 of Organon of Medicine, Dr Hahnemann talked of basic knowledge required for Homoeopathic practice of Holistic cure. According to him homoeopathic physician has to have knowledge of:

- a. Constitution of Man
- b. His moral & intellectual character
- c. Mode of living habits
- d. His social & domestic relations
- e. His adaptations with the environment

Above knowledge will help the Homoeopathic physician not only to understand the person in the patient but also to identify the cause of suffering by delving in to detailed enquiry. This may take the form of exploring evolutionary aspects from childhood to present, from family history – past history to present illness - all of which will indicate the qualities of the human in health as well as in disease.

Psychology is a science of mind and behavior which is important and necessary in all areas of life including the growth and development of human being. Theoretically, psychology examines psychological phenomena and behavioral patterns that appear as individual's external behavioral reactions against any stimulus - be it Biological–Psychological– Emotional –Social-Spiritual.

Modern concept of psychology has talked of Mental Health and Hygiene which indicates the importance and great need for ensuring psychological wellbeing in us. This state is under constant stress due to the rapid changes taking place in the life situation due to internal pressures and external environment.

2. COURSE OUTCOMES (CO):

At the end of course in Organon of Medicine and Homoeopathic philosophy and Fundamentals of Psychology, the BHMS student shall be able to:

1. Explain the Cardinal Principles and Fundamental laws of Homoeopathy.
2. Describe the concept of Health, Disease and Cure in Homeopathy
3. Interpret a case according to the Hahnemannian Classification of Disease
4. Apply the Theory of Chronic Disease to determine the miasmatic background in a case.
5. Demonstrate case taking and show empathy with the patient and family during case taking
6. Demonstrate Analysis, evaluation of the case to form the Portrait of disease
7. Apply the concept of Susceptibility to determine posology in a given case
8. Interpret the action of the medicine in a case on the basis of Remedy reactions.
9. Apply knowledge of various therapeutic modalities, auxiliary measures & its integration with prevalent & other concepts in the management of patients.
10. Identify the various obstacles to cure and plan treatment accordingly.
11. Display qualities, duties & roles of a Physician as true practitioner of healing art
12. Develop the competencies essential for primary health care in clinical diagnosis and treatment of diseases through the judicious application of homoeopathic principles
13. Recognize the scope and limitation of homoeopathy and to apply the Homoeopathic Principles for curative, prophylactic, promotive, palliative, and rehabilitative primary health care for the benefit of the individual and community.
14. Discern the relevance of other systems of medical practice for rational use of cross referral and life saving measures, so as to address clinical emergencies
15. Develop capacity for critical thinking and research aptitude as required for evidence based homoeopathic practice.
16. Demonstrate aptitude for lifelong learning and develop competencies as and when conditions of practice demand.
17. Be competent enough to practice homoeopathy as per the medical ethics and professionalism.
18. Develop the necessary communication skills to work as a team member in various healthcare setting and contribute towards the larger goals of national policies such as school health, community health, environmental conservation.
19. Identify socio-demographic, psychological, cultural, environmental & economic factors that affect health and disease and plan homoeopathic intervention to achieve the sustainable development Goal.

Specific Objectives of Organon of Medicine and Homoeopathic philosophy in 1st BHMS

- a. Recall the history of medicine and history of homoeopathy to relate it's evolution
- b. Correlate the first six aphorisms of Organon of Medicine for the study of anatomy, physiology, pharmacy.
- c. Discuss the concept of health, indisposition and disease and its importance into the learning of anatomy, physiology, pharmacy and psychology
- d. Discuss concept of Dynamization with health, disease and drug
- e. Develop portrait of drug in the context of knowledge of anatomy, physiology, psychology and pharmacy
- f. Explain the procedure and ethics of Drug proving

COURSE OUTCOMES (CO) OF ORGANON OF MEDICINE AND HOMOEOPATHIC PHILOSOPHY FOR I BHMS

At the end of IBHMS, the student should be able to,

1. Summarize the important milestones in the History of Medicine and development of Homoeopathy.
2. Value the contributions and qualities of Dr.Hahnemann as a physician and person
3. Recall the contributions of stalwarts in development of Homoeopathy
4. Explain the Cardinal Principles and Fundamental laws of Homoeopathy
5. Explain the Homoeopathic concept of Health, Disease and Cure in light of modern concepts
6. Apply Inductive and Deductive Logic in the study of the Basic principles of Homoeopathy
7. Describe the important features of the various editions and Ground plan of Organon of Medicine
8. Explain the meaning and significance of aphorisms §1-27
9. Relate the concepts of homoeopathic philosophy with other pre-, para-, and clinical skills by way of horizontal, vertical and spiral integration.

COURSE OUTCOMES OF FUNDAMENTALS OF PSYCHOLOGY:

1. Explain the concept of Mind as perceived by Hahnemann and other stalwarts
2. Define the structure of the mind as conscious and unconscious and its various constituents / components in terms of Emotion, Thinking, Behavior, Sleep and Dreams
3. Identify the conscious expressions of Mind as Emotion, Thought and Behavior
4. Explain the neurophysiological basis of mental functioning
5. Discuss the relationship between the growth of the brain and the mind and its correlation with physical growth of the from infancy to old age and psychosocial development.
6. Evaluate the role that emotions and intellectual functions play in our daily lives
7. Derive the importance of the role of 'Learning' in human adaptation and change

8. Discuss 'Personality' as a synthesis of inborn traits and learnt responses occurring over the growing years
9. Realize the various forms of 'conflict', their origins and their role in determining the quality of our personal and social lives
10. Integrate the concept of mind as conceived in homoeopathic philosophy with that in modern psychology
11. Demonstrate the importance of the study of the Mind in approaching the study of Repertory and Materia Medica
12. Realize how a healthy individual experiences the harmonious functioning of the different constituents of the mind
13. Summarize the importance of knowledge of Psychology in Modern life and in Homoeopathic practice

General Instructions

1. Instructions in psychology should be planned in such a way that students should be able to present a basic understanding of the structure of mind, brain and its functioning with the kind of interrelationship they are sharing with each other.
2. Each topic should be planned in parallel with others subjects of Homeopathy where ever relevant to achieve integration with other subjects.
3. Since this subject is dealing with the human mind and its functions, topic should be dealt in more interactive ways where maximum learning will be achieved by doing rather than memorizing the things.
4. Emphasis would be more on the organization of the brain areas, their functions and correlated with the medical concept and philosophical concept of Mind.
5. Student should learn the psychological organization with learning the importance of special senses and their functions in great details that forms the foundation of the subject.
6. Most of the basic topics can be studied in interactive ways, discussion based on clinical case or any relevant event/ incidence of daily life.
7. Topics having philosophical connection should be taught with the help of discussion or in the form of story -telling with connections to the principles of philosophy.
8. Topics requiring a lot of analysis of information can be taught with role-play with directed observation method followed by discussion on the same pointing out its relevance and importance.
9. Nice to know topics along with a lot of community related information should be dealt with survey methods
10. Topics which are interrelated with other subjects of Homoeopathy should be presented and discussed.
11. Lectures or demonstration on the clinical and applied part of psychology should be arranged in the 3rd semester of the course and it should aim at demonstrating the structural-physiological –psychological basis of mental expressions of the symptoms and its value in Homeopathy.

12. Learning of applied psychology would be more qualitative in the various OPDs/Peripheral OPDs where contact with community will improve their knowledge, observation skills, attitude of communication with the community.
13. Some of the theoretical lectures should conclude with discussion on the learning achieved with its importance.
14. Periodical seminars on general topics related to philosophical aspect and its connection with psychology should be arranged for vertical, horizontal and spiral integration.
15. Role of observation and correlation should be demonstrated while discussing the intricacies of the subject of psychology.
16. Inter-departmental or joint seminars should be planned
17. While working on community survey- purpose should be kept very broad with the following objectives.
 - (i) Experiencing the community in actuality for the demographic configuration, different cultural traditions, different practices and inter-relationship and its effect on Mind and Body as a joint system.
 - (ii) Learning the functioning of human being in multiple situations of stress and process of getting adapted with those.
 - (iii) Quality of Mental Health of the community and its varied expressions

Quality of Inter-relationship within different castes, communities, religions and its impact on Individuals

4. COURSE CONTENT for HomUG-OM-I

ORGANON OF MEDICINE & HOMOEOPATHIC PHILOSOPHY:

Course Contents-

1. Introduction:
 - 1.1. History of medicine
 - 1.2. History of Homoeopathy

Short history of Hahnemann's life, his contributions, and situation leading to discovery of Homoeopathy
 - 1.3. Brief history and contributions of Boenninghausen, Hering, Kent, R L Dutt, M L Sircar & B K Sarkar.
 - 1.4. History and Development of Homoeopathy in brief in India, U.S.A. and European countries
 - 1.5. Fundamental Principles of Homoeopathy.
 - 1.6. Basic concept: Individualistic, Holistic & Dynamic
 - 1.6.1. Life; Hahnemann's concept and modern concept.
 - 1.6.2. Health: Hahnemann's concept and modern concept.
 - 1.6.3. Disease: Hahnemann's concept and modern concept.

1.6.4 Cure.

- 1.7. Understanding Homoeopathy in vertical, horizontal & spiral integration with pre, para & clinical subject.
2. Logic: To understand Organon of medicine and homoeopathic philosophy, it is essential to be acquainted with the basics of LOGIC to grasp inductive and deductive reasoning. Preliminary lectures on inductive and deductive logic (with reference to philosophy book of Stuart Close Chapter 3 and 16).
3. § 1 to 27 of Organon of medicine, § 105 to 145
4. The physician – purpose of existence, qualities, duties and knowledge
5. Vital force- dynamization- homoeopathic cure- nature's law of cure & its Implications- drug proving

Topic	Kent	Roberts	Close	Dhawale
Understanding the first six aphorisms and its application in the study of anatomy, physiology, pharmacy.	1-6	1	6	4
Concept of health, indisposition and disease and its importance in learning anatomy, physiology, pharmacy and psychology	1 to 9	2, 3, 4	6	2
Dynamization and relating with health, disease and drug	10, 11	2-6	14, 15	2, 16
Developing portrait of drug with help of knowledge of anatomy, physiology, psychology and pharmacy	13,21-25,26	15	15	16

Non lectures– community – OPD/IPD -

Students will be exposed to OPD/PD-community from first BHMS:

Students will understand the first six aphorisms in action and will get sensitized to sociocultural-political-economical perspective of the community. They should develop insight into what constitutes health and how disease develops.

Introduce Journals from 1st year–

Habit of collecting evidence and noting them down vis-a-vis the expected objective will train them for evidence-based learning and inculcating the habit of using logic so inherent in Homoeopathic practice.

They also will realize the importance of skill and attitude and relevance of each subject in relation to Organon and Homoeopathic philosophy

They will write their experience of the clinic/OPD in relation to Observation/Cure/relief/Mission/Prevention/acute/chronic/indisposition etc.

(i) 5 medicine from HMM to correlate with Physiology-Anatomy-Pharmacy. (ii) 5 cases observed in OPD

FUNDAMENTALS OF PSYCHOLOGY:

Note: Each topic should be related with relevant clinical examples and the relationship with the subjects of Homoeopathic Philosophy, Materia Medica and Repertory must be made.

1. Introduction to the study of Mind in Homoeopathy
 - A. Concept of Mind-
 - i. Contemporary schools of psychology
 - ii. Concept of Mind by Hahnemann
2. Psychological organization and the interrelationship of Thought (Cognition), Feelings (Affect) and Behavior (Conation); Conscious and Unconscious elements
 - A. Psychological Organization
 - i. Definition of Emotions and its types
 - ii. Definition of Thinking and its types
 - iii. Definition of Behavior and its types
 - B. Effects on Thought (Cognition), Feelings (Affect) and Behavior (Conation) on Mind and Body
 - C. Interrelationship of Thought (Cognition), Feelings (Affect) and Behavior (Conation) on Mind and Body
 - D. Representation of Thought (Cognition), Feelings (Affect) and Behavior (Conation) in Materia Medica
 - E. Representation of Thought (Cognition), Feelings (Affect) and Behavior (Conation) in Repertory
3. Physiological and Evolutionary basis of behavior -
 - A. Instincts, Conditioned and unconditioned reflexes
 - B. Conscious and unconscious behavior
 - C. Scientific study of Behavior and its expressions
 - D. Evolutionary study of behavior

- E. Understanding Relationship of Behavior to Emotions and Thought
 - F. Expressions of Behavior in Repertory and Materia Medica
- 4. Understanding Emotion, its different definitions and expressions in Repertory and Materia Medica
 - A. Scientific study of Emotions
 - i. Definition of Emotions and its types
 - ii. Effects Emotions on Mind and Body
 - iii. Effect of emotions on sexual behavior
 - iv. Interrelationship of Emotions on Mind and Body
 - B. Representation of Emotions in Materia Medica-
 - C. Representation of Emotions in Repertory
- 5. Understanding Intellect: Attention, memory and its function and expression in Repertory and Materia Medica
 - Basic concepts of Thinking
 - A. Definition of Thinking and its types
 - B. Intelligence and its measurement
 - C. Effects of Thinking /Thought (Cognition) on Mind and Body
 - D. Representation of Thinking /Thought (Cognition) in Materia Medica
 - E. Representation of Thinking /Thought in Repertory
- 6. Motivation and their types with role in our lives
 - Study of Motivation and its types
 - Importance of study of Motivation for Homoeopathic Physicians
- 7. Learning and its place in adaptation
 - A. Study Learning:
 - Definition of Learning and its types
 - Study of relevance of Learning for Homoeopathic Physician
 - Study of disturbances/ malfunctioning of Learning
 - B. Adaption
 - Definition and its dynamic nature
 - Successful and unsuccessful adaptation
- 8. Growth and development of Mind and its expressions from Infancy to old age
 - Study of Developmental Psychology
 - i. Normal developments since birth to maturity (both physical and psychological)
 - ii. Deviations- in Growth and Development and its effects on later behavior

- iii. Understanding the bio-psycho-socio-cultural-economical-political-spiritual concept of evolution
 - iv. Importance of above study to understand Materia Medica drug proving
- 9. Structure of Personality, the types, their assessment, relationship to Temperament and representation in Materia Medica
 - i. Definition of Personality and its types
 - ii. Various constituents of Personality like Traits and Temperament
 - iii. Theories of Personality by psychologists
 - iv. Measures for the assessment of Personality, relationship to Temperament and representation in Materia Medica
- 10. Conflicts: their genesis and effects on the mind and body
 - i. Conflicts and their types
 - ii. Genesis of Conflicts and effects on the mind and body
 - iii. Genesis of Conflicts and related Materia Medica images
- 11. Applied Psychology: Clinical, Education, Sports, Business, Industrial
Application of knowledge of Psychological Components and its Integration in understanding
 - i. Psychological basis of Clinical Conditions
 - ii. Education
 - iii. Sports
 - iv. Business
- 12. Psychology and its importance in Homoeopathic practice for Holistic Management of the patient

5. Teaching Learning Methods

ORGANON OF MEDICINE & HOMOEOPATHIC PHILOSOPHY:

Assignments- Group work

Problem Based Learning through Cases- Literature

Group Discussion – Problem based learning

Project work with its presentations in class

Practicing Evaluation & Feedback system- after Project work, assignments & Group Discussions.

Non-Lecture Activities

Seminars/ Workshops

Group Discussions

Problem based learning

Integrated Teaching

Case Based Learning

Self-Directed Learning

Tutorials, Assignments, Projects

FUNDAMENTALS OF PSYCHOLOGY:

- a. Classroom teaching
 - i. Lecture
 - ii. Demonstration
 - iii. Group discussion
 - iv. Problem based learning
- b. Practical
 - i. Psychometric Tests
 - ii. Facial recognition spotters
- c. Individual learning
 - i. Assignment
 - ii. Short project -e.g., searching MM or Repertory for representation of emotions, thoughts and behavior

Practical – Lab work – Field – Clinical Hospital work

- a. Journal club: a team of students to present the understanding of current development in psychological aspects of every day events
- b. Field work - Some survey for identification of psychological disturbance in Common Man
- c. Clinical Hospital Work- Small project on psychometric tests.

6. Teaching Hours-

1 st BHMS Organon Classroom teaching and non-lecture hours		
YEAR	TEACHING HOURS- LECTURES	Non-lecture
1 ST BHMS	130	78

Teaching Hours ORGANON OF MEDICINE

Sr. No.	List of Topics	Term	Lectures	Non-Lectures
1	History of medicine in brief History and Development of Homoeopathy in brief in India, U.S.A. and European countries.	I	5	5
2	Short history of Hahnemann's life, his contributions, and situation leading to discovery of Homoeopathy	I	5	5
3	Brief history and contributions of Boenninghausen, Hering, Kent, R L Dutt, M L Sircar & B K Sarkar.	I	15	
4	Logic: To understand Organon of medicine and homoeopathic philosophy, it is essential to be acquainted with the basics of LOGIC to grasp inductive and deductive reasoning. Preliminary lectures on inductive and deductive logic (with reference to philosophy of Stuart Close).	I	5	5
5	Science & Art in Homoeopathy	I	5	
6	Different editions and constructions of Hahnemann's Organon of Medicine.	I	10	5
7	Fundamental Principles of Homoeopathy	II	20	5

8	<p>Basic concept of: Individualistic& Holistic</p> <p>Life: Hahnemann's concept and modern concept.</p> <p>Health: Hahnemann's concept and modern concept.</p> <p>Disease: Hahnemann's concept concept.</p> <p>Cure.</p>	II	5	5
9	§1-27&105-145 of Organon of medicine	II/III	60 (20+40)	48
			130	78

Teaching Hours: FUNDAMENTALS OF PSYCHOLOGY

Sr. No	Topic	No of lectures	Non-lectures
1.	Introduction to the study of Mind in Homoeopathy	3	-
2.	Psychological organization and the interrelationship of Thought (Cognition), Feelings (Affect) and Behaviour (Conation); Conscious and Unconscious elements	2	1
3.	Physiological basis of behaviour - the place of conditioned and unconditioned reflex	3	1
4.	Understanding Behavior and Functioning and expressions in Repertory and Materia Medica	4	2
5.	Understanding Emotion, its different definitions and expressions in Repertory and Materia Medica	5	3
6.	Understanding Intellect: Attention, memory and its function and expression in Repertory and Materia Medica	4	3
7.	Understanding Intellect: Perception and expressions in Repertory and Materia Medica	3	2
8.	Understanding Intellect: Thinking, intelligence and its measurement and expressions in Repertory and Materia Medica	4	2
9.	Motivation and their types with role in our lives	2	2
10.	Learning and its place in adaptation	4	2
11.	Growth and development of Mind and its expressions from Infancy to old age	4	2
12.	Structure of Personality, the types, their assessment, relationship to Temperament and representation in Materia Medica	4	2
13.	Conflicts: their genesis and effects on the mind and body	3	1
14.	Applied Psychology: Clinical, Education, Sports, Business, Industrial	2	-
15.	Psychology and its importance in Homoeopathic practice	2	-
	Total	50	22

7. Assessment

7A -Number of papers and Mark Distribution

Sr. No.	Course Code	Papers	Theory	Practical	Viva Voce	Internal Assessment Practical	Grand Total
1	HomUG-OM-I	1	100	50	40	10	200

7B -Scheme of Assessment (formative and Summative)

Sr. No	Professional Course	1 st term (1-6 Months)	2 nd Term (7-12 Months)	3 rd Term (13-18 Months)
1	First Professional BHMS	First PA + 1 ST TT	2 nd PA+2 ND TT	3 rd PA UE

PA: Periodical Assessment; TT: Term Test; UE: University Examinations

7 C- Evaluation Methods for Periodical Assessment

Sr. No	Evaluation Dimensions
1	Practical/Clinical Performance
2	Viva Voce, MCQs, MEQ (Modified Essay Questions/Structured Questions)
3	Open Book Test (Problem Based)
4	Reflective writing
5	Class Presentations; Work Book Maintenance
6	Problem Based Assignment
7	Co-curricular Activities, (Social Work, Public Awareness, Surveillance/ Prophylaxis Activities, Sports or Other Activities which may be decided by the Department).
8	Small Project

Sr. No	Professional Course	1 st term (1-6 Months)		2 nd term (1-6 Months)		3 rd Term (13-18 Months)		
		1 st PA	1 st TT	2 nd PA	2 nd TT	3 rd PA		
1	First Professional BHMS	10 Marks Practical/Viva	50 Marks Practical/Viva	10 Marks Practical/Viva	50 Marks Practical/Viva	10 Marks Practical/Viva		

7D - Scheme of Assessment (Formative)

For Internal assessment, Only Practical/Viva marks will be considered. Theory marks will not be counted)

7E - Method of Calculation of Internal Assessment Marks for Final University Examination:

PA1 Practical/Viva(10 Marks)	PA2 Practical/Viva(10 Marks)	PA3 Practical/Viva(10 Marks)	Periodical Assessment Average PA1+PA2+PA3/3	TT1 Practical/Viva(50 Marks)	TT2 Practical/Viva(50 Marks)	Terminal Test Average TT1 + TT2/100*	Final Internal Assessment Marks D+G/2
A	B	C	D	E	F	G	

PA: Periodical Assessment; TT: Term Test; UE: University Examinations

7 F- Paper Layout**Summative Assessment:****Theory 100 marks****Section 1-50 marks-Organon**

MCQ	5 marks	10min
SAQ	25 marks	50 min
LAQ	20 marks	30 min

Section –II-50 marks- Psychology

MCQ	5 marks	10min
SAQ	25 marks	50 min
LAQ	20 marks	30 min

7 G- I- Distribution of Theory Exam- Organon

Sr. No	Paper	B	C	D		
				MCQ	SAQ	LAQ
	A	Term	Marks	(1 Mark)	(5 Marks)	(10 Marks)
	List of Topics					
				Type of Questions “Yes” can be asked. “No” should not be asked.		
1	Introductory Topics	I	Refer Next Table	Yes	Yes	No
2	Logic	I		No	Yes	No
3	§ 1 to 27 of Organon of medicine, § 105 to 145	II & III		No	Yes	Yes
4	The physician – purpose of existence, qualities, duties and knowledge	III		Yes	Yes	Yes
5	Vital force- dynamization - homoeopathic cure- natures law of cure & its Implications- drug proving	III		Yes	Yes	Yes

Theme*	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
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Theme*	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
A	Introductory Topics	I	10	Yes	Yes	No
B	Logic	I	05	No	Yes	No
C	§ 1 to 27 of Organon of medicine, § 105 to 145	II & III	25	No	Yes	Yes
D	The physician – purpose of existence, qualities, duties and knowledge	III	10	Yes	Yes	Yes

7 G –II- Theme Table Organon

A	Introduction to psychology	I	05	NO	Yes	No
B	Psychological organization of Mind –Structural and Functional	I	10	Yes	Yes	Yes
C	Understanding Emotion/thinking/ Behaviour	I	10	Yes	Yes	Yes
D	Motivation and their types withrole in our lives	I	05	Yes	Yes	Yes
E	Growth and development	II	10	Yes	Yes	Yes
F	Personality development and stress management	III	05	NO	yes	no
G	Applied Psychology	III	05	No	Yes	no

7 H- Question paper Blue print:

Section-I-Organon 50 marks

A Question Serial Number	B Type of Question	Question Paper Format (Refer table 4 F II Theme table for themes)
Q1	Multiple choice Questions (MCQ) 5 Questions 1 mark each All compulsory Must know part: 3 MCQ Desirable to know: 2 MCQ. Nice to know: Nil	Theme A Theme A Theme A Theme A Theme A

Q2	<p>Short answer Questions (SAQ)</p> <p>5 Questions</p> <p>5 Marks Each</p> <p>All compulsory</p> <p>Must know part:5 SAQ</p> <p>Desirable to know: Nil</p> <p>Nice to know: Nil</p>	<p>Theme A</p> <p>Theme B</p> <p>Theme C</p> <p>Theme C</p> <p>Theme C</p>
Q3	<p>Long answer Questions (LAQ)</p> <p>Two Questions</p> <p>10 marks each</p> <p>All compulsory</p> <p>All questions on must know</p> <p>No Questions on Nice to know and Desirable to know</p>	<p>Theme C</p> <p>Theme D</p>

Section-II- Psychology -50 marks

Question Number	Serial	Type of Question	Question Paper Format (Refer table 4 F II Theme table for themes)
Q1		<p>All compulsory</p> <p>Multiple choice Questions (MCQ) 5 Questions -1 mark each</p> <p>Must know – 3MCQ</p> <p>Desirable to know-1 MCQ</p> <p>Nice to know -1 MCQ</p>	Theme B +C +E+F+G

Q2	Short answer Questions (SAQ) 5 Questions 5 Marks Each All compulsory Must know part: 3 SAQ Desirable to know: 1 SAQ Nice to know: 1 SAQ	Theme A+B+C+D+E +F+G
Q3	Long answer Questions (LAQ) 2 Questions 10 marks each All compulsory Must know part: 2 LAQ	Theme B+C +E+F+G

7 I-Distribution of Practical Exam

Practical 100 marks – Practical Organon: 50 marks

Practical	25 marks
Viva voce	20 marks
Internal assessment	5 marks

Practical Psychology 50 Marks

Practical	25 marks
Viva voce	20 marks
Internal assessment	5 marks

8. References/Resources

ORGANON

Text book/s

1. Hahnemann S. Organon of medicine. 6ed (2016) New Delhi: Indian Book & Periodicals Publishers;.
2. Sarkar. B. K. Hahnemann's organon of medicine. (2014) Reprint ed. Birla Publications Pvt.Ltd;.
3. Roberts H. A. The principles and Art of cure by homoeopathy. student ed. (2014) New Delhi: B. Jain Publisher's (P) Ltd; 2006.
4. Kent J. T. Lecture's on homoeopathic philosophy. Reprint ed. New delhi: B Jain Publisher's (P) Ltd;
5. M. L. Dhawale. Principles & Practice of Homoeopathy. 5th ed. 2014.
6. Hughes Richard The Principles and Practice Of Homoeopathy, Reprint ed. New Delhi: B Jain Publisher's (P)Ltd.
7. Close Stuart: The genius of homoeopathy, Reprint ed. New Delhi: B Jain Publisher's (P) Ltd. 2006.
8. Allen J Henry: The Chronic Miasm With Repertory, Reprint ed. New Delhi: B Jain Publisher's (P) Ltd.
9. Banerjee P N.: Chronic diseases- Its cause and cure, Reprint ed. New Delhi: B Jain Publisher's (P) Ltd.

Reference books

1. Arya M.P (2018): A study of Hahnemann's Organon of medicine. 6th ed. New Delhi: B Jain Publisher's (P) Ltd.
2. Singh Mahindra: Pioneers Of Homoeopathy, B Jain Publisher's(P) Ltd. B Jain Publisher's(P) Ltd.
3. Vithoukas George (2002): Science of Homoeopathy. B Jain Publisher's(P) Ltd.

PSYCHOLOGY

References/Resources Standard Textbooks for Psychology

1. Shelley E Tylor. 10th edition (2018) Health psychology
2. Shashi Jain 4th edition (2014) Introduction to psychology, Kalyani.
3. Psychology textbook for class XI.7th edition (2013) National Council for Educational Research and training
4. Psychology textbook for class XII 7th edition (2013) National Council for Educational Research and training
5. Morgan Clifford Thomas 7th edition (2017) Introduction to Psychology, Tata McGraw-Hill
6. Alder (2009) Psychology and Sociology applied to medicine, Elsevier publishers.
7. Chavan (2013), Community Mental Health in India, Jaypee Brothers Medical
8. Munn (2010) Norman Normal Psychology, Boston, Houghton Mifflin
9. Baron Misra (2016) Psychology, Pearson
10. Susan (2011) Ayers Psychology for Medicine, Sage publication Ltd.
11. Diana Papilia (2001) Developmental psychology, Colombia: Editorial McGraw Hill
12. Atkinsons & Hilgard (2015) Introduction to Psychology, Cengage India Private Limited

9. Content Mapping (Competencies Table)

(Reference – F.No-3-90/2022/NCH/HEB/HEB Notice- Circular / 13099-13107;
Dated : 14 Feb 2023; Page no 41-127)

Human Anatomy

S.No	Description	Page Number
1.	Course Code and Name of Course	
2.	Preamble	
3.	Course Outcomes (CO)	
4.	Teaching Hours	
5.	Course Content	
6.	Teaching Learning Methods	
7.	Assessment	
8.	List of Recommended Books	
9.	Content Mapping (Competencies Table) (Reference – F.No-3-90/2022/NCH/HEB/HEB Notice- Circular / 13099-13107 ; Dated : 14 Feb 2023; Page no171-246)	

1. Course Name- Human Anatomy

Course Code: Hom UG-AN

2. PREAMBLE

Anatomy is a study of the structural organization and development of man from gross to cellular aspects along with exploring the interrelationship of different tissues, organs and systems.

An important aspect for the homoeopathic student to grasp is the essentially holistic approach emphasized by Hahnemann. From that perspective, study of anatomy is not a study of isolated organs, parts or tissues but that of a hierarchical system which is intimately interconnected and functions with a purpose of striking balance when in a state of adaptation. The subtle ways in which this balance is lost through a malfunctioning of the vital force needs to be appreciated. This can occur when anatomy is taught with applied anatomy in the background. This delivers an immediate clinical relevance in the mind of the student who is being simultaneously being exposed to clinical practice in the OPD and IPD.

While anatomy explores the structural organization of man, physiology gives us an understanding of the functional organization of the human being. These subjects, which are in reality the two sides of the coin, need to be taught interdependently. This enables the student to develop an insight into the essential interconnection of both in normal health and how both these alter when the disease process gets initiated in the system. This will also reduce the number of teaching hours due to avoiding duplication of information. While the clinical integration is taking place, homoeopathic connection is emphasized when the relevance of the Homoeopathic subjects being taught in the 1st year (Philosophy, Materia Medica, Pharmacy and Repertory), is simultaneously brought to the forefront and hence student centred teaching of the first BHMS year be achieved.

Advances in the understanding of tissues and cell structures which subsume functions of the organs and systems can afford a fertile area for exploring the action of drugs of Materia medica.

3.COURSE OUTCOMES

At the end of the course, I BHMS student must be able to-

1. Discuss the evolution of life and the developmental anatomy and genetics of human.
2. Explain the ethics of Anatomy, such as Anatomy act, Body donation & receiving procedure and its legal aspects, develop respect to the human cadaver.
3. Differentiate the structural organization of man from micro to macro and its evolution from embryo
4. Correlate the structural organization of man with functional organization and its applied aspect
5. Apply anatomy knowledge to achieve vertical integration with clinical subjects
6. Correlate structural organization of man with homeopathic philosophy and concept of man, Homoeopathic Materia Medica, Repertory and Pharmacy.
7. Correlate structural organization in interpreting different investigations

4.TEACHING HOURS

Sr No.	Subject	Theoretical Lecture	Practical / Tutorial / Seminar / Clinical Posting
01	Anatomy	325 hrs.	330hrs.

Sr. No	Paper-I	
	A List of Topics	B Term
1	General Anatomy	I
2	Head, Neck & Face	II
3	Central Nervous System	II
4	Upper Extremities	I
5	Embryology	I

HOURS (THEORY)

Sr. No	Paper-II		
	A List of Topics	B Term	C Teaching Hours
1	Thorax	II	25
2	Abdomen & Pelvis	III	55
3	Lower Extremities	III	50
4	Histology	I	20

TEACHING HOURS (PRACTICAL)

Sr. No	A	B	C
	List of Topics	Term	Teaching Hours
1	Head, Neck & Face	II	24
2	Central Nervous System	II	18
3	Upper Extremities	I	72
4	Thorax	II	48
5	Abdomen & Pelvis	III	66
6	Lower Extremities	III	72
7	Histology	I	18
8	Embryology	I	12

5.COURSE CONTENT (THEORY)

Syllabus Planning:

- Syllabus should start with revision of some of important topics of BIOLOGY- (To connect Biology to Medical Science) Origin of Earth-Environment - Origin of LIFE-Evolution of Human Lives.
- The complete course of Human Anatomy should be subdivided in number of modules-according to topics/region/system.
- Syllabus of other subjects of same year should plan out where the maximum integration (Vertical & Horizontal) of topics is possible.
- Theory/Practical/Tutorial/Clinical posting should be arranged in parallel.
- Integrated Syllabus planning of whole year should be briefed to clinician where clinical postings are going to be arranged for application of classroom knowledge to clinical knowledge.
- Each module should be planned according to the need of system-Co-relation with Homoeopathy & time dimension. (No. of hours)
- At the end of each module knowledge should be assessed by arranging joint seminars.(Application of classroom knowledge to practical understanding)

A. Theory:-

The curriculum includes the following from an introductory stage which would include

1. Anatomy Act
2. Body donation procedure and its legal aspects.
3. Develop respect to the human cadaver, empathy towards diseased and sense of gratification for the voluntary body donors and their families
4. Anatomy and Ethics

The rest of the contents have been detailed below:

1. General Anatomy: -

- 1.1 Modern concepts of cell and its components; cell division, types with their significance.
- 1.2 Tissues- Theory & demonstration of each basic Tissue (Structure, Location & Function)-Organ formation- Histology.
- 1.3 Genetics
- 1.4 Basics of General Anatomy-
 - i. Definition & Subdivision of Anatomy
 - ii. History of Anatomy
 - iii. Anatomical Terms, Position & Movements
 - iv. Superficial and Deep fasciae
 - v. Muscles
 - vi. Bones
 - vii. Joints
 - viii. Blood vessels
 - ix. Lymphatic system
 - x. Nerves

2. Developmental anatomy (Embryology): -

- 2.1 Male & Female reproductive organs (Superficial)
- 2.2 Spermatogenesis
- 2.3 Oogenesis
- 2.4 Fertilization
- 2.5 Formation of Germ Layers-Tissue formation & its classification
- 2.6 Notochord
- 2.7 Yolk Sac
- 2.8 Amniotic Sac
- 2.9 Developmental embryogenic disk
- 2.10 Placenta
- 2.11 Development of abdominal organ
- 2.12 Development of cardio vascular system
- 2.13 Development of nervous system

- 2.14 Development of respiratory system
- 2.15 Development of body cavities
- 2.16 Development of uro-genital system

3. Regional Anatomy

- (a) Osteology
- (b) Syndesmology (Joints)
- (c) Myology
- (d) Angiology
- (e) Neurology
- (f) Splanchnology (Viscera and Organ)
- (g) Histology
- (h) Surface anatomy
- (i) Applied anatomy
- (j) Radiographic anatomy
- (k) Correlation with homoeopathic subjects
- (l)

This will be taught under the following regions: -

- 3.1 Upper and Lower extremities
- 3.2 Head, Neck and Face
- 3.3 Brain- CNS
- 3.4 Thorax- Respiratory & Cardio vascular system
- 3.5 Abdomen- GIT, Metabolism, Excretory, RE system, Lymphatics & Reproductive

Practical – Lab work – Field – Clinical Hospital work

1. Dissection of whole Human Body, Demonstration of dissected parts.- Small group discussion
2. Identification of histological slides, related to tissue & Organs. - Microscope/OHP slides
3. Students shall maintain Practical-Dissection & Histology record and clinical journals

THEORY

Sr. No.	Topics	Hrs	Term
1	GENERAL ANATOMY		I
	3.5 Modern concepts of cell and its components; cell division, types with their significance	2	
	1.1 Tissues- Theory & demonstration of each basic Tissue (Structure, Location & Function)-Organ formation- Histology	2	
	3.6 Basics of General Anatomy- xi. Definition & Subdivision of Anatomy xii. History of Anatomy xiii. Anatomical Terms, Position & Movements xiv. Superficial and Deep fasciae xv. Muscles xvi. Bones xvii. Joints xviii. Blood vessels xix. Lymphatic system xx. Nerves	2 1 1 1 2 2 2 1 1 1	
	1. Anatomy – Physiology Seminar on cell	1	
	2. Anatomy – Physiology Seminar on Musculoskeletal System	1	
	Total Hours	20 Hrs	
2	EMBRYOLOGY & GENETICS		I
	1. Developmental anatomy (Embryology): -		
	1.1 Male & Female reproductive organs (Superficial)	2	
	1.2 Spermatogenesis	1	
	1.3 Oogenesis	1	
	1.4 Fertilization	1	
	1.5 Formation of Germ Layers- Tissue formation & its classification	3	

	1.6 Notochord	1	
	1.7 Yolk Sac	1	
	1.8 Amniotic Sac	1	
	1.9 Developmental embryogenic disk	1	
	1.10 placenta	2	
	1.11 Development of abdominal organs	1	
	1.12 Development of cardio vascular system	1	
	1.13 Development of Nervous System	2	
	1.14 Development of Respiratory system	2	
	1.15 Development of Body Cavities	2	
	1.16 Development of Genitaln system	2	
3	HISTOLOGY		1
	1. Modern concept of cell, tissue & systemic structure	1	
	2. Connective tissue	1	
	3. Histology lectures-General	3	
	4. Epithelial tissue	1	
	5. Nervous tissue	1	
	6. Histology lectures of specific organs	13	
	Total Hours	20 hrs	
4	UPPER LIMB		1
	1. Brachial plexus	2	
	2. Mammary Gland	2	
	3. Shoulder Joint	2	
	4. Median nerve and wrist joint	2	
	5. Muscles of scapular region	2	
	6. Muscles of shoulder region	2	
	7. Back and Intermuscular spaces around scapula	2	
	8. Arm- Post. Aspect	1	
	9. Radial nerve	2	
	10. Forearm – superficial extensor	2	
	11. Forearm- Deep extensor	2	
	12. Elbow joint	2	
	13. Radioulnar joint	1	
	14. Extensor retinaculum	1	
	15. Ulnar nerve	2	
	16. Hand- post. Aspect	2	
	17. Pectoral region	2	
	18. Arm- Ant. Aspect	2	

	19. Musculocutaneous nerve	1	
	20. Cubital fossa	1	
	21. Forearm- superficial flexors	2	
	22. Forearm- deep flexors	2	
	23. Median nerve	2	
	24. Flexor retinaculum	1	
	25. Brachial, Ulnar & Radial artery	3	
	26. Venous drainage of upper limb	2	
	27. Anatomy – Physiology Seminar on nerves of upper limb & nervous system	1	
	28. Integrated lecture with Surgery on Joints of Upper limb	1	
	29. Tutorial	1	
	Total Hours	50 hrs	

5	LOWER LIMB		III
	1. Introduction to lower limb	1	
	2. Hip Joint	2	
	3. Knee Joint	2	
	4. Arches of foot	2	
	5. Sacral Plexus	1	
	6. Gluteal region	2	
	7. Back of thigh	2	
	8. Sciatic nerve	2	
	9. Popliteal fossa	2	
	10. Lat. Compartment of leg	2	
	11. Post. Compartment of leg	2	
	12. Femoral, popliteal & tibial artery	3	
	13. Ankle joint	2	
	14. Peroneal nerve	2	
	15. Median compartment of thigh	2	
	16. Obturator nerve	1	
	17. Femoral Triangle	2	
	18. Front of thigh & Tensor Fascia Lata	3	
	19. Femoral vessels	2	
	20. Ant. Compartment of leg	2	
	21. Venous drainage of lower limb	2	
	22. Saphenous vein	2	
	23. Retinaculum (Lat., Ant. & medial)	2	
	24. Sole of foot	2	
	25. Femoral nerve	1	
	26. Anatomy – Physiology Seminar on nerves of lower limb & nervous system	1	
	27. Integrated lecture with Surgery on Joints of Lower limb	1	

	28. Tutorial	1	
	Total Hours	50 hrs	

6	THORAX		II
	1. Introduction to thorax	1	
	2. Development of Heart and lung	2	
	3. Pericardium and Heart	2	
	4. Coronary circulation	1	
	5. Lungs and pleura	3	
	6. Trachea	1	
	7. Oesophagus	1	
	8. Thoracic duct	1	
	9. Diaphragm	1	
	10. Aorta	2	
	11. Mediastinum	2	
	12. Azygous vein	1	
	13. Sup. Vena cava	1	
	14. Inf. Vena cava	1	
	17. Tutorial	1	
	18. Anatomy – Physiology Seminar on Cardiovascular System	1	
	19. Revision	1	
	Total Hours	25 hrs	
7	ABDOMEN		III
	1. Introduction to Abdomen	1	
	2. Development of organs Abdominal	2	
	3. Oesophagus	1	
	4. Stomach	2	
	5. Duodenum	1	
	6. Small intestine	2	
	7. Revision	2	
	8. Caecum	1	
	9. Appendix	1	
	10. Large intestine	2	
	11. Rectum	2	
	12. Anal canal	1	

	13. Liver	2	
	14. Abdominal aorta	1	
	15. Female genital system	4	
	16. Post. Abdominal wall	2	
	17. Male reproductive system	2	
	18. Ant. Abdominal wall	2	
	19. Pancreas	2	
	20. Gall Bladder	1	
	21. Spleen	2	
	22. Kidney	2	
	23. Supra renal gland	1	
	24. Ureter	1	
	25. Urinary bladder	2	
	26. Pelvic diaphragm	1	
	27. Portal venous system	1	
	28. Peritoneum	2	
	29. Extrahepatic biliary apparatus	2	
	30. Walls of pelvis	1	
	31. Revision	6	
	Total Hours	55 hrs	
8	HNF		II
	1. Introduction to HNF	1	
	2. Ear	1	
	3. Tongue	1	
	4. Face- muscles	2	
	5. Contents of Orbit	1	
	6. Lachrymal apparatus	1	
	7. Extraocular muscles	2	
	8. Ant. Triangle of neck	2	
	9. Post. Triangle of neck	1	
	10. Common & Internal carotid artery	1	
	11. External carotid artery	1	
	12. Sternocleidomastoid muscle	1	
	13. Fascias of neck	1	
	14. Suboccipital triangle of neck	1	
	15. Contents of vertebral canal	1	
	16. Cranial cavity	2	
	17. Supra & Infra hyoid muscle	1	
	18. Vertebral artery	1	
	19. Scalp	1	
	20. Eyeball	2	
	21. Oral cavity	1	
	22. Pharynx	2	
	23. Larynx	2	
	24. Eustachian tube	1	
	25. Parotid gland	1	

	26. Submandibular gland	1	
	27. Thyroid gland	1	
	28. Muscles of mastication	1	
	29. Jugular vein	1	
	30. Lateral wall of Nose	1	
	31. Revision	3	
	Total Hours	40 hrs	
9	CNS		II
	1. Introduction to Brain	1	
	2. IIIrd Ventricle and Ventricle IVth	2	
	3. Pons	2	
	4. Medulla	2	
	5. Spinal cord	1	
	6. Lateral Ventricle	1	
	7. Cerebrum Sulci & gyri	2	
	8. Areas of cerebrum	2	
	9. Corpus callosum	1	
	10. White matter of cerebrum	1	
	11. Internal capsule	1	
	12. Basal ganglia	1	
	13. Midbrain	1	
	14. Blood supply of brain	1	
	15. Meninges	1	
	16. CSF	1	
	17. Thalamus	1	
	18. Cerebellum	2	
	19. Cranial nerves including special senses.	12	
	20. Revision	4	
	Total Hours	40 hrs	

Total – 325 hrs

PRACTICAL

Sr. No.	Topics	Hrs
1.	EMBRYOLOGY & GENETICS	
	Stages of Development	
	Spermatogenesis, Oogenesis and Germ layers.	
	Development of Embryogenic Disc, Placenta	
	Embryology of organs	
	Total Hours	12 hrs
2	HISTOLOGY	
	Histology lectures of specific organs	18
	Total Hours	18 hrs
3	UPPER LIMB	
	Practicals	
	Clavicle	6
	Scapula	6
	Humerus	6
	Radius	6
	Ulna	6
	Hand	6
	Surface Marking of Upper limb	6
	Dissection	
	Axilla & Arm	6
	Forearm & Hand	6
	Muscles of Back	6
	Muscles of Pectoral Region	6
	Radiology	
	Joints of Upper limb	6
		72 hrs
4	LOWER LIMB	
	Practicals	
	Hip Bone	6
	Femur	6
	Tibia	6
	Fibula	6
	Foot	6
	Surface Marking of Lower limb	6
	Dissection	
	Femoral Region	6
	Gluteal Region	6
	Thigh	6

	Leg	6
	Foot	6
	Radiology	
	Joints of Lower limb	6
		72 hrs
5	THORAX	
	Practicals	
	Ribs – Typical & Atypical	6
	Thoracic Vertebrae	6
	Sternum	6
	Dissection	
	Heart	6
	Mediastinum	6
	Lungs	6
	Surface Marking of thorax	6
	Radiology	6
	Total Hours	48 hrs
6	ABDOMEN	
	Practical	
	Lumbar Vertebrae	6
	Dissection	
	Abdominal cavity, Abdominal vessels	6
	Stomach, Pancreas, Spleen	6
	Relation of viscera	6
	Liver, Gall bladder	6
	Kidney, Ureter, Urinary bladder	6
	Peritoneum & Intestine	6
	Uterus, fallopian tubes, Ovaries	6
	Ant. Abdominal wall & Post. Abdominal wall	6
	Surface Marking of Abdomen	6
	Radiology	6
		66 hrs
7	Head, Neck and Face	
	Practical	
	Skull & Mandible	12
	Dissection	
	Face & Neck	6
	Radiology	6
		24 hrs
8	CNS	
	Cerebrum	6
	Cerebellum	6
	Midbrain, Pons & Medulla	6
		18 Hrs

Total – 330 Hrs

6. TEACHING LEARNING METHODS

General Instructions

- (a) Instructions in anatomy should be so planned as to present a general working knowledge of the structure of the human body both at micro and macro level and should correlate with function. Topics-syllabus should be planned out in parallel with other subjects for better understanding & to achieve integration.
- (b) The amount of detail which a student is required to memorise should be reduced to the minimum but should connect to syllabus of other subjects and applied anatomy
- (c) Major emphasis should be laid on functional anatomy of the living subject rather than on the static structures of the cadaver and on general anatomical positions and broad relations of the viscera, muscles, blood vessels, nerves and lymphatics and study of the cadaver is the only means to achieve this
- (d) Students should know the basic applied anatomy & should not be burdened with minute anatomical details which have no clinical significance.
- (e) Only such details which have professional or general educational value for the Homoeopathic medical students need to be focused.
- (f) Normal radiological anatomy may also form part of practical or clinical training and the structure of the body should be presented linking functional aspects.
- (g) A good part of theoretical lectures on anatomy can be transferred to tutorial classes with the demonstrations / Prosection / Dissection.
- (h) Lectures or demonstration on the clinical and applied anatomy should be arranged in the later part of the course and it should aim at demonstrating the anatomical basis of physical signs and the value of anatomical knowledge to the students. For better exposure of applied & Clinical aspects of all the subjects, student should be allotted clinical posting at various OPDs/Clinical Pathology lab/Radiology/Dispensing/ Community OPDs/Causality etc
- (i) Seminars and group discussion to be arranged periodically with view of presenting these subjects in an integrated manner.
- (j) More stress on demonstrations and tutorials should be given. Emphasis should be laid on the general anatomical positions and broad relations of the viscera, muscles, blood vessels, nerves and lymphatics.

- (k) There should be joint seminars with the departments of Physiology and Bio-Chemistry, Repertory, HMM, Philosophy and Pharmacy which should be organized once a month considering that syllabus of all the subjects is arranged in an integrated form.-Teaching tool can be a CASE (Clinical Posting) which students have attended.
- (l) There should be a close correlation in the teaching of gross Anatomy, Histology, Embryology and Genetics and the teaching of Anatomy, Physiology including Bio Chemistry along with Homoeopathic subjects shall be integrated.

Though dissection of the entire body is essential for the preparation of the student for his clinical studies, the burden of dissection can be reduced and much saving of time can be effected with considerable reduction of the amount of topographical details while following the above points-

The purpose of dissection is to give the student an understanding of the body-Structure from Macro to Micro correlate to its function- Functional anatomy to integrate with Physiology and the dissection should be designed to achieve this goal.

- (v) Dissection should be preceded by a course of lectures on the general structure of the organ or the system under discussion and then its function. In this way anatomical and physiological knowledge can be presented to students in an integrated form and the instruction of the whole course of anatomy and physiology made interesting, lively practical or clinical. Syllabus of all the subjects of First BHMS should be structured to run parallelly, horizontally & vertically as far as possible to achieve maximum integration.

Students should be able to identify anatomical specimens and structures displayed in the dissection. Teaching and Demonstration methods should be supported with latest software/Practical/Charts/OHP/slides/Working or 3D Diagrams, Audio-Visual/ Multimedia presentation/Simulation to train clinical application

The Teaching Learning activities in Anatomy requires change in structure & process in order to be more skill based & providing hands on experience. The Teaching Learning methods with respect to Anatomy may be covered in the following manner –

- a) **Class Room Lectures** – Oral Presentation, Board Work, Power point Presentation.
- b) **Tutorials** on the topics covered.
- c) **Assignments** – For Slow Learners

d) **Practical Class** – Demonstration, Dissection, Surface Marking, Histology, Radiology

e) **Student Activities** – Working out the Assignments, Projects, PowerPoint presentations as assigned

f) **Case based Learning & Problem Based Learning (CBL & PBL)**- for students to understand the application of knowledge of Anatomy with Clinical subjects.

g) **DOAP (Demonstration – Observation – Assistance – Performance)**- For Clinical Anatomy

7.ASSESSMENT

Assessment Summary Number of papers and Mark Distribution

Sr. No.	Course Code	Papers	Theory	Practical	Viva Voce	Internal Assessment -Practical	Grand Total
1	HomUG-AN	2	200	100	80	20	400

Scheme of Assessment (formative and Summative)

Sl. No	Professional Course	1 st term (1-6 Months)	2 nd Term (7-12 Months)	3 rd Term (13-18 Months)	
1.	First Professional BHMS	1 st PA + 1 ST TT	2 nd PA+2 ND TT	3 rd PA	UE
		1 st PA – 4 th month 1 st TT – 6 th month	2 nd PA – 9 th month 2 nd TT – 12 th month	3 rd PA - 14 th month	17 th month

PA: Periodical Assessment; TT: Term Test; UE: University Examinations

Evaluation Methods for Assessment

Sl. No	Evaluation Criteria
1.	Theory, Practical, Viva voce Performance
2.	Theory: MCQs, SAQs and LAQs (MEQ - Modified Essay Questions/Structured Questions)

Paper Layout

Paper-1 (100 marks)

General Anatomy, Head, face and neck, Central nervous System, upper extremities and Embryology

1	MCQ	10 marks
2	SAQ	50 marks
3	LAQ	40 marks

Paper-2 (100 marks)

Thorax, Abdomen, Pelvis, Lower extremities and Histology (micro anatomy).

1	MCQ	10 marks
2	SAQ	50 marks
3	LAQ	40 marks

I- Distribution of Theory exam

Sr. No	Paper-I	B	C	D		
				Type of Question		
	A	Term	Marks	MCQ (1 Mark)	SAQ(5 Marks)	LA Q (10 Mar ks)
	List of Topics					
1	General Anatomy	I	Refer Next Table	Yes	Yes	No
2	Head, Neck & Face	II		Yes	Yes	Yes
3	Central Nervous System	II		Yes	Yes	Yes
4	Upper Extremities	I		Yes	Yes	Yes
5	Embryology	I		Yes	Yes	No

Paper-II						
Sl. No	A	B	C	D		
				Type of Questions and marks allotted “Yes” can be asked. “No” should not be asked.		
	List of Topics	Ter m	Marks	MCQ (1 Mark)	SAQ (5 Marks)	LAQ (10 Marks)
1.	Thorax	II	ReferNext Table	Yes	Yes	Yes
2.	Abdomen, Pelvis & Perineum	III		Yes	Yes	Yes
3.	Lower Extremities	III		Yes	Yes	Yes
4.	Histology	I		Yes	Yes	No

II- Theme table

Paper I

Theme*	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
A	General Anatomy	I	10	Yes	Yes	No
B	Upper Extremities	I	25	Yes	Yes	Yes
C	Embryology	I	15	Yes	Yes	No
D	Head, neck and Face	II	30	Yes	Yes	Yes
E	Central nervous System	II	20	Yes	Yes	Yes

Paper-II

Theme*	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
A	Lower Extremities	III	30	Yes	Yes	Yes
B	Thorax	II	30	Yes	Yes	Yes
C	Abdomen and Pelvis	III	30	Yes	Yes	Yes
D	Histology	I	10	Yes	Yes	No

Question Paper Blue print

Paper I

A Question Serial Number	B Type of Question	Question Paper Format (Refer table 4 F II Theme table for themes)
Q1	Multiple choice Questions(MCQ) 10 Questions 1 mark each All compulsory Must know part: 7 MCQ Desirable to know: 2 MCQ. Nice to know: 1 MCQ	<ol style="list-style-type: none"> 1. Theme A 2. Theme A 3. Theme B 4. Theme B 5. Theme C 6. Theme C 7. Theme D 8. Theme D 9. Theme E 10. Theme E
Q2	Short answer Questions(SAQ) Ten Questions 5 Marks Each All compulsory Must know part: 7 SAQ Desirable to know: 2 SAQ Nice to know: 1 SAQ	<ol style="list-style-type: none"> 1. Theme A 2. Theme B 3. Theme B 4. Theme B 5. Theme C 6. Theme C 7. Theme D 8. Theme D 9. Theme E 10. Theme E
Q3	Long answer Questions(LAQ) Four Questions 10 marks each All compulsory All questions on must know No Questions on Nice to know and Desirable to know	<ol style="list-style-type: none"> 1. Theme B 2. Theme D 3. Theme D 4. Theme E

Paper II

A Question Serial Number	B Type of Question	Question Paper Format (Refer table II Theme table for themes)
Q1	Multiple choice Questions(MCQ) 10 Questions 1 mark each All compulsory Must know part:7 MCQ Desirable to know: 2 MCQ. Nice to know: 1 MCQ	<ol style="list-style-type: none"> 1. Theme A 2. Theme A 3. Theme A 4. Theme B 5. Theme B 6. Theme C 7. Theme C 8. Theme C 9. Theme D 10. Theme D
Q2	Short answer Questions(SAQ) ten Questions 5 Marks Each All compulsory Must know part: 7 SAQ Desirable to know: 2 SAQ Nice to know: 1 SAQ	<ol style="list-style-type: none"> 1. Theme A 2. Theme A 3. Theme A 4. Theme B 5. Theme B 6. Theme C 7. Theme C 8. Theme C 9. Theme D 10. Theme D
Q3	Long answer Questions (LAQ) four Questions 10 marks each All compulsory All questions on must know No Questions on Nice to know and Desirable to know	<ol style="list-style-type: none"> 1. Theme A 2. Theme B 3. Theme C 4. Theme C

II. **Scheme of Practical and Viva voce Examination and distribution of marks**
(Practical 100 marks – Viva voce 80 marks + Internal assessment 20 marks: Total 200 marks)

Scheme of Practical Examination	
<p>1. Spotters: 4 (5 marks each)</p> <p>A. Histology Slide – 2 (5 marks each)</p> <p style="margin-left: 20px;">a) Identification – 1 mark</p> <p style="margin-left: 20px;">b) Draw and label – 2 marks</p> <p style="margin-left: 20px;">c) Two identification features – 2 marks</p> <p>B. Radiology – 2 X-RAYS (5 marks each)</p>	20 marks
<p style="margin-left: 40px;">a) Identification of X-Ray and its view – 1 mark</p> <p style="margin-left: 40px;">b) Identification of features – 4 marks</p>	
<p>2. Osteology - Bones of Upper Extremity, Lower Extremity, Skull, Ribs and Vertebrae.</p>	20 marks
<p>3.Viscera - Organs from Thorax, Abdomen and CNS.</p>	20 marks

4. Knowledge of dissected parts - Dissected Specimens of Upper and Lower Extremities.	20 marks
2. Surface marking	10 marks
3. Journal – Practical record of Anatomy including Histology and dissection card.	10 marks
Total	100 Marks

Viva voce Max. Marks - 80 + Internal assessment marks – 20	
Total marks	100 marks

9B - Scheme of Assessment (Formative)

Sr. No	Professional Course	1 st term (1-6 Months)		2 nd Term (7-12 Months)		3 rd Term (13-18 Months)	
		1 st PA	1 ST TT	2 nd PA	2 ND TT	3 rd PA	UE
1	First Professional BHMS	20 Marks Practical/Viva	100 Marks Practical/ Viva	20 Marks Practical/Viva	100 Marks Practical/ Viva	20 Marks Practical/Viva	

For Internal assessment, Only Practical/Viva marks will be considered. Theory marks will not be counted)Method of Calculation of Internal Assessment Marks for Final University Examination:

PA1 Practical/ Viva(20 Marks)	PA2 Practical/ Viva(20 Marks)	PA3 Practical/ Viva(20 Marks)	Periodical Assessment Average PA1+PA2+P A3/3	T T 1 Practic al/ Viva (100 Marks)	TT2 Practic al/ Viva (100 Marks)	Termi nal Test Avera ge TT1+ TT2/ 200*20	Final Internal Assessm entMarks
A	B	C	D	E	F	G	D+G/2

PA- Periodical Assessment, TT- Terminal Test, UE- University Examination

8. List of recommended books –

Standard Books

- Garg K, B.D. Chaurasia's Human Anatomy Regional & Applied, Dissection & Clinical. Upper limb & Thorax.
- Garg K, B.D. Chaurasia's Human Anatomy Regional & Applied, Dissection & Clinical. Lower limb & Abdomen
- Garg K, B.D. Chaurasia's Human Anatomy Regional & Applied, Dissection & Clinical. Head, Neck & Brain.
- Singh V. General Anatomy
- Singh V. Anatomy of Head, Neck & Brain
- Singh V. Anatomy of Upper limb & Thorax
- Singh V. Anatomy of Abdomen & Lower limb
- Singh V. Anatomy of Clinical embryology
- Garg K, Indira Bahl, Mohini Kaul. Textbook of Histology
- Halim A. Surface and Radiological Anatomy
- Khurana A, Khurana I, Garg K B.D. Chaurasia's Dream Human Embryology
- Loukas M, Benninger B, Tubbs R S. Gray's Clinical Photographic Dissector of Human Body
- Romanes G J. Cunningham's Manual of Practical Anatomy. Upper & Lower limb
- Romanes G J. Cunningham's Manual of Practical Anatomy. Abdomen & Pelvis
- Romanes G J. Cunningham's Manual of Practical Anatomy. Head & Neck

Reference books

- Eroschenko VP. *Di'fiore's Atlas of Histology with functional correlation*
 - Gunasegaran JP. *Text book of Histology & Practical Guide*
 - Hansen JT. *Netter's Atlas of Human Anatomy*. South Asian Ed
 - Mescher AL. *Junquera's Basic Histology Text & Atlas*
 - Mortan DA, Peterson KD, Albretine K. H. *Gray's Dissection Guide for Human Anatomy*
 - RomanesGJ. *Cunningham's Textbook of Anatomy*
 - Ross & Wilson. *Anatomy and Physiology in Health and Illness*
 - Singh, Inderbir. *Human Embryology*
 - Sinnathamby CS. *Snell's Clinical Anatomy for Medical Students*.
-
- Standring Susan. *Gray's Anatomy The Anatomical Basis of Clinical Practice*
 - Tortora GJ & Derrickson B. *Anatomy & Physiology*.

9. LIST OF CONTRIBUTORS

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9. Content Mapping (Competencies Table)

(Reference – F.No-3-90/2022/NCH/HEB/HEB Notice- Circular / 13099-13107 ; Dated : 14 Feb 2023; Page no171-246)

Human physiology & Biochemistry

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1.Course Name - Human physiology & Biochemistry

Course code: Hom UG - PB

2. PREAMBLE

Physiology studies the functional organization of man at several levels like atom, chemical, cells, tissues, organ systems and the whole body to understand fundamental mechanisms that operate in a living organism. The underlying goal is to explain the operations in a living organism.

Besides satisfying a natural curiosity about how humans function, the study of physiology is of central importance in medicine and related health sciences, as it underpins advances in our understanding of disease and our ability to treat it more effectively. It is also important from psychological and philosophical viewpoints, helping us to understand the different systems. Homoeopathic Philosophy postulates the force animating every cell as the Vital Force which helps in homoeostasis. When it is deranged due to web of causes, disease develops.

Homoeopath must understand Man in a holistic way which would help him to deliver the therapeutic action for the purpose of bringing about a cure. Understanding the structural organisation i.e., Anatomy along with psychological organisation go hand in hand. Their interplay maintains health and delivers optimum function for healthy living and progressing towards higher purpose as per Hahnemannian guidelines. Hence physiology needs to be integrated horizontally with Anatomy, Materia Medica, Organon of Medicine, Psychology & Pharmacy as well as vertically with Pathology, Surgery, Obstetrics & Gynaecology, Community Medicine, Practice of Medicine and Repertory for better grasp of health, disease and process of cure.

Advances in biochemical processes have been occurring at an astonishing pace. The action of homoeopathic medicines does occur at sub-cellular levels. Hence an in-depth understanding and correlation of the processes in health and disease can open up a whole new way of understanding Homoeopathic drugs and their far-reaching effects.

3. Course Outcomes (COs):

At the end of the course the student will be able to:

- a. Discuss the Homoeopathic concept of health in relation to integrated body structure and functions.
- b. Explain the normal functioning of the human body at all levels of organization.
- c. Relate the concept of homoeostasis with relevant ideas in Anatomy, Materia medica and Organon of Medicine at BHMS I level .
- d. Elucidate the physiological aspects of normal growth and development with focus on evolution.
- e. Correlate micro functions at cellular level with macro functions at organ-system level.
- f. Use necessary communication skills required for history-taking of the patient & relating various clinical findings in the patient.
- g. Perform experiments in haematology, clinical physiology & biochemistry as required for the study of physiological phenomena and for assessment of normal function.
- h. Identify the normal values of haematology, clinical physiology & biochemistry.
- i. Perform clinical – physiological examination under supervision.
- j. Correlate knowledge of Organon & Materia Medica with Physiology.
- k. Explain the integrated responses of the organ systems of the body to physiological and pathological stresses

4. Teaching Hours

Sr No.	Subject	Theoretical Lecture	Practical / Tutorial / Seminar / Clinical Posting
01	PHYSIOLOGY & BIOCHEMISTRY	325hrs	330 hrs.

Theory Wise Teaching Hours Distribution – 325 Hours

Sr. No	Paper-I	
	List of System	Teaching Hours
1	General Physiology	20
2	Bio Physics Science	15
3	Skin & The Integumentary System	15
4	Body fluids & Immune mechanism	35
5	Nerve Muscle physiology	15
6	Cardiovascular system	20
7	Respiratory and Environmental Physiology	25
8	Renal Physiology	20
	Total	165
Sr. No	Paper-II	
	List of System	Teaching Hours
1	Central Nervous System	35
2	Endocrinology	30
3	Reproduction	15
4	Special Senses	20
5	Digestion and Nutrition	35
6	Biochemistry	25
	Total	160

Practical / Clinical Physiology / OPD Wise Teaching Hours Distribution – 330 Hours

Physiology – SEMESTER 1 : Practical – lab work			
No	Practical	Demonstration/ Performance	Number of Teaching Hours
HAEMATOLOGY			
1	Study of the Compound Microscope	Performance	05
2.	Collection of Blood Samples	Performance	05
3	Estimation of Haemoglobin Concentration	Performance	05
4	Determination of Haematocrit	Demonstration	05
5	Hemocytometry	Performance	05
6	Total RBC Count	Performance	10
7	Determination of RBC Indices	Demonstration	05
8	Total Leucocytes Count (TLC)	Performance	10
9	Preparation And Examination Of Blood Smear	Performance	10
10	Differential Leucocyte Count (DLC)	Performance	10
11	Absolute Eosinophil Count	Demonstration	05
12	Determination of Erythrocyte Sedimentation Rate	Demonstration	05
13	Determination of Blood Groups	Performance	05
14	Determination of Bleeding Time and Coagulation Time	Performance	05
BIOCHEMISTRY			
1	Demonstration of Uses Of Instruments Or Equipment	Demonstration	05
2	Qualitative Analysis of Carbohydrates, Proteins And Lipids	Performance	10
3	Normal Characteristics of Urine	Performance	04
4	Abnormal Constituents of Urine	Performance	10
5	Quantitative Estimation of Glucose, Total Proteins, Uric Acid in Blood	Performance	05
6	Liver Function Tests	Demonstration	04
7	Kidney Function Tests	Demonstration	04
8	Lipid Profile	Demonstration	04
9	Interpretation and Discussion of	Demonstration	04

	<u>Results of Biochemical Tests</u>		
	Total		140

CLINICAL PHYSIOLOGY			
1	Case Taking & Approach to pt	Performance	05
2	General Concept Of Examination	Performance	10
3	Examination of muscles, joints,	Performance	10
4	Cardio-Vascular System – Blood Pressure Recording, Radial Pulse, ECG, Clinical Examination	Performance	15
5	Nervous System- Clinical Examination	Performance	15
6	Respiratory System- Clinical Examination, Spirometry, Stethography	Performance	15
7	Special Senses- Clinical Examination	Performance	15
8	Reproductive System- Diagnosis of Pregnancy	Performance	05
9	Gastrointestinal System- Clinical Examination	Performance	10
	Total		100
OPD – APPLIED PHYSIOLOGY			
1	OPD (Applied Physiology)	Demonstration & Performance	90
	TOTAL		90

Semester Wise Distribution of Theory, Practical, Clinical Physiology & OPDs

Sr No./ Duration	Wk	Physiology
SEMESTER - 1		

Module 1. Organizational	16 Wks	<ul style="list-style-type: none"> • General physiology • Bio Physics Science • Skin & The integumentary System <p>Clinical Physiology :</p> <ul style="list-style-type: none"> • Case Taking & Approach to Patient • General concept of examination.
Module Principals		<ul style="list-style-type: none"> • Body Fluid & Immune Mechanism • Nerve Muscles Physiology <p>Practical :</p> <ul style="list-style-type: none"> • Study of the Compound Microscope • Collection of Blood Samples • Estimation of Haemoglobin Concentration • Determination of Haematocrit • Haemocytometry • Total RBC Count • Determination of RBC Indices • Total Leucocytes Count (TLC) • Preparation And Examination Of Blood Smear • Differential Leucocyte Count (DLC) • Absolute Eosinophil Count • Determination of Erythrocyte Sedimentation Rate • Determination of Blood Groups • Determination of Bleeding Time and Coagulation Time <p>Clinical Physiology :</p> <ul style="list-style-type: none"> • Examination of muscles, joints,
	4 th Month – 5 days PA 6 th Month – 10 days TT – including Viva Voce	
SEMESTER - 2		
Module 3. Vital Maintenance of the human body	16 Wks	<ul style="list-style-type: none"> • Cardiovascular System • Respiratory & Environmental Physiology <p>Clinical Physiology :-</p> <ul style="list-style-type: none"> • Cardio-Vascular System – Blood Pressure Recording, Radial Pulse, ECG, Clinical Examination • Respiratory System- Clinical Examination, Spirometry, Stethography • OPD (Applied Physiology)
Module 4. Control system of		<ul style="list-style-type: none"> • Central Nervous System • Endocrinology

the human body with continuity	<p>Clinical Physiology :</p> <ul style="list-style-type: none"> • Nervous System- Clinical Examination • Special Senses- Clinical Examination • Reproductive System – Diagnosis of pregnancy • OPD (Applied Physiology) 	
<p>9th Month – 5 days PA</p> <p>12th Month – 10 days TT – including Viva Voce</p>		
SEMESTER - 3		
<p>Module 5.</p> <p>Energy maintenance of human body</p>	<p>16 wks</p>	<ul style="list-style-type: none"> • Reproductive System • Special Senses • Digestion System & Nutrition • Renal Physiology • Bio-Chemistry <p>Practical : -</p> <ul style="list-style-type: none"> • Demonstration of Uses Of Instruments Or Equipment • Qualitative Analysis of Carbohydrates, Proteins And Lipids • Normal Characteristics of Urine • Abnormal Constituents of Urine • Quantitative Estimation of Glucose, Total Proteins, Uric Acid in Blood • Liver Function Tests • Kidney Function Tests • Lipid Profile • Interpretation and Discussion of Results of Biochemical Tests <p>Clinical Physiology :-</p> <ul style="list-style-type: none"> • Gastrointestinal System- Clinical Examination • OPD (Applied Physiology)
<p>14th Month – 5 days PA</p> <p>18th Month – 12 days TT – including Viva Voce – University exam</p>		

5. COURSE CONTENT

- a. The purpose of a course in physiology is to enable the students to learn the functions, processes and inter-relationship of the different organs and systems of the normal disturbance in disease so that the student is familiar with normal standards of reference while diagnosing deviations from the normal, and while treating the patients.
- b. There can be no symptoms of disease without vital force animating the human organism and it is primarily the vital force which is maintaining state of health
- c. Physiology shall be taught from the stand point of describing physical processes underlying them in health;
- d. Applied aspect of every system including the organs is to be stressed upon while teaching the subject.
- e. Correlation with Organon and philosophy especially the concept of health and its derangement the interplay of different cell, tissue organ and system, their representation in repertory and integration in HMM
- f. There should be close co-operation between the various departments while teaching the different systems;
- g. There should be joint courses between the two departments of anatomy and physiology so that there is maximum co-ordination in the teaching of these subjects;
- h. Seminars should be arranged periodically and lecturers of anatomy, physiology and bio-chemistry should bring home the point to the students that the integrated approach is more meaningful.

A. THEORY:-

1. GENERAL PHYSIOLOGY

Introduction to cellular physiology

Transport through cell membrane and resting
membrane potential Body fluids compartments
Homeostasis

2. BIO-PHYSICAL SCIENCES

Filtration Ultra-filtration Osmosis

Diffusion Adsorption Hydrotropy, Colloid

Donnan Equilibrium Tracer elements Dialysis

Absorption Assimilation Surface tension

3. SKIN & THE INTEGUMENTARY SYSTEM

Skin & Integumentary System

Layers of Skin Function of Skin Sweat

Body temperature and its regulation

4. BODY FLUID & IMMUNE MECHANISM

Blood

Plasma Proteins

Red Blood Cells

Erythropoiesis

Haemoglobin and Iron Metabolism

Erythrocyte Sedimentation Rate

Packed Cell Volume and Blood Indices

Haemolysis and Fragility of Red Blood Cells

White Blood Cell

Immunity Platelets

Haemostasis

Coagulation of Blood

Blood groups

Blood Transfusion

Blood volume

Reticulo-endothelial System and Tissue Macrophage Lymphatic System and Lymph

Tissue Fluid and Oedema

5. NERVE MUSCLE PHYSIOLOGY

Physiological properties of nerve fibres

Nerve fibre- types, classification, function, Degeneration and regeneration of peripheral nerves Neuro-Muscular junction

Physiology of Skeletal muscle

Physiology of Cardiac muscle

Physiology of Smooth muscle

EMG

6. CARDIO-VASCULAR SYSTEM

Introduction to cardiovascular system Properties of cardiac muscle

Cardiac cycle

General principles of circulation Heart sounds

Regulation of cardiovascular system

Normal and abnormal Electrocardiogram (ECG)

Cardiac output

Heart rate

Arterial blood pressure

Radial Pulse

Regional circulation- Cerebral, Splanchnic, Capillary, Cutaneous & skeletal muscle circulation. Cardiovascular adjustments during exercise

7. RESPIRATORY SYSTEM AND ENVIRONMENTAL PHYSIOLOGY

Physiological anatomy of respiratory tract

Mechanism of respiration: Ventilation, diffusion of gases

Transport of respiratory gases Regulation of respiration Pulmonary Function Test

High altitude and space physiology Deep sea physiology

Artificial respiration

Effects of exercise on respiration

8. CENTRAL NERVOUS SYSTEM

Introduction to nervous system Neuron

Neuroglia

Receptors

Synapse

Neurotransmitters

Reflex

Spinal cord

Somato-sensory system and somato-motor system Physiology of pain

Brain stem, Vestibular apparatus

Cerebral cortex

Thalamus

Hypothalamus

Internal capsule

Basal ganglia

Limbic system

Cerebellum – Posture and equilibrium

Reticular formation

Proprioceptors

Higher intellectual function Electroencephalogram (EEG)

Physiology of sleep

Cerebro-spinal fluid (CSF) Autonomic Nervous System (ANS)

9. ENDOCRINOLOGY

Introduction of endocrinology and importance of PNEI axis Hormones and hypothalamo- hypophyseal axis

Pituitary gland

Thyroid gland

Parathyroid

Endocrine functions of pancreas Adrenal cortex

Adrenal medulla

Endocrine functions of other organs

10. REPRODUCTIVE SYSTEM

Male reproductive system-testis and its hormones; seminal vesicles, prostate gland, semen. Introduction to female reproductive system

Menstrual cycle

Ovulation

Menopause

Infertility

Pregnancy and parturition Placenta

Pregnancy tests

Mammary glands and lactation Fertility

Foetal circulation

11. SPECIAL SENSES

Eye: Photochemistry of vision, Visual pathway, Pupillary reflexes, Colour vision, Errors of refraction Ear: Auditory pathway, Mechanism of hearing, Auditory defects

Sensation of taste: Taste receptors, Taste pathways

Sensation of smell: Olfactory receptors, olfactory, pathways Sensation of touch

12. DIGESTIVE SYSTEM & NUTRITION

Introduction to digestive system

Composition and functions of digestive juices

Physiological anatomy of Stomach, Pancreas, Liver and Gall bladder, Small intestine, Large- intestine

Movements of gastrointestinal tract

Gastrointestinal hormones

Digestion and absorption of carbohydrates, proteins and lipids

13. RENAL PHYSIOLOGY

Physiological anatomy of kidneys and urinary tract

Fluid & electrolyte with acid base balance need to be include

Renal circulation

Urine formation: Renal clearance, glomerular filtration, tubular reabsorption, selective secretion, concentration of urine, acidification of urine

Renal functions tests

Micturition

14. BIO-CHEMISTRY THEORY

Carbohydrates: (Chemistry, Metabolism, Glycolysis, TCA, HMP, Glycogen synthesis and degradation, Blood glucose regulation)

Lipids: (Chemistry, Metabolism, Intestinal uptake, Fat transport, Utilization of stored fat, Activation of fatty acids, Beta oxidation and synthesis of fatty acids)

Proteins: (Chemistry, Metabolism, Digestion of protein, Transamination, Deamination Fate of Ammonia, Urea cycle, End products of each amino acid and their entry into TCA cycle)

Enzymes: (Definition, Classification, Biological Importance, Diagnostic use, Inhibition)

Vitamins: (Daily requirements, Dietary source, Disorders and physiological role)

Minerals (Daily requirement, Dietary Sources, Disorders and physiological role)
mineral metabolism

Organ function test

B. PRACTICAL & CLINICAL PHYSIOLOGY:-

<u>No</u>	<u>Practical</u>	<u>Demonstration/ Performance</u>
HAEMATOLOGY		
1	Study of the Compound Microscope	Performance
2.	Collection of Blood Samples	Performance
3	Estimation of Haemoglobin Concentration	Performance
4	Determination of Haematocrit	Demonstration
5	Hemocytometry	Performance
6	Total RBC Count	Performance

7	Determination of RBC Indices	Demonstration
8	Total Leucocytes Count (TLC)	Performance
9	Preparation And Examination Of Blood Smear	Performance
10	Differential Leucocyte Count (DLC)	Performance
11	Absolute Eosinophil Count	Demonstration
12	Determination of Erythrocyte Sedimentation Rate	Demonstration
13	Determination of Blood Groups	Performance
14	Determination of Bleeding Time and Coagulation Time	Performance
BIOCHEMISTRY		
1	Demonstration of Uses Of Instruments Or Equipment	Demonstration
2	Qualitative Analysis of Carbohydrates, Proteins And Lipids	Performance
3	Normal Characteristics of Urine	Performance
4	Abnormal Constituents of Urine	Performance
5	Quantitative Estimation of Glucose, Total Proteins, Uric Acid in Blood	Performance
6	Liver Function Tests	Demonstration
7	Kidney Function Tests	Demonstration
8	Lipid Profile	Demonstration
9	<u>Interpretation and Discussion of Results of Biochemical Tests</u>	Demonstration
CLINICAL PHYSIOLOGY & OPD		
1	Case Taking & Approach to pt	Performance
2	General Concept Of Examination	Performance
3	Examination of muscles, joints,	Performance
4	Cardio-Vascular System – Blood Pressure Recording, Radial Pulse, ECG, Clinical Examination	Performance
5	Respiratory System- Clinical Examination, Spirometry, Stethography	Performance
6	Nervous System- Clinical Examination	Performance
7	Special Senses- Clinical Examination	Performance
8	Reproductive System- Diagnosis of Pregnancy	Performance

9	Gastrointestinal System- Clinical Examination	Performance
10	OPD (Applied Physiology)	Demonstration & Performance

6. Teaching Learning Methods

Different teaching-learning methods must be apply for understanding holistic and integrated way of physiology. There has to be classroom lectures, small group discussions, case discussion where case based learning (CBL) and problem based learning (PBL). In the applied physiology, Case discussion (CBL-PBL) methods are helpful for students. AV – Methods for demonstration of physiological processes will be very helpful. In process of Clinical Physiology – DOAP (Demonstration – Observation – Assistance – Performance) is very well applicable.

Practical & Clinics are the best medium to demonstrate all physiological processes in objective ways. They help us to understand and explain the physiological signs. Haematological& Biochemistry practicals are done in laboratory, where one can apply the DOAP (Demonstration – Observation – Assistance – Performance) & OSPE (Objective Structured Practical Examination) methods. All this should be recorded in the journal.

In the clinics / OPD / IPD / Bed side there shall be exposure of Clinical & Applied Physiology. These can be demonstratedby DOAP (Demonstration – Observation – Assistance – Performance) & OSCE (Objective Structured Clinical Examination) methods. These methods are more objective, and t will help students to develop the attitude as clinicians.

Other Innovative methods include preparation of charts and models.

7. Assessment

PHYSIOLOGY THEME TABLE

PAPER – 1

Theme*	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
A	General Physiology	I	07	Yes	Yes	No
B	Biophysics Science	I	07	Yes	Yes	No
C	Body fluids & Immune Mechanism	I	16	Yes	Yes	Yes
D	Cardiovascular system	II	16	Yes	Yes	Yes
E	Respiratory system	II	16	Yes	Yes	Yes
F	Excretory system	III	16	Yes	Yes	Yes
G	Skin & The Integumentary System	I	11	Yes	Yes	No
H	Nerve Muscle physiology system	I	11	Yes	Yes	No

PAPER – 2

Theme*	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
A	Endocrine system	II	21	Yes	Yes	Yes
B	Central Nervous System	II	21	Yes	Yes	Yes
C	Digestive system and Nutrition	III	21	Yes	Yes	Yes
D	Reproductive system	III	17	Yes	Yes	Yes

E	Sense organs	III	12	Yes	Yes	Yes
F	Biochemistry	III	08	Yes	Yes	No

QUESTION PAPER BLUE PRINT

UNIVERSITY EXAM PAPER-I – 100 MARKS

MCQs – 10 Marks. SAQs – 50 Marks. FAQs – 40 Marks

Question Serial Number	Type of Question	Question Paper Format (Refer Theme table for themes)
Q1	Multiple choice Questions (MCQ) 10 Questions 1 mark each All questions compulsory	<ol style="list-style-type: none"> 1. Theme A 2. Theme A 3. Theme B 4. Theme B 5. Theme C 6. Theme D 7. Theme E 8. Theme F 9. Theme G 10. Theme H

Q2	Short answer Questions(SAQ) All questions compulsory 5 Marks Each	<ol style="list-style-type: none"> 1. Theme A 2. Theme B 3. Theme C 4. Theme D 5. Theme E 6. Theme F 7. Theme G 8. Theme G 9. Theme H 10. Theme H
Q3	Long answer Questions (LAQ) All questions compulsory 10 marks each	<ol style="list-style-type: none"> 1. Theme C 2. Theme D 3. Theme E 4. Theme F

UNIVERSITY EXAM PAPER-II – 100 MARKS

MCQs – 10 Marks. SAQs – 50 Marks. FAQs – 40 Marks

Question Serial Number	Type of Question	Question Paper Format (Refer Theme table for themes)
Q1	Multiple choice Questions (MCQ) 10 Questions 1 mark each All questions compulsory	<ol style="list-style-type: none"> 1) Theme A 2) Theme B 3) Theme C 4) Theme D 5) Theme D 6) Theme E 7) Theme E 8) Theme F 9) Theme F 10) Theme F

Q2	Short answer Questions(SAQ) All questions compulsory 5 Marks Each	1) Theme A 2) Theme A 3) Theme B 4) Theme B 5) Theme C 6) Theme C 7) Theme D 8) Theme D 9) Theme E 10) Theme F
Q3	Long answer Questions (LAQ) All questions compulsory 10 marks each	1) Theme A 2) Theme B 3) Theme C 4) Theme E

Distribution of Marks for Practical Exam:

Practical Exam: 100 Marks	
Hematology	20 marks
Bio-chemistry	20 marks
Clinical Physiology	20 marks
Spotters	30 marks
Journal	10 marks
Viva: 80 Marks	
Viva Voce	80 marks
Internal Assessment: 20	
IA	20

The Pass Marks in Each Component of the Examination shall be 50%.

7B- Scheme of Assessment (formative and Summative)

Sr. no	Professional course	1 st Term (1-6 Months)	2 nd Term (7-12 Months)	3 rd Term (13-18 Months)
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1	First Professional BHMS	1 st PA	1 st TT		2 nd PA	2 nd TT		3 rd PA	UE
		20 Marks Practical / Viva	100 Marks Theory	100 Marks Practical/ Viva	20 Marks Practical/ Viva	100 Marks Theory	100 Marks Practical / Viva	20 Marks Practical / Viva	

For internal assessment, only practical or viva marks will be considered. Theory marks will not be counted.

Method of calculation of internal assessment marks for final university examination.

PA 1 Practical / Viva (20 Marks)	PA 2 Practical / Viva (20 Marks)	PA 3 Practical / Viva (20 Marks)	Periodical Assessment Average PA1+PA2+PA3/ 3	TT1 Practical / Viva (100 Marks)	TT2 Practical / Viva (100 Marks)	Terminal test average TT1+TT2 / 200*20	Final Internal assessment marks
A	B	C	D	E	F	G	D+G/2

PA- Periodical assessment, **TT-** Terminal test, **UE-** University Examination

8. List Of Recommended Books Theory

A. Text Books:-

1. John N A (2023) Chatterjee C C. Text Book of Physiology 14th Edition. CBS Publication. (CBDC based)
2. Tortora G (2020). Principles of Anatomy & Physiology. Wiley Publication.
3. Jain A (2021). Text Book of Physiology Vol – 1 & 2. Avichal Publishing Company.
4. Glynn M (2022). Hutchion's Clinical Method, Elsevier Publication.
5. Reddy L P (2023) Fundamentals of Medical Physiology. CBS Publishers and Distributors (CBDC based)

B. Reference Books:-

1. Hall J. (2020). Guyton & Hall Text book of Medical Physiology. Elsevier Publication.
2. Khurana I (2021). Essential Medical Physiology. Elsevier Publication.

C. Practical & Clinical Physiology:-

1. Varshney VP, Bedi M, (2019) Practical Physiology: A Student's Workbook. 1st Edition. Jaypee Brothers Medical Publisher
2. Varshney VP, Bedi M, (2023) Ghai's Textbook of Practical Physiology: 10th Edition. Jaypee Brothers Medical Publisher (CBDC based)
3. John N Aet al (2021) C C Chatterjee's Manual of Practical Physiology: CBS Publishers and Distributors (CBDC based)
4. Jain A. (2019) Manual of Practical Physiology. 6th ed. Arya Publications.
5. Glynn M., William D. (2017). Hutchison's Clinical methods. 24th edition Elsevier Publication

Index

Sr. No	Description	Page no
1	Course Code and Name of Course	
2	Preamble	
3	Course Outcomes (CO)	
4	Teaching Hours	
5	Course Content	
6	Teaching Learning Methods	
7	Assessment	
8	List of Recommended Books	
9	Content Mapping (Competencies Table) (Reference – F.No-3-90/2022/NCH/HEB/HEB Notice- Circular / 13099-13107 ; Dated : 14 Feb 2023; Page no 456-588)	

1.Course-Homoeopathic Pharmacy

Course code: Hom-UG-HP

2. PREAMBLE

Pharmacy holds a unique place in Homoeopathic practice and education. It involves knowledge of sources of drugs and the process through which these are processed to obtain dynamic, potent homoeopathic drugs for use at the bedside. It encompasses knowledge of drug action, drug proving, methods of Quality testing, standardization & storage with up to date information of changing drug laws related to Homoeopathic Pharmaceutical Industry & Homoeopathy.

We all know the travails which Master went through while establishing the right to manufacture and dispense what he had so painfully discovered. The challenges have not lessened in the modern era when 'scientific' evidence has been gathered for dubbing Homoeopathic medicines as nothing more than a placebo. It is important that the entrant to our science is introduced to the scientific nature of the process employed to prepare our medicines and he develops confidence in the soundness of the practices as well as its efficacy. The student should also appreciate the more than 250 year advance that Hahnemann was able to establish of Homoeopathic science. We now know that Homoeopathy is the 'greenest' of all medical systems in existence and that is sustainable, eco-friendly and the most economic while being effective over a wide range of conditions.

The way that this can be conveyed is by adopting an integrated approach to Pharmacy education and training. Effective linkages with the subjects of Homoeopathic Philosophy and Materia Medica will be able to convey the strong roots that the practice of Pharmacy has not only in the philosophical approach but also the experimental results as seen through the proving from which the world of Materia Medica has evolved.

Simultaneously, the recent advances in the bio-physical and quantum physics has opened new avenues to address the age-old question of how homoeopathic medicines act. A host of researchers are already doing work which the student needs to be made conversant with. That will produce an insight of the way new researches and developments in related fields of the 21st century are able to start explaining Hahnemann's insights of the 18th! This will also firmly root the student in the first year itself to being a participant in ongoing research related to the discipline 431

which will be his own. Hence the teacher of Pharmacy has a crucial role to play in being abreast of the developments in the field and lend to the student the excitement that becomes a part of teaching-learning.

3. COURSE OUTCOMES

At the end of the course of Homoeopathic Pharmacy, I BHMS Student will be able to

1. Explain the principles that govern homoeopathic pharmacy.
2. Discuss the pharmacognosical basis of homoeopathic drugs with respect to their identification, nomenclature, source, part used, method of collection and preparation.
3. Prepare homoeopathic medicines from their respective sources according to the different scales & methods of potentisation on a small scale in the laboratory.
4. Describe the pharmacology of homoeopathic drugs with respect to the types of drug action, sphere of action and pharmacological action of homoeopathic drugs integrated with Homoeopathic Materia Medica, Anatomy and physiology.
5. Relate the methodology of Homoeopathic Drug Proving integrated with Organon of Medicine.
6. Apply the principles of Homoeopathic Posology in different health care setting like OPD/IPD integrated with Organon of Medicine and Homoeopathic Materia Medica.
7. State the methods of standardization and quality control of homoeopathic medicines to ensure the genuineness of homoeopathic medicines.
8. Explain the principles of pharmaconomy, dispensing and preservation of homoeopathic medicines.
9. Engage the principles of pharmaco-vigilance, and adverse drug reaction in relation to homoeopathic medicines.
10. Write an ideal prescription.
11. Evaluate the scope for research in homoeopathic pharmacy in the context of the recent advancements in pharmaceutical sciences.

4. TEACHING HOURS

PARTICULARS	RECOMMENDED HOURS BY NCH	ACTUAL HOURS ALLOTTED
Theory	100	110
Practicals +Posting at IPD/OPD/Hospital Dispensing Section.	110	120

5.Course Content:

A. Theory: (105 Hours)

Marks: 100

List of Topics	B. TERM	C.Teaching Hours
a)General Concepts and Orientation		
History of Pharmacy with emphasis on emergence of Homoeopathic Pharmacy.	I	03
Homoeopathic Pharmacy Basics	I	04
Homoeopathic Pharmacopoeia	I	04

	Monograph, Contents of Monograph with its individual importance .		
Ideal laboratory	Pre requisites of ideal Laboratory (General Laboratory), Laboratory safety Rules Role of Laboratory in Homoeopathic Pharmacy Education	I	02
Weights and Measurements	Metrology Basics & Units of Apothecary System, British Imperial System, Metric System Interrelationship between various systems of Weight & Measure Concept on Domestic Measures with Metric Equivalentents	I	01
Nomenclature	The Basic Rules Nomenclature Nomenclature of Homoeopathic Drugs Important terminologies like scientific names, common names, synonyms Anomalies in Nomenclature	I	02
Pioneers of Homoeopathic Pharmacy	Role & contributions of Pioneers in development of Homoeopathic Pharmacy	I	02
b)Raw Material: Drugs and Vehicles			
Source of Drugs in Homoeopathy	Different sources – Plant kingdom, Animal kingdom, Mineral kingdom, Nosodes, Sarcodes, Imponderabilia, Synthetic source, New Sources – Allersode, Isodes with reference to their clinical utility Introduction to Bowel Nosodes, Tissue remedies	I	07
Collection of Drug Substances	General and Specific guidelines for collecting drugs from all available sources	I	03
Vehicles	Definition, classification, General Use Source, Properties & Particular use of Vehicles with respect to List Provided in Appendix D Preparation – Commercial Lactose, Alcohol Purity tests – Water, Alcohol, Sugar of Milk	I	06
c) Homoeopathic Pharmaceutics			
Mother tincture and its preparation	Extraction – Principles & Various Methods	II	07

	Old Method (Based on Class I to IX) Concept of Uniform Drug Strength Estimation of Moisture Content - Necessity New Method/Modern Approach of Homoeopathic Drug Preparation		
Various Scales used in Homoeopathic Pharmacy	History of development, Introducer, Designation, Preparation, Administration & Application with respect to - Centesimal Scale, Decimal Scale & 50 Millesimal Scale	II	03
Drug Dynamisation or Potentisation	The Evolution of Dynamisation Concept in Homoeopathy Potentisation & its types The Merits of Potentisation Succession & Trituration Various types of Potency– Fluxion Potency, Jumping Potency, Back Potency, Single Vial Potency, Multiple Vial Potency, Mixed Vial Potency Post- Hahnemannian Potentization Techniques	II	06
External applications (focus on scope of Homoeopathic lotion, Glycerol, Liniment and Ointment)	Scope of administration of External Applications in Homoeopathic Practice Dr Hahnemann's View as per Organon (5th & 6th Ed) Preparation & Uses of lotion, glycerol, liniment and ointment. Commercial Preparation of Ointment	II	05
Doctrine of Signature		II	
Posology	Basic principles of Homoeopathic Posology Related aphorisms of Organon of medicine. Criteria for Selection of Potency & Repetition of Dose Various Kinds of Dose, Emphasis on Minimum Dose	II	06
Prescription	Prescription Writing Important Abbreviations Parts & Contents of Prescription Merits & Demerits of Prescription Writing	III	02
Dispensing of Medicines	Various Dosage Forms – Solid, Liquid Dosage Forms, Methods of Dispensing	II	02
Placebo	Concept of Homoeopathic Placebo The Philosophy of administration of placebo Concept of Placebo Effect	II	01
Pharmacology	Routes of Homoeopathic drug administration	II	02

Preservation	Preservation Rules – Raw Materials Drug Substance, Mother Preparations, Finished products & Vehicles	II	02
d) Pharmacodynamics			
Doctrine of Signature	Basic Concept, Its Evolution & Application in Ancient Medical System Supporters of the Doctrine Dr Hahnemann's view on the Doctrine	II	01
Drug Proving	Homoeopathic Pharmacodynamics With reference to aphorisms 105 – 145 of Organon of Medicine – 6 th Ed) Post Hahnemannian Drug Proving Homoeopathic Pathogenetic Trial (HPT) CCRH & Other Protocols on HPT Other Noted Provers & their work on Drug Proving	II	06
Adverse Drug Reaction	Basic Idea, Reporting of ADE Drug safety with Ref to HPI Medication errors, Causality Assessment Incompatible Remedies	II	02
Pharmacovigilance	Pharmacovigilance in Homoeopathy Activities of Pharmacovigilance Centres Awareness on Medicinal Preparations against Homoeopathic Principles – Patents, Combinations	II	02
Pharmacological study of drugs	listed in Appendix-A (Any 15)	III	05
e) Quality Control:			
Standardisation in Homoeopathy	Different Methods of Standardisation Quality Control of Raw Materials – Various Evaluation techniques In Process Quality Control Quality Control of finished products – Various standard parameters	II	02
Industrial pharmacy.	Good Manufacturing Practices (GMP) Schedule M1	II	02
Homoeopathic pharmacopoeia laboratory (HPL)	Functions and Activities of HPL relating to quality control of drugs. Pharmacopoeia Commission for Indian Medicines	II	01
f) Legislations pertaining to Homoeopathic Pharmacy:		III	04
The Drugs and Cosmetics Act, 1940 (23 to 1940) Drugs and Cosmetics Rules, 1945 Medicinal and Toilet Preparations (Excise Duties) Act, 1955 (16 of 1955) Drugs			

and Magic Remedies (Objectionable Advertisements) Act, 1954 (21 of 1954) The Narcotic Drugs and Psychotropic Substances Act, 1985 (61 of 1985) Dangerous Drug Act, 193		
The Drugs and Cosmetics Act, 1940 (23 to 1940)		
Drugs and Cosmetics Rules, 1945		
Medicinal and Toilet Preparations (Excise Duties) Act, 1955 (16 of 1955)		
Drugs and Magic Remedies (Objectionable Advertisements) Act, 1954 (21 of 1954)		
The Narcotic Drugs and Psychotropic Substances Act, 1985 (61 of 1985)		
Dangerous Drug Act, 1930		
g) Recent Advances in Homoeopathic Pharmacy	III	02
<ol style="list-style-type: none"> 1. Modern theories related with Homoeopathic Drug action 2. Principles of Drug action 3. Introduction to Nanomedicine 4. Molecular Mechanism of Drug Action 5. Mechanism of Action of Homoeopathic Medicines 		
Scope of Research in Homoeopathic Pharmacy <ol style="list-style-type: none"> 1. Drug Discovery 2. Principles of New Drug discovery 3. Clinical evaluation of New Drugs 4. Pre-Clinical Research in Homoeopathic Pharmacy 	III	01
h) Homoeopathic Pharmacy - Relationships	III	02
Relation of Homoeopathic Pharmacy with Anatomy		
Relation of Homoeopathic Pharmacy with Physiology		
Relation of Homoeopathic Pharmacy with Materia Medica With reference to Source of Drugs, Identification, Common Name of Drugs, Role of Drug Proving & Other Types of Proving in construction of Materia Medica, Clinical Verification Family wise study of Sphere of action – Solanaceae, Loganiaceae, Compositae, Liliaceae, Anacardiaceae, Rubiaceae etc		

B. Practical – Lab Work – Field – Clinical Hospital Work

1. Laboratory Work – Practical Class (Experiments) - Maintaining Record of Experiments Conducted (Principle, Requirements, Calculation if applicable, Process, Label, Conclusion/Inference)

Practical Class (Demonstration) – Maintaining Records of Practical Demonstrated

(Principle, Requirements, Calculation if applicable, Process, Label, Conclusion/Inference)

Field Visits-

A) Maintain File/Report on Visit to GMP Compliant Large Scale Medicine Manufacturing Unit (Format should be as per Appendix – E)

B) Maintain File/Report on Visit to Medicinal Plant Garden (Format should be as per Appendix - F)

Activity –

(a) Clinical Hospital Work – Maintain Record (Activities/Posting in Dispensing Section, Prescriptions based on Homoeopathic Principles in IPD/OPD) – Record to be maintained as per format in Appendix G

(b) Seminar – Maintain Record on Seminar Presentation on Topics of Homoeopathic Pharmacy as assigned – Record to be maintained as per Appendix – H

(c) Herbarium – Maintenance of 30 Plant Drug Substances Samples.

Homoeopathic Pharmacy Practicals		
Sl. No	Particulars of Experiments	Teaching Hours
1.	Estimation of size of Globules	2 hrs
2.	Medication of globules (small scale)	2 hrs
3.	Purity Test of sugar of milk	2 hrs
4	Purity Test of water	2 hrs
5	Purity Test of Ethyl alcohol	2 hrs
6.	Determination of specific gravity of a given liquid Vehicle & identifying the same.	2 hrs
7.	Preparation of dispensing alcohol from strong alcohol.	2 hrs
8.	Preparation of dilute alcohol from strong alcohol	2 hrs
9.	Trituration of drug in Old Method(one each of class VII,VIII& IX)	3 hrs
10.	Trituration of one drug as per HPI	
11.	Succussion in decimal scale from Mother tincture (Prepared in Old Method) to 3x potency.	2 hrs
12.	Succussion in decimal scale from Mother tincture (Prepared in New Method) to 3x potency.	2 hrs
13.	Succussion in Centesimal scale from Mother tincture (Prepared in Old Method) to 3C.	2 hrs
14.	Succussion in scale from Mother tincture (Prepared in New Method) to 3C.	2 hrs
15.	Conversion of Trituration to liquid potency : Decimal scale 6x to 8x potency	1 hr
16.	Conversion of trituration to liquid potency : Centesimal scale 3c to 4c potency	1 hr
17.	Preparation of 0/2 potency (Solid form) (LM scale) of 1 drug from 3 rd Degree Trituration.	2 hrs
18.	Preparation of external applications – Lotion	1 hr
19.	Preparation of external applications – Glycerol	1 hr
20.	Preparation of external applications – Liniment	1 hr
21.	Preparation of external applications – Ointment	1 hr
22.	Writing of prescription & Dispensing the Medicine in Water with preparation of Doses	1 hr
23.	Writing of prescription & Dispensing the Medicine in Sugar of Milk with Preparation of Dose	1 hr
24.	Preparation of mother tinctures according to Old	8 hrs

	Hahnemannian method (Class I, II, III, IV)	
25.	Preparation of mother solutions according to Old Hahnemannian method (Class Va, Vb, VIa, VIb)	4 hrs

Demonstration

1. Homoeopathic pharmaceutical instruments and appliances with their cleaning (List provided in Appendix C)-06 Hours
2. Estimation of moisture content using water bath-02 Hours
3. Paper chromatography & TLC of any mother tincture-04 Hours
4. Laboratory methods – Sublimation, distillation, decantation, filtration, crystallization.-04 Hours
5. Preparation of mother tincture – Maceration and Percolation- 04 Hours.
6. Study & demonstration of Drug Substances (listed in Appendix B)- 10 Hours i) Macroscopic Characteristic (Any 15) ii) Microscopic characteristic (Any 05)
7. Study & demonstration of vehicles (Solid, Liquid & Semi solid – as available)- 02 Hours
8. Microscopical study of Trituration (One drug up to 3X Potency)-02 Hours
9. Medication of Globule (Large Scale)-1 Hour

Clinical Hospital Work – Maintain Record (Activities/Posting in Dispensing Section, Prescriptions based on Homoeopathic Principles in IPD/OPD) – Record to be maintained as per format in Appendix G- 20 Hours .

Seminar – Maintain Record on Seminar Presentation on Topics of Homoeopathic Pharmacy as assigned- 07 Hours.

Activities

1. Collection of 30 drugs for herbarium.
2. Visit to a Large-scale manufacturing unit of Homoeopathic medicine (GMP compliant).
3. Visit to a Medicinal Plant /Botanical Garden & shall keep details Visit report.
4. Clinical Class: Visit to IPD, OPD to take note on prescriptions as per Homoeopathic Principles & keep record.
5. Visit to Hospital dispensing section to observe & gain knowledge on Dispensing techniques & Keep Records.

6. TEACHING LEARNING METHODS

The Teaching Learning activities in Homoeopathic Pharmacy requires change in structure & process in order to be more skill based & providing hands on experience. The Teaching Learning methods with respect to Homoeopathic Pharmacy may be covered in the following manner –

- a) Class Room Lectures – Oral Presentation, Board Work, Power point Presentation
- b) Tutorials – Special Classes on Doubt Clearing of Completed topics/Chapters, Special Classes for Slow Learners (involving Students in Groups comprising 5-10)
- c) Practical Class – Demonstration & Explanation of the Experiments, this would follow by conduction of the Experiment by the students on their own, write up of the Experiment conducted.
- d) Clinical Class – Visit to IPD/OPD for gaining Knowledge on Prescription writing, Administration of Homoeopathic medicines based on Homoeopathic Posology, Visiting Hospital Pharmacy to observe & Gain Knowledge on dispensing techniques.
- e) Field Visit – Visit to One GMP Compliant Homoeopathic Manufactory. Visit to One Medicinal Plant Garden.
- f) Student Activities – Working out the Assignments, Projects, Power point presentations as assigned.

7. ASSESSMENT

Assessment Summary

7A- Number of papers and Mark Distribution

Sr No	Course Code	Papers	Theory	Practicals	Viva Voce	Internal Assessment- Practical	Electives Grade Obtained	Grand Total
1	HomUG-HP	1	100	50	40	10		100

7B - Scheme of Assessment (formative and Summative)

Sr. No	Professional Course	1 st term (1-6 Months)			2 nd Term (7-12 Months)			3 rd Term (13-18 Months)	
		1 st PA	1 ST TT		2 nd PA	2 ND TT		3 rd PA	UE
1	First Professional BHMS	10 Marks Practical/Viva	50 Marks Theory	50 Marks Practical/Viva	10 Marks Practical/Viva	50 Marks Theory	50 Marks Practical/Viva	10 Marks Practical/Viva	

For Internal assessment, Only Practical/Viva marks will be considered. Theory marks will not be counted.

Method of Calculation of Internal Assessment Marks for Final University Examination

PA- Periodical Assessment **TT-** Terminal Test **UE-** University Examination

7C - Evaluation Methods for Periodical Assessment

Sr. No	Evaluation Criteria
1	Practical Performance
2.	Viva Voce,MCQs,MEQ(Modified Essay Questions/Structured Questions)

7D- Paper Layout

MCQ	10 marks	15 min
SAQ	50 marks	85 min
LAQ	40 marks	80 min

7E- I - Distribution of Theory exam

Sr No	Paper	B Term	C Marks	D Type of Questions "Yes" can be asked. "No" should not be asked.		
				MCQ (1 Mark)	SAQ (5 Marks)	LAQ (10 Marks)
	A List of Topics					
1	General Concepts and Orientation	I	Refer Next Table	Yes	Yes	No
2	Raw Material: Drugs and Vehicles	I		Yes	Yes	Yes
3	Homoeopathic Pharmaceutics	II		Yes	Yes	Yes
4	Pharmacodynamics	III		Yes	Yes	Yes
5	Quality Control	II		No	Yes	No
6	Legislations pertaining to Homoeopathic Pharmacy	III		No	No	Yes
7	Homoeopathic Pharmacy - Relationships	III		No	Yes	No

7E -Theme table

Theme	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
A	General Concepts and Orientation	I	11	Yes	Yes	No
B	Raw Material: Drugs and Vehicles	I	25	Yes	Yes	Yes
C	Homoeopathic Pharmaceutics	II	23	Yes	Yes	Yes
D	Pharmacodynamics	III	16	Yes	Yes	Yes

E	Quality Control	II	10	No	Yes	
F	Legislations pertaining to Homoeopathic Pharmacy	III	10	No	No	Yes
G	Homoeopathic Pharmacy - Relationships	III	05	No	Yes	No

7 F Question paper Blueprint

A Question Serial Number	B Type of Question	Question Paper Format (Refer table 7F ii Theme table for themes)
Q1	Multiple choice Questions (MCQ) 10 Questions 1 mark each All compulsory Must know part: 6 MCQ Desirable to know: 2 MCQ. Nice to know: 2 MCQ	1. Theme A 2. Theme B 3. Theme B 4. Theme B 5. Theme B 6. Theme B 7. Theme C 8. Theme C 9. Theme C 10. Theme D
Q2	Short answer Questions (SAQ) 10 Questions 5 Marks Each All compulsory Must know part: 10 SAQ Desirable to know: Nil Nice to know: Nil	1. Theme A 2. Theme A 3. Theme B 4. Theme B 5. Theme C 6. Theme C 7. Theme D 8. Theme E 9. Theme E 10. Theme G
Q3	Long answer Questions (LAQ) 4 Questions 10 marks each All compulsory All questions on must know No Questions on Nice to know and Desirable to know	1. Theme A 2. Theme B 3. Theme B 4. Theme B

7G - Distribution of Practical Exam Practical, Viva & Internal Assessment - 100 marks

Spotting	20 marks
Experiment	20 marks
Journal	10 marks
Viva Voce	40 marks
Internal assessment	10 marks

8. LIST OF RECOMMENDED BOOKS Text Books

1. Dr. Partha Mandal & Dr. Biman Mandal, A Textbook of Homoeopathic Pharmacy, Revised and Enlarged 3rd Edition, 2012, New Central Book Agency Publishers.

2. Dr. D.D. Banerjee, Augmented Textbook of Homoeopathic Pharmacy, 2 nd Edition, 2012, B. Jain Publishers.

3. Dr. K.P. Mujumdar, Textbook of Homoeopathic Pharmacy, 2013, New Central Book Agency Publishers

Reference Texts

1. Banerjee SK & Sinha N. (Reprint edition, 1993). A Treatise on Homoeopathic Pharmacy. B Jain Publishers, New Delhi.

2. Govt. of India, Ministry of Health & Family Welfare, New Delhi (1971 to 2006). Homoeopathic Pharmacopoeia of India (1-9 Vol.)

3. Hughes R (Reprint edition, 1999). A Manual of Pharmacodynamics. B Jain Publishers, New Delhi.

4. Dr. P.N. Verma & Dr. (Mrs.) InduVaid, Encyclopaedia of Homoeopathic Pharmacopoeia, Vol- I,II,III, Edition 2002,B. Jain Publishers.

APPENDIX-A

List of drugs included in the syllabus of Homoeopathic Pharmacy for Pharmacological action -

Sl. No	Drugs	Sl. No	Drugs
1	Aconitum napellus	16	Glonoinum
2	Adonis Vernails	17	Hydrastis Canadensis
3	Allium Cepa	18	Hyoscyamus Niger
4	Argentum Nitricum	19	Kali Bichromium
5	Arsenicum Album	20	Lachesis
6	Atropa Belladonna	21	Lithium Carbonicum
7	Cactus Grandiflorus	22	Mercurius Corrosives
8	Cantharis Vesicatoria	23	Naja Tripudians
9	Cannabis Indica	24	Nitricum Acidum
10	Cannabis Sativa	25	Nux Vomica
11	Cinchona Officinalis	26	Passiflora Incarnate
12	Coffea Cruda	27	Stannum Metallicum
13	Crataegus Oxyacantha	28	Stramonium

14	Crotalus Horridus	29	Symphytum Officinale
15	Gelsemium Sempervirens	30	Tabacum

APPENDIX-B

List of drugs for Identification

Sl. No	Drugs	Sl. No	Drugs
I	Vegetable Kingdom		
1	Aegle Folia	14	Holarrhena Antidysenterica
2	Anacardium Orientale	15	Hydrocotyle Asiatica
3	Andrographis Panniculata	16	Justicia Adhatoda
4	Calendula officinalis	17	Lobelia Inflata
5	Cassia Sophera	18	Nux Vomica
6	Cinchona Officinalis	19	Ocimum Sanctum
7	CocculusIndicus	20	Opium
8	CoffeaCruda	21	Rauwolfia Serpentia
9	Colocynthis	22	Rheum
10	Crocus Sativa	23	SaracaIndica
11	Croton Tiglium	24	Senna
12	CynodonDactylon	25	Stramonium
13	FicusReligiosa	26	Vinca Minor
II	Chemical or Minerals		
1	AceticumAcidum	7	CarboVegetabilis
2	Alumina	8	Graphites
3	Argentum metallicum	9	Magnesium Phosphorica
4	Argentum Nitricum	10	NatrumMuriaticum
5	Arsenicum Album	11	Sulphur
6	CalcareCarbonica		
III	Animal Kingdom		
1	ApisMellifica	4	Sepia
2	BlattaOrientalis	5	TarentulaCubensis
3	Formica Rufa		

Appendix C

List of instrument & Appliances for Demonstration & Study

Crucible with lid	Test Tube	Tripod stand	Hot Air Oven
Porcelain Basin	Conical Flask	Wire gauze	Water bath
Mortar & Pestle Porcelain	Volumetric flask	Spatula	Macerating Jar
Ointment Slab	Minim glass	Leather pad	Percolator
Chemical Balance r	Thermometer	Stop watch	Microscope
Hydrometer	Mortar & Pestle - Glass	Chopping Board	pH Meter
Alcoholometer	Glass Phials	Chopping Knife	Burette

Lactometer	Pyknometer	Sieve	Pipette
Spoon	Measuring Cylinder	Tincture Press	Dropper
Beaker	Graduated Conical Flask	Funnel	Glass Rod

Appendix – D (List of Important Vehicles for Study)

Appendix – D (List of Important Vehicles for Study)		
Solid	Liquid	Semisolid
Sugar of Milk	Water	Vaseline
Globules	Ethyl Alcohol	Beeswax
Tablets	Glycerine	Lanolin
Cane sugar	Olive oil	Spermaceti
	Simple syrup	Isin glass
	Lavender Oil, Sesame Oil, Rosemary oil, Almond oil	

Appendix E
Format for Maintaining Record on visit to Homoeopathic Manufactory (GMP Compliant)
<p>Date of Visit</p> <p>No. of Visiting Students & Teaching Faculty</p> <p>Name of Teaching Faculty</p> <p>Detail of the Instructor/s at the Manufactory</p> <p>How the Tour was arranged</p> <p>Name & Location of the Homoeopathic Manufactory</p> <p>History about the Manufactory</p> <p>Different Sections of the manufactory with its working process</p> <p>Activities of R&D Dept</p> <p>How the visit helped in correlation with topics studied in Theory</p> <p>Conclusion</p> <p>(Any other related information, not mentioned in format, if required can be included)</p>

Appendix F
Format for Maintaining Record on visit to Medicinal Plant Garden
Date of the Visit No. of visiting Students & Teaching Faculty Name of Teaching Faculty Detail of Instructor/s How the Tour was arranged Name & Location of the Medicinal Plant Garden History & about the Medicinal Plant Garden A list Medicinal Plants seen with brief description, Conclusion

Appendix G
Format for maintaining record on Hospital Activities (Visit to OPD/IPD & Dispensing Section)
Record on Prescriptions based on Homoeopathic Principles in IPD/OPD No of Cases: Total 10 cases (5 Acute, 5 Chronic) Format - Patient ID Complaint Diagnosis Details of 1st Prescription – Name of Medicine, Potency, Dose with its Repetition, Second Prescription (if Record is available) Conclusion at the end of Acute & Chronic Cases on Lessons learnt on Homoeopathic Principles
Record on Activities/Posting in Hospital Dispensing Section Total No. of Patients Date wise Sl No as per Prescription Register, Dosage form- Liquid/solid, Name of Vehicle used, Medication Process etc Conclusion at the end on Lessons learnt on Homoeopathic Dispensing Techniques

Appendix H
Format for Maintaining record on Departmental Seminars
Maintenance of Record on Seminar Presentation on Topics of Homoeopathic Pharmacy as assigned
Circular/Notice of Departmental Seminar
Title of Topic for Presentation,
Date
Presented by Name of Student/s
Brief Report on the Seminar
Any New Information provided by the Speakers
Rating on a Scale of 10
No of Students & Faculty Members attending the Seminar
Photos
Signed by the Departmental Head

9. Content Mapping (Competencies Table)

(Reference – F.No-3-90/2022/NCH/HEB/HEB Notice- Circular / 13099-13107 ; Dated : 14 Feb 2023; Page no 456-588)

Homoeopathic Materia Medica

INDEX

S.No	Description	Page Number
1.	Course Code and Name of Course	
2.	Preamble	
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4.	Teaching Hours	
5.	Course Content	
6.	Teaching Learning Methods	
7.	Assessment	
8.	List of Recommended Books	
9.	Content Mapping (Competencies Table) Reference no-F.No-3-90/2022/NCH/HEB/HEB/ Circular/13099-13107 Page no- 623-647	Notice- Circular/13099-13107

1. **Course Name** :Homoeopathic Materia Medica

Course code: Hom UG-HMM-I

2.PREAMBLE

Homoeopathic Materia Medica is the study of the action of drugs on healthy human being as a whole taking into consideration individual susceptibility and its reaction to various circumstances and time. A good prescription by a homoeopath mainly depends upon the case receiving, processing and a sound knowledge of Homoeopathic Materia Medica.

Each drug in Materia Medica not only has its own personality with its mental and physical constitution but also has its own affinity to an area, direction, spread, tissue, organ, system. Study of a drug in context of altered sensation, function and structure covers the pathology caused by it, which is also expressed in the pathogenesis of the drugs. Materia Medica also has symptoms from toxicological and clinical proving. All this knowledge is of utmost importance in order to apply the remedies in various clinical conditions. This can be achieved only by integrating the study of Materia Medica with other parallel subjects taught during the course.

Apart from the source books of Materia Medica there are different types of Materia Medica constructed on different philosophical backgrounds by different authors. Materia Medica also forms the platform of various repertories. Therefore, it becomes very important for a student of homoeopathy to learn the plan and construction of all the basic Materia Medica in order to understand their practical utility in practice.

It is also important to keep in mind that the end point of the teaching of HMM is not to burden the student with information of more number of remedies but to equip with an approach which will help to develop the vision towards self-guided study and apply the knowledge in practice.

This self-directed learning can ultimately lead to a critical approach of studying Materia Medica hence empowering evidence based practice and initiate the process of lifelong learning. Exploring Materia Medica is an endless journey as newer illnesses will keep on emerging and newer drugs or undiscovered facets of existing drugs will be needed to explore for managing these situations.

3.COURSE OUTCOMES

At the end of BHMS I course, the students should be able to-

1. Define the homoeopathic Materia Medica.
2. Understand the philosophy of homoeopathic Materia Medica.
3. Describe evolution, sources and construction of different types of Homoeopathic Materia Medica.
4. Enumerate the scope and limitations of Homoeopathic Materia Medica.
5. Evolve the portrait and symptomatology of a particular drug using the knowledge of pharmacy, psychology, anatomy, physiology and Organon of medicine.
6. Observe the symptoms of a particular medicine in a clinical set-up with emphasis on individualizing symptoms.

Learning Objectives

1. To define the homoeopathic Materia Medica and grasp the basic concept with philosophy of it based on Hahnemannian directions.
2. To discuss different sources and types of homoeopathic Materia Medica.
3. To understand the drug in context of its pharmacological data, constitution, temperament, sphere of action, pathogenesis, both mental and physical generals, particular symptoms, characteristic/ individualising symptoms, general and particular modalities, relationship with other remedies including doctrine of signature.
4. To study and understand the bio-chemic system of medicine.
5. To identify the symptoms of a sick individual corresponding to the symptoms of a particular drug.
6. To develop an insight into scopes and limitations of homoeopathic Materia Medica.

4. Teaching Hours

Distribution of Teaching hours.

Homoeopathic Materia Medica		
Year	Teaching hours- Lectures	Teaching hours- Non-lectures
1 st BHMS	120	75

4.A. Teaching Hours Theory:

S. no.	List of Topics	Hours
1.	Definition and introduction of Materia Medica	2
2.	Types of Homoeopathic Materia Medica	3
3.	Sources of Homoeopathic Materia Medica	3
4.	Study of drug picture (term I)	32
5.	Study of drug picture (term II)	33
6.	Theory of Bio chemic salts	2
7.	Individual bio chemic salts	15
8.	Study of drug picture (term III)	29
9.	Scope and Limitation of HMM	1
	Total	20

4.B. Teaching Hours Non-lecture:

Sr. No	A Study Setting	B Term	C Teaching Hours
1	OPD/IPD/Classroom	II & III	75

Non-Lecture Activities (Practical)-

Sr. No	Non Lecture Teaching Learning methods	Time Allotted per Activity (Hours)
1	Group Discussions	5
2	Problem based learning	5
3	Tutorials	10
4	Case Based Learning (live case)	55
	Total	75

5.COURSE CONTENTS BHMS I (Theory)

1. Introductory Lectures

- a. Definition and introduction of basic Materia Medica.
- b. Sources, types, scope and limitation of Homoeopathic Materia Medica
- c. Theory of biochemic system of medicine, its comparison with Homoeopathy and study of **12 biochemic tissue salts** with their physico-chemical reaction.

2. Homoeopathic medicines:

1. Aconite	18. Calcarea Phos	35. Hypericum
2. Aethusa cynapium	19. Calendula	36. Ignatia
3. Allium cepa	20. Carbo Veg	37. Ipecac
4. Aloe soc	21. Chamomilla	38. Ledum pal
5. Ammonium Carb	22. Cina	39. Lycopodium
6. Ammonium Mur	23. Cinchona	40. Natrum Carb
7. Antim Crude	24. Cocculus	41. Natrum Mur
8. Antim Tart	25. Coffea cruda	42. Nux vomica
9. Apis Mel	26. Colchicum	43. Podophyllum
10. Arnica montana	27. Colocynth	44. Pulsatilla
11. Ars Alb	28. Dioscoria villosa	45. Rhus tox
12. Arum triph	29. Croton tig	46. Ruta
13. Baryta Carb	30. Drossera	47. Silicea
14. Belladonna	31. Dulcamara	48. Spongia
15. Borax	32. Euphrasia	49. Sulphur
16. Bryonia alba	33. Gelsemium	50. Symphytum
17. Calc Carb	34. HeparSulph	

Biochemic tissue salts:

1. Calc Flour	5. Kali Mur	9. Nat Mur*
2. Calc Phos*	6. Kali Phos	10. Nat Phos
3. Calc Sulph	7. Kali Sulph	11. Nat Sulph
4. FerrPhos	8. Mag Phos	12. Silicea*

**Also included in the list of Homoeopathic medicines, hence total no. of medicines shall remain 59 for BHMS I*

Contents for Term I:

I. Introductory Lectures

- a. Definition and introduction of basic Materia Medica.
- b. Sources, types of Homoeopathic Materia **Medica**

II. Homoeopathic medicines

1. Arnica montana	8. Natrum Mur
2. Bryonia	9. Rhus tox
3. Baryta carb	10. Ruta
4. Calc Carb	11. Silicea
5. Calendula	12. Sulphur
6. Hypericum	13. Symphytum
7. Ledum pal	

Contents for Term II:

1. Homoeopathic medicines:

1. Aconite nap	11. Colchicum
2. Aloes soc	12. Colocynth
3. Apis mellifica	13. Dioscorea
4. Arsenic Alb	14. Dulcamara
5. Belladonna	15. Gelsemium
6. Cina	16. Ignatia
7. Chamomila	17. Lycopodium
8. Carbo veg	18. Nux vomica
9. Cinchona	19. Podophyllum
10. Cocculus	20. Pulsatilla nig.

- I. Theory of biochemic system of medicine, its comparison with Homoeopathy
- II. Study of 5 **biochemic tissue salts** with their physico-chemical reaction:

1. Calc Flour

2. Calc Phos
4. Natrum Phos
5. Natrum Sulph

Contents for Term III:

I. Homoeopathic medicines:

1. Aethusa cyn	9. Coffea cruda
2. Allium cepa	10. Croton tigli
3. Ammon Carb	11. Drosera
4. Ammon Mur	12. Euphrasia
5. Antim Crud	13. Hepar Sulph
6. Antim Tart	14. Ipecacuanha
7. Arum triph	15. Natrum Carb
8. Borax	16. Spongia

II. Study of 5 **biochemic tissue salts** with their physico-chemical reaction:

1. FerrPhos
2. Kali Mur
3. Kali Phos
4. Kali Sulph
5. Mag Phos

III. Scope and limitations of Homoeopathic Materia medica

6.TEACHING LEARNING METHODS

Lectures (Theory)	Non-lectures (Practical)
Lectures	Clinical demonstration
Small group discussion	Problem based discussion
Integrated lectures	Case Study
Assignments	
Library reference	

Different teaching-learning methods must be applied for understanding holistic and integrated Materia Medica. There has to be classroom lectures, small group discussions, case discussion where case-based learning (CBL) and problem based learning (PBL) are specially helpful. In the applied Materia Medica, case discussion (CBL-PBL) method is beneficial for students. Audio visual (AV) methods for classroom teaching may be an innovative aid in order to demonstrate the related graphics and animations etc. In case of clinical demonstration – DOAP (Demonstration – Observation – Assistance – Performance) is very well applicable.

7.ASSESSMENT

Assessment Summary

7A- Number of papers and Mark Distribution

Sr. No.	Course Code	Papers	Theory	Practical (Assignment+ Spotting)	Viva Voce	Internal Assessment- Practical*	Grand Total
1	HomUG-HMM-I	1	100	20+10= 30	60	10	200

**Note- For Internal assessment, only Viva marks obtained in three PAs and two TTs will be considered as explained in table 8B-1 and to be calculated as per the table 8B-2 given below. Theory marks shall not be taken into account for this purpose.*

7B-I - Scheme of Assessment (formative and Summative)

Sr. No	Professional Course	1 st term (1-6 Months)			2 nd Term (7-12 Months)			3 rd Term (13-18 Months)	
1	First Professional BHMS	First PA + 1 ST TT			2 nd PA+2 ND TT			3 rd PA+UE	
		1 st PA	1 st TT		2 nd PA	2 nd TT		3 rd PA	UE
		10 marks practical/viva	50 marks theory	50 mark sviva	10 marks practical/viva	50 marks theory	50 marks viva	10 marks practical/viva	As per table 8A

PA: Periodical Assessment to be done only through practical/viva; TT: Term Test shall include both theory and viva; UE: University Examinations shall include both theory and viva as per table 8A

7B-II- Method of calculation of internal assessment marks for final university examination:

PA1 Practical/Viva(10 Marks)	PA2 Practical/Viva(10 Marks)	PA3 Practical/Viva(10 Marks)	Periodical AssessmentAverage $PA1+PA2+PA3/3$	TT1 Practical/ Viva (50 Marks)	TT2 Practical/ Viva (50 Marks)	Terminal Test Average TT1 + TT2/ 10	Final Internal Assessment Marks
A	B	C	$D= A+B+C/3$	E	F	$G=E+F/10$	$D+G/2$

7 C - Evaluation Methods for Periodical Assessment

Sr. No	Evaluation Criteria
1	Practical/Clinical Performance
2	Viva Voce, MCQs, SAQs, LAQs

7D - Paper Layout

Summative assessment:

Theory- 100 marks

MCQ	10 marks
SAQ	50 marks
LAQ	40 marks

8 D- I - Distribution of Theory exam

Sr. No	Paper	B Ter m	C Mar ks	D Type of Questions “Yes” can be asked. “No” should not be asked.		
				MCQ (1 Mark)	S A Q (5 Mar ks)	LAQ (10 Marks)
1	Definition and introduction of basic materia medica and HMM; compare HMM and other Materia Medica	I	Ref er Ne xt Ta ble	Yes	Yes	No
2	Sources, types, construction, scope and limitation of Homoeopathic Materia Medica	I,III		Yes	Yes	Yes
3	Theory of Biochemic system of medicine, its comparison with Homoeopathy and study of 12 Biochemic tissue salts with their physico- chemical reaction	II		Yes	Yes	Yes
4	Drug Picture- 50 Homoeopathic Medicines	II & III		Yes	Yes	Yes

7D– II - Theme table

Theme*	Topics	Term	Marks	MCQ's	SAQ's	LAQ's
A	Definition and introduction of basic materia medica and HMM; compare HMM and other Materia Medica	I	7	Yes	Yes	No
B	Sources, types, construction, scope and limitation of Homoeopathic Materia Medica	I,III	17	Yes	Yes	Yes
C	Theory of Biochemic system of medicine, its comparison with Homoeopathy and study of 12 Biochemic tissue salts with their physico-chemical reaction	II & III	22	Yes	Yes	Yes
D	Drug Picture- 50 Homoeopathic Medicines	I,II& III	54	Yes	Yes	Yes

7E- Question paper Blue print

Question Serial Number	Type of Question	Question Paper Format (Refer table 8D- II Theme table for themes)
Q1	Multiple choice Questions(MCQ) 10 Questions 1 mark each All compulsory Must know part: 7 MCQ Desirable to know: 2 MCQ Nice to know: 1 MCQ	<ol style="list-style-type: none"> 1. Theme A 2. Theme A 3. Theme B 4. Theme B 5. Theme C 6. Theme C 7. Theme D 8. Theme D 9. Theme D 10. Theme D

Q2	Short answer Questions (SAQ) ten Questions 5 Marks Each All compulsory Must know part: 7 SAQ Desirable to know: 2 SAQ Nice to know: 1 SAQ	<ol style="list-style-type: none"> 1. Theme A 2. Theme B 3. Theme C 4. Theme C 5. Theme D 6. Theme D 7. Theme D 8. Theme D 9. Theme D 10. Theme D
Q3	Long answer Questions (LAQ) Four Questions 10 marks each All compulsory All questions on must know No Questions on Nice to know and Desirable to know	<ol style="list-style-type: none"> 1. Theme B 2. Theme C 3. Theme D 4. Theme D

8F - Distribution of Practical Exam

Practical & Viva-100 marks

Viva voce	60 marks
Practical (Assignment)*	20 marks
Practical (Spotting)	10 marks
Internal assessment**	10 marks (viva/ clinical assessment)

*Assignment shall comprise of compilation of complete drug-portrait of 6 polychrest remedies and 4 biochemic salts

** Method of calculation explained in table no. 8B-II

6. LIST OF RECOMMENDED REFERENCE BOOKS:

- Allen HC, 2005, Keynotes Rearranged and Classified with Leading Remedies of the Materia Medica and Bowel Nosodes, Reprint edition, B.JainPublishers, New Delhi
- Choudhuri NM, 2006, A Study On Materia Medica Enriched with real case studies, Reprint revised edn, B.Jain Publishers, New Delhi
- Kent JT, 2015, Lectures On Homoeopathic Materia Medica, Reprint edn, B.Jain Publishers, New Delhi
- Burt W, 2009, Physiological Materia Medica, Third edn, B.Jain Publishers, New Delhi
- Boericke W, Dewey W, 2016, The Twelve Tissue Remedies By Schessler, Reprint edn, B.Jain Publishers, New Delhi
- All source books may be referred whenever required.

9. CONTENT MAPPING (COMPETENCIES TABLE)

Reference no-F.No-3-90/2022/NCH/HEB/HEB/ Notice-Circular/13099-13107

Page no- 623-647

1.COURSE CODE: Hom UG-R-I

COURSE NAME: HOMOEOPATHIC REPERTORY and CASE TAKING

PREAMBLE

The Homoeopathic Materia Medica has expanded manifold since the proving of "Cinchona Bark" by Dr. Samuel Hahnemann and today we have over five thousand remedies in the Materia Medica. It is impossible for any human mind to memorise all the symptoms of each drug and to recall those symptoms while prescribing. Therefore, the need of indexing of these symptoms along with the drugs producing those symptoms were felt by Dr. Samuel Hahnemann himself and subsequently by other homoeopaths for prescribing at the bedside of the patient.

Homoeopathic Repertory is a Dictionary or Storehouse or an index to the huge mass of symptoms of the Homoeopathic Materia Medica. The repertory is organized in a practical form indicating the relative gradation of drugs. Repertories not only contain symptoms of proving but also clinical and pathological symptoms found in the Homoeopathic Materia Medica. Repertories serve as an instrument at the disposal of the physician for sifting through the maze of symptoms of the vast Homoeopathic Materia Medica. Repertories aim at simplifying the work of the physician to find the indicated remedy by eliminating the non-indicated remedies. Repertorisation is not the end but a means to arrive to the simillimum and reference to Homoeopathic Materia Medica based on sound principles of Philosophy is the final court of appeal.

Each repertory has been compiled on the basis of distinct philosophy, structure and utility. In order to use these instruments effectively, one must understand thoroughly its conceptual base, construction and utility and limitations. Even though there are a number of repertories, the student at the under graduate level is expected to learn the philosophy and application of basic core repertories namely Kent, Boger's Boenninghausen Characteristics and Repertory and Boenninghausen's Therapeutic Pocket Book. The subject of Repertory must not be taught in isolation but must be taught in horizontal integration with Anatomy, Physiology in I BHMS; Pathology, Surgery, Gynaecology and Practice of Medicine in II BHMS; Surgery, Gynaecology, Practice of Medicine in III BHMS and Practice of Medicine in IV BHMS and vertically integrated with Homoeopathic Materia Medica and Organon and Homoeopathic Philosophy in all the years. Integrated teaching in all the years will help the student to grasp and understand the subjects better and connect repertory to all other subjects. Similarly, case taking demands virtual integration of all the subjects taught from the I st BHMS to IV BHMS in the consulting room or at the bedside. The physician can never say that he has learnt all that is to the case taking process. Every new

patient has a new lesson to teach.

The advent of computerization and resulting software has opened up vast newer avenues to collate and correlate the vast information found in the Homoeopathic Materia Medica through the repertories. Continued exploration of these connections will generate new data, newer repertories and the newer application to existing or newer illnesses.

COURSE OUTCOMES OF REPERTORY FOR I BHMS

At the end of Ist BHMS, the student should be able to,

- 1) Define Repertory.
- 2) Explain the need and utility of repertory to find simillimum, and for the study of Materia Medica
- 3) Define various terminologies used in repertory
- 4) Locate different rubrics related to anatomy, physiology and psychology in Kent's Repertory
- 5) Illustrate the construction of Kent's Repertory as per the Hahnemannian Anatomical schema

TEACHING HOURS

Total Number of Teaching Hours: 21			
Course Name	Lectures	Non-Lectures	Total
Homoeopathic Repertory and Case Taking (Hom UG-R-I)	21	-	21

COURSE CONTENT (Hom - UG-R-I)

S.No	List of Topics	Lecture Hours
1	Introduction to Repertory, Definition and Meaning of Repertory ❖ General Introduction to Repertory ❖ Origin of Repertory ❖ Need of Repertory	3

	<ul style="list-style-type: none"> ❖ Definition of Repertory ❖ Meaning of REPERTORIUM 	
2	<p>Need and uses of repertory and repertorisation</p> <ul style="list-style-type: none"> ❖ Uses and Scopes of Repertory ❖ Limitations of Repertory ❖ Definition of Repertorization ❖ Introduction to Methods and Techniques of Repertorization 	3
3	<p>Terminologies relevant to Repertory</p> <ul style="list-style-type: none"> ❖ Repertory ❖ Rubric ❖ Gradation ❖ Cross Reference ❖ Synonym ❖ Repertorization ❖ Totality of Symptoms ❖ Repertorial Totality ❖ Potential Differential Field ❖ Conceptual Image ❖ Case taking ❖ Analysis of a case ❖ Evaluation of a Case ❖ Longitudinal case Study ❖ Cross Section Study of a case ❖ General Repertory ❖ Regional Repertory ❖ Logico-Utilitarian Repertory ❖ Puritan Repertory 	3
4	<p>Correlation of Anatomy, Physiology and</p>	6

	<p>Psychology with Repertory</p> <ul style="list-style-type: none"> ❖ Introduction to correlation Anatomy, Physiology and Psychology with Repertory ❖ Chapters and Rubrics related to Anatomical parts in Dr. Kent's Repertory ❖ Chapters and Rubrics related to Physiology in Dr. Kent's Repertory ❖ Rubrics related to emotions, intellect and memory in Mind chapter of Dr. Kent Repertory 	
5	<p>Schematic representation of chapters in Kent's repertory</p> <ul style="list-style-type: none"> ❖ Introduction to Kent's Repertory ❖ Listing of Chapters in Kent's Repertory ❖ Correlation of Chapters in Kent's Repertory to Hahnemannian Anatomical Schema ❖ Chapters and Rubrics related to anatomical structures, physiological processes and psychology in Kent's Repertory 	6

Teaching Learning Methods

Theory	Practical's / Clinics
Lectures	Clinical Bedside Teaching
Small Group Discussion	Integrated Clinics
Integrated Lectures	Case Study
Integrated Seminars	Rubric Banks
Assignments	

Rubric Banks	
Library Reference	

List of Practical Topics

S.No	Name of Topic	Activity/ Practical	TL Method
1	Basic Structure of Repertory showing arrangement of rubric of anatomy, physiology and psychology	Arrangement of Chapters and rubrics related to anatomical structures, physiology and psychology (Emotions, intellect, and behavior) in Kent's Repertory	Integrated teaching in Clinics in IBHMS

List of Recommended Books

1. Dhawale ML (2000) - Principles and Practice of Homoeopathy, 3rd Edition, Institute of Clinical Research Mumbai
2. Hahnemann S (2017). Organon of Medicine 6th edition, 48th Impression, B. Jain Publishers
3. Kent, JT- Repertory of the Homoeopathic Materia Medica (Sixth American Edition), 54th Impression (2017), B. Jain Publishers
4. Kishore, Jugal (2004) - Evolution of Homoeopathic Repertories and Repertorization, Revised Edition, B. Jain Publishers
5. Munir Ahmed R (2016). Fundamentals of Repertories: alchemy of homeopathic methodology. Hi-Line Publishers, Bengaluru.
6. Patel, R.P (1998): The Art of Case Taking and Practical Repertorization, 6th Edition. Sai Homoeopathic Book Corporation
7. Tiwari, Shashikant (2005) - Essentials of Repertorisation, 4th Edition, B. Jain Publishers

Subject Code: HomUG-Yoga I**Subject: Yoga for Health Promotion**

The syllabus of Yoga for the 1st BHMS students should include the basic concept of Yoga and its philosophy, with a clear idea of the different section of asana, pranayama, kriya and meditation. Total 30 hours of class will include practical training. The students will be trained in understanding the relationship between Yoga and Homoeopathy in a wholistic approach, and the point of application of yoga in part of treatment.

The topic and respective allotted hours are as follows-

Sr.no.	TOPIC	CLASS
1		
1.	Yoga definition, concept, types, benefits, and origin.	Hours 1
2.	History and patanjali, yoga philosophy and development of yoga.	Hours 1
3.	Astanga, yoga, hathayoga.	Hours 1
4.	Asana-types, examples, benefits.	Hours 1
5	Corelation of vital force and prana.	Hours 1
6	Meditation-types, methods, benefits.	Hours 1
7	Kriya-types, methods, benefits.	Hours 1
8	Relationship of yoga and homoeopathy on wholistic plane.	Hours 1
9	Application of yoga in terms of hahnemann's accessory circumtanses.	Hours 1
10	Pranayanam, types, benefits.	Hours 1
11	Practical learning about asanas (postures)- pawanmuktasna, backstreching, sunsalutation, classical sequences.	Hours 5
12	Practical learning about Breathing, pranyama including abdominal, thoracic, clavicular, hathamudra, vilom, lung sensitising.	Hours 5
13	Practice of relaxation, tense and relax, short yoganidra, extended, savasana, yoganidra, sankalpa.	Hours 5
14	Meditation practice, sitting posture, kaya sthairam, omchanting, trataka.	Hours 5

GUIDELINES FOR COMPETENCY BASED POSTGRADUATE TRAINING PROGRAMME FOR MD IN ANATOMY

Preamble:

The purpose of PG education is to create specialists who would provide high quality health care and advance the cause of science through research & training.

These guidelines would help to achieve a uniform level of training of MD Anatomy to post graduate students throughout the country. The student, after undergoing the training, should be able to deal effectively with the needs of the medical community and should be competent to handle all problems related to the specialty of Anatomy and recent advances in the subject. The post graduate student should also acquire skills in teaching anatomy to medical and para-medical students and be able to integrate teaching of Anatomy with other relevant subjects, while being aware of her/his limitations.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes through learning and assessment. This document was prepared by various subject-content specialists. The Reconciliation Board of the Academic Committee has attempted to render uniformity without compromise to purpose and content of the document. Compromise in purity of syntax has been made in order to preserve the purpose and content. This has necessitated retention of “domains of learning” under the heading “competencies”.

Goal :

The **Goal** of MD Anatomy is to train a doctor to become a competent teacher and researcher in Anatomy who:

1. Is aware of *contemporary advances and developments* in the field of Anatomy.
2. Has *acquired the competencies* pertaining to the subject of Anatomy that are required to be practiced at all levels of health system.
3. Is oriented to the *principles of research methodology*.
4. Has acquired *skills in educating* medical and paramedical professionals.
5. Has acquired *skills in effectively communicating* with the students and colleagues from various medical and paramedical fields.
6. Has acquired skills of integrating anatomy with other disciplines as and when needed.
7. Has acquired qualities of a good teacher capable of innovations in teaching methodology.
8. Has been able to demonstrate adequate management skills to function as an effective leader of the team engaged in teaching and research.

Competencies

After completing the three-year course in MD Anatomy, the student should have achieved Competence in the following:

1. Knowledge of Anatomy

- 1.1. Acquire competencies in gross and surface anatomy, neuroanatomy, embryology, genetics, Histology, radiological anatomy, applied aspects and recent advances of the above mentioned branches of anatomy to clinical practice.

2. Practical and Procedural skills

- 2.1 Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.

3. Training skill in Research Methodology

- 3.1 Acquire skills in teaching, research methodology, epidemiology & basic information technology.
- 3.2 Acquire knowledge in the basic aspects of Biostatistics and research methodology.
- 3.3 Has knowledge to plan the protocol of a thesis, carry out review of literature, execution of research project and preparation of report.
- 3.4 Has ability to use computer applications Microsoft office (Microsoft word, excel, power point), Internet, Searching scientific databases (e.g. PubMed, Medline, Cochrane reviews).
- 3.5 Acquire skills in paper & poster preparation, writing research papers and Thesis.

4. Professionalism, attitude and communication skills:

- 4.1 Develop honest work ethics and empathetic behavior with students and colleagues.
- 4.2 Acquire capacity of not letting his/her personal beliefs, prejudices, and limitations come in the way of duty.
- 4.3 Acquire attitude and communication skills to interact with colleagues, teachers ,students , body donors and their families.

5. Teaching Anatomy

- 5.1 Practicing different methods of teaching-learning.
- 5.2 Making presentations of the subject topics and research outputs.

6. Problem Solving

- 6.1 Demonstrate the ability to identify applied implications of the knowledge of anatomy

and discuss information relevant to the problem, using consultation, texts, archival literature and electronic media.

6.2 Demonstrate the ability to correlate the clinical conditions to the anatomical/embryological/hereditary factors.

6.3 Demonstrate the ability to evaluate scientific/clinical information and critically analyze conflicting data and hypothesis.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the student should have acquired following competencies:

A. Cognitive domain

1. Describe gross anatomy of entire body including upper limb, lower limb, thorax, abdomen, pelvis, perineum, head and neck, brain and spinal cord.
2. Explain the normal disposition of gross structure, and their interrelationship in the human body. She/He should be able to analyze the integrated functions of organs systems and locate the site of gross lesions according to deficits encountered.
3. Describe the process of gametogenesis, fertilization, implantation and placenta formation in early human embryonic development along with its variation and applied anatomy.
4. Describe the sequential development of organs and systems along with its clinical anatomy, recognize critical stages of development and effects of common teratogens, genetic mutations and environmental hazards. She/He should be able to explain developmental basis of variations and congenital anomalies.
5. Explain the principles of light, transmission and scanning, compound, electron, fluorescent and virtual microscopy.
6. Describe the microscopic structure of various tissues & organs and correlate structure with functions as a prerequisite for understanding the altered state in various disease processes.
7. Describe the structure of cell and its components, cell cycle, cellular differentiation and proliferation.
8. Describe structure, number, classification, abnormalities and syndromes related to human chromosomes.
9. Describe important procedures in cytogenetics and molecular genetics with its application.
10. Describe about single gene pattern inheritance, intermediate pattern and multiple alleles, mutations, non-mendelian inheritance, mitochondrial inheritance, genome imprinting and parental disomy.
11. Describe multifactorial pattern of inheritance, teratology, structure gene, molecular screening, cancer genetics and pharmacogenetics.
12. Describe about reproduction genetics, assisted reproduction, prenatal diagnosis, genetic counseling and ethics in genetics.
13. Explain principles of gene therapy and its applied knowledge.
14. Describe immune system and cell types involved in defense mechanisms of the body. Also explain gross features, cytoarchitecture, functions, development and histogenesis of various

primary and secondary lymphoid organs in the body.

15. Describe about common techniques employed in cellular immunology and histocompatibility testing.
16. Describe structure & development of tissue-organ system to comprehend deviations from normal.
17. Demonstrate knowledge about recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.
18. Explain collection, maintenance and application of stem cells, cryo-banking and principles of organ donation from recently dead bodies.
19. Demonstrate knowledge about surface marking of all regions of the body.
20. Able to interpret various radiographs of the body, normal CT-Scan, ultrasound and MRI.
21. Describe the different anthropological traits and use of related instruments.
22. Describe the outline of comparative anatomy of whole body and basic human evolution
23. Demonstrate knowledge about identification of human bones, determination of sex, age, and height for medico legal application of anatomy

B. Affective domain

1. Demonstrate self-awareness and personal development in routine conduct. (*Self-awareness*)
2. Communicate effectively with peers, students and teachers in various teaching learning activities. (*Communication*)
3. Demonstrate
 - a. Due respect in handling human body parts & cadavers during dissection. (*Ethics& Professionalism*)
 - b. Humane touch while demonstrating living surface marking in subject/patient. (*Ethics & Professionalism*)
4. Acquire capacity of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
5. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure. (*Equity and social accountability*)
6. Ability to communicate with the registered body donors and family of donors.

C. Psychomotor domain

At the end of the course the student should be able to:

1. Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy.
2. Acquire mastery in dissection skills, embalming, tissue preparation, staining and museum preparation.
3. Locate and identify clinically relevant structures in dissected cadavers.
4. Locate and identify cells & tissues under the microscope.
5. Identify important structures visualized by imaging techniques, specifically radiographs,

computerized tomography (CT) scans, MRI and ultrasonography.

6. Demonstrate various movements at the important joints and actions of various groups of muscles in the human body.
7. Demonstrate anatomical basis of common clinical procedures expected to be performed by a basic medical doctor.
8. Demonstrate different methods of teaching-learning and make presentations of the subject topics and research outputs.

Specific practice-based competencies:

Name/Description of practice-based competencies

1. Gross anatomy:

- 1.1 Procurement, Embalming and Preservation of human cadavers
- 1.2 Preparation of chemicals for preserving bodies in tanks.
- 1.3 Dissection of cadaver
- 1.4 Window dissection of important regions
- 1.5 Preparation of specimens for museum with display
 - a) soft parts
 - b) models
 - c) charts
- 1.6 Preparation and preservation of human bones / skeleton as assigned by the faculty
- 1.7 Gross anatomy file in which labelled diagrams of important structures of upper limb, lower limb, thorax, abdomen, head & neck and brain should be drawn.

2. Histology

- 2.1 Preparation of common fixatives like 10% formalin, Bouin's fluid etc
- 2.2 Making paraffin blocks and section cutting and mounting
- 2.3 Preparation of staining set for H and E staining and staining paraffin sections with the stain.
- 2.4 Making celloidin, araldite, gelatin blocks and their section cutting
- 2.5 Processing hard tissues, decalcification of bones, block making and sectioning, preparation of ground sections of calcified bones.
- 2.6 Frozen section cutting on freezing microtome and cryostat
- 2.7 Honing and Stropping of microtome knives, including sharpening by automatic knife

sharpener

2.8 Histology record book in which Light Microscopic pictures of all the organs and tissues of the body should be drawn and a small description of salient features written

3. Histochemical Methods

3.1 Practical classes for staining of glycogen, mucopolysaccharides, alkaline phosphatase ,acid phosphatase, and calcium

4. Cytogenetics

4.1 Preparation of media, different solutions, stains etc.

4.2 Preparation of buccal smear for sex chromatin

Human chromosome preparation from peripheral blood and karyotyping.

4.3 Banding techniques (G and C)

4.4 Making of Pedigree charts for study of patterns of inheritance.

4.5 Chromosomal Analysis.

5. Neuroanatomy:

5.1 Dissection of brain and spinal cord for teaching and learning purpose

5.2 Preparation of brain and spinal cord macroscopic and microscopic sections and identification of different parts in them.

5.3 Discussions on clinical problems related to neurological disorders and anatomical explanation for the same.

Syllabus:

A post graduate student, after three years of training in M.D. (Anatomy) should have acquired knowledge in the following aspects of anatomy:

A: Cognitive domain:

Section – I

Gross anatomy

Gross Anatomy of entire body including upper limb, lower limb, thorax, abdomen, pelvis, perineum, head and neck, brain and spinal cord

Section – 2

Developmental anatomy/embryology

- General embryology: gametogenesis, fertilization, implantation and placenta, early human embryonic development.
- Systemic embryology: development of organ systems and associated common congenital abnormalities with teratogenesis.
- Anatomical basis of congenital anomalies.

Section – 3

Histology and histochemistry

Cell Biology:

- Cytoplasm - cytoplasmic matrix, cell membrane, cell organelles, cytoskeleton, cell inclusions, cilia and flagella.
- Nucleus - nuclear envelope, nuclear matrix, DNA and other components of chromatin, protein synthesis, nucleolus, nuclear changes indicating cell death.
- Cell cycle - mitosis, meiosis, cell renewal.
- Cellular differentiation and proliferation.
- **Microscopic structure of the body:**
- Principles of light, transmission and scanning, electron, fluorescent, confocal and virtual microscopy.
- The systems/organs of body - Cellular organization, light and electron microscopic features, structure - function correlations, and cellular organization.
- Various histo-techniques and museum preparation techniques.

Section – 4

Neuroanatomy:

- Brain and its environment, Development of the nervous system, Neuron and Neuroglia, Somatic sensory system, Olfactory and optic pathways, Cochleovestibular and gustatory pathways, Motor pathways, Central autonomic pathways, Hypothalamo-hypophyseal system, Limbic system, Basal ganglia, Reticular system, Ventricular system of Brain, Cross Sectional anatomy of brain and spinal cord & its applied anatomy.
- Detailed structure of the central nervous system and its applied aspect.

Section – 5

Genetics

- Human Chromosomes - Structure, number and classification, methods of chromosome preparation banding patterns. Chromosome abnormalities, Autosomal and Sex chromosomal abnormalities syndromes, Molecular and Cytogenetics.
- Single gene pattern inheritance: Autosomal and Sex chromosomal pattern of inheritance, Intermediate pattern and multiple alleles, Mutations, Non-Mendelian inheritance, Mitochondrial inheritance, Genome imprinting,

- parental disomy.
- Multifactorial pattern of inheritance: Criteria for multifactorial inheritance, Teratology, Structure gene, Molecular Screening, Cancer Genetics - Haematological malignancies, Pharmacogenetics.
- Reproduction Genetics - Male and Female Infertility, Abortuses, Assisted reproduction, Preimplantation genetics, Prenatal diagnosis, Genetic Counseling and Ethics of Genetics.
- Principles of Gene therapy and its applied knowledge.

Section – 6

Immunology

- Immune system and the cell types involved in defense mechanisms of the body. Gross features, cytoarchitecture, functions, development and histogenesis of various primary and secondary lymphoid organs in the body.
- Biological and clinical significance of the major histocompatibility complex of man including its role in transplantation, disease susceptibility/resistance and genetic control of the immune response.
- Common techniques employed in cellular immunology and histocompatibility testing.
- Molecular hybridization and PCR technology in immunology research particularly mechanism of antigen presentation, structural and functional relevance of the T cell receptor, genetic control of the immune response, Molecular basis of susceptibility to disease.

Section – 7

Applied anatomy and recent advances

- Clinical correlations of structure and functions of human body. Anatomical basis and explanations for clinical problems.
- Applications of knowledge of development, structural (microscopy), neuro anatomy to comprehend deviations from normal.
- Recent advances in medical sciences which facilitate comprehension of structure function correlations and applications in clinical problem solving.
- Collection, maintenance and application of stem cells, cryobanking and principles of organ donation from recently dead bodies.

Section – 8

- **Surface Marking and Radiology**

Surface marking of all regions of the body. Interpretation of normal radiographs of the body including special contrast procedures like barium studies, cholecystography, pyelography, salphingography. Normal CTScan, MRI and Ultrasound.

Section - 9

Anthropology and Comparative Anatomy

- Different anthropological traits, Identification and use of Anthropological instruments.
- Outline of comparative anatomy of the whole body and basic human evolution.

Section - 10

- **Forensic Medicine:**

Identification of human bones from their remains and determination of sex, age, and height. for medico legal application of Anatomy.

B - PSYCHOMOTOR DOMAIN:

Demonstrate following predominant Psychomotor domain competencies		
Sr. No	Competency	Perform under supervision / perform Independently/ Observation only
1.	Identify, locate and demonstrate surface marking of clinically important structures in the cadaver and correlate it with living anatomy	Independently
2.	Acquire mastery in dissection skills including window dissection of important regions	Independently
3.	Acquire mastery in embalming the human body	Independently
4.	Prepare tanks for preserving bodies	Observation
5.	Tissue preparation for histology and staining techniques	Independently
6.	Honing and Stropping of microtome knives, including sharpening by automatic knife sharpener	Independently
7.	Preparation of common fixatives embalming fluid 10% formalin, Bouin's fluid etc.	Independently
8.	Demonstrate the mounting of specimen in the museum	Independently
9.	Locate and identify clinically relevant structures in dissected cadavers.	Independently
10.	Locate, identify and demonstrate cells & tissues under the microscope.	Independently
11.	Identify the anatomical structures visualized by imaging techniques, specifically radiographs, computerized tomography (CT) scans, MRI and ultrasonography in normal individuals	Independently

12.	Demonstrate various movements at the important joints and actions of various groups of muscles in the human body.	Independently
13.	Demonstrate anatomical basis of common clinical procedures expected to be performed by a basic medical doctor.	Under supervision
14.	Demonstrate different methods of teaching-learning and assessments. Independently	Independently
15.	Make presentations of the subject topics for teaching and research outputs. independently	Independently
16.	Prepare buccal smear for sex chromatin. independently	Independently
17.	Prepare Human chromosome from peripheral blood and karyotyping. Under supervision	Under supervision
18.	Demonstrate Banding techniques (G and C) and Chromosomal Analysis Under supervision	Under supervision
19.	Demonstrate use of different anthropological instruments	Under supervision

Departmental Resources:

It is mandatory for the Department of Anatomy to develop at least three of the following laboratories, in addition to the other facilities. The laboratory should be involved in active research in at least one well defined field.

1. Histology
2. Immunology
3. Electron microscopy / Fluorescence microscopy / confocal and other forms of microscopy laboratories
4. Developmental anatomy
5. Anthropometry
6. Neuroanatomy
7. Cytogenetics
8. Imaging technique for Radiological Anatomy

TEACHING AND LEARNING METHODS:

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skills oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a log book

for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations of dissections, symposia, journal clubs, seminars, small group discussion, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject should also be used. The suggested examples of teaching-learning methods are given below but are not limited to these.

A. Lectures: Didactic lectures should be used sparingly. A minimum of 10 lectures per year is suggested. All postgraduate trainees will be required to attend these lectures. Some examples of topics which can be covered in lecture are:

1. Topics in gross, surface and cross sectional anatomy, microanatomy, embryology, neuroanatomy, histochemistry, and genetics.
2. Recent advances in microanatomy, embryology, neuroanatomy, histochemistry, and genetics.
3. Research methodology and biostatistics.
4. **Salient features of** Undergraduate/Postgraduate medical curriculum.
5. Teaching and assessment methodology.

Topic numbers 3, 4, 5 can be done during research methodology/biostatistics and medical education workshops in the institute.

B. Journal club: Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar: Minimum of once every 1-2 weeks is suggested.

Important topics should be selected and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work: Minimum - once every 1-2 weeks.

Laboratory work/ Skills lab teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department should participate in moderating the teaching-learning sessions. Hands-on experience on various techniques and procedures in microanatomy, histochemistry, genetics, embalming & preparation of museum specimens should be acquired.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest.

G. a. Rotational clinical / community / institutional postings

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions. The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based

Guidelines. **The postings schedule with duration is given below:**

- Surgery -1 weeks
- Radiology -1 weeks
- Pathology -2 weeks
- ENT -1 week
- Ophthalmology -1 week
- Obstetrics & Gynecology } -1 week
- Pediatrics } }
- Medical Education Unit -1 week (Optional & can be done in common with other department PGs

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

G b. Posting under “District Residency Programme” (DRP):

All postgraduate students pursuing MS/MS in broad specialities in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate programme and the rotation shall be termed as “District Residency Programme” and the PG medical student undergoing training shall be termed as “District Resident”.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis (if so mandated) under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

I. Training in teaching skills

MEU/DOME should train PG students in education methodologies and assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

Others

The students shall undergo training in other courses such as on Telemedicine, how to write a manuscript and make effective presentations, use of Pubmed and other resources etc. as required – The student shall attend a one-day Medical Education Technology (MET) training workshop conducted by the Institution.

J. Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in labs, dissection hall, skill labs and other areas of

posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The log book is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the Log Book is to:

- a) help maintain a record of the work done during training,
- b) enable Faculty/Consultants to have direct information about the work done and intervene, if necessary,
- c) provide feedback and assess the progress of learning with experience gained periodically.

The Log Book should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical examination.

It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in log book particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the MCI Logbook Guidelines uploaded on the Website.

K. Course in Research Methodology: All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

Other aspects:

- The Postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending

the department.

- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department shall encourage e-learning activities.
- The Postgraduate trainees should undergo training in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS).
- The Postgraduate trainees must undergo training in information technology and use of computers.

During the training program, patient safety is of paramount importance; therefore, relevant clinical skills are to be learnt initially on the models, later to be performed under supervision followed by independent performance. For this purpose, provision of skills laboratories in medical colleges is mandatory.

Examination

Examination shall consist of dissertation, written paper (theory), practical and viva voce. The Examination shall be organized based on marking system to evaluate and to certify post graduates students level knowledge, skill and competence at the end of the training.

Criteria for Passing

Obtaining a minimum of 40% marks in each theory paper and not less than 50% cumulatively in all the four papers for degrees examination shall be mandatory. Obtaining if 50% marks in Practical Examination shall be mandatory of passing the examination as a whole in the said degree examination as the case may be. Hence a candidate shall secure not less than 50% marks in each head of examination which shall include Theory, Practical and Viva voce examination. No grace mark is permitted in Postgraduate Examination either for Theory or for Practical.

ASSESSMENT

FORMATIVE ASSESSMENT, ie., assessment to improve learning

Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

During the three-year training period,

- A record of all theoretical, practical and experimental work done by

the post graduate student and its assessment will be kept and shall be available for examiners at the time of the final practical and viva voce examination.

- There will be periodical examinations during the course of training. The pre-final theory and practical examination will be conducted by the faculty of the concerned college.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

The Internal Assessment should be conducted in theory and practical/clinical examination, should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

Quarterly assessment during the MD training should be based on:

- Dissection presentation : once a week
- Laboratory performance : twice a week
- Journal club : once a week
- Seminar : once a fortnight
- Case discussions : once a fortnight/month
- Interdepartmental case or seminar : once a month

Note: These sessions may be organized and recorded as an institutional activity for all postgraduates.

- Attendance at Scientific meetings, CME programmes (at least 02 each)

The student to be assessed periodically as per categories listed in the preclinical postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT, ie., assessment at the end of training

Essential pre-requisites for appearing for examination

include:

1. **Log book** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted
2. At least **two presentations** at national level conference. One research paper should be published / accepted in an indexed journal. **(It is suggested that the local or University Review committee assess the work sent for publication).**

The summative examination would be carried out as per the Rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. The theory examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination.

The postgraduate examination shall be in three parts:

1. **Thesis**

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A post graduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. **Theory examination**

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify post graduate student's level of knowledge, skill and competence at the end of the training, as given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D./ M.S shall be held at the end of 3rd academic year.

There shall be four theory papers (as per PG Regulations).

Paper I: 100 Marks

Gross Anatomy, Embryology, Microscopic Anatomy of human body above the diaphragm with Radiological Anatomy & Body Preservation

- a) Gross Anatomy of human body above the diaphragm i.e. upper limb, thorax, head and neck.
- b) Embryology & Microscopic anatomy of tissues and organs above the diaphragm.
- c) Methods of preservation of human body and its parts, radiological anatomy, sectional anatomy

Paper II: 100 Marks

Gross Anatomy, Embryology, Microscopic Anatomy of human body below the diaphragm with General (Embryology & Microscopic) Anatomy

- a) Gross Anatomy of human body below the diaphragm i.e. lower limb, abdomen, pelvis.
- b) Embryology & Microscopic anatomy of tissues and organs below the diaphragm.
- c) General Histology, General Embryology
- d) Principles of light, transmission and scanning electron microscopy, confocal, virtual microscopy.

Paper III: 100 Marks

Neuroanatomy & Genetics

- a) Neuroanatomy - gross and applied aspects.
- b) General principles of genetics, cytogenetics as applicable to medicine and different genetic disorders, gene therapy.

Paper IV: 100 Marks

Recent advances and applied Anatomy in medical sciences

- a) Comparative and evolutionary anatomy
- b) Clinical and applied aspect of Anatomy
- c) Recent advances in the application of knowledge of anatomy on human body
- d) Basics of principles of organ donation from recently dead bodies.

3. Practical/clinical and Oral/viva voce examination Practical examination

Practical examination should be spread over **two** days and include various major components of the syllabus focusing mainly on the psychomotor domain.

- **First Day Practical:** To submit the duly signed gross anatomy file, histology file & the log book and thesis

a) Gross Anatomy

Dissection and related viva voce, Major and minor dissections to be included.

b) Histology

Spotting (10 spots) and viva voce

Techniques of tissue processing, paraffin block making, section cutting and staining (H and E stain) with related viva

- **Second Day Practical:**

- a) Microteaching of a short topic to assess teaching skills
- b) A short synopsis of the thesis work should be presented by the post graduate student
- c) Grand viva including Gross anatomy, cross sectional anatomy, radiological Anatomy, Surface Anatomy, Embryology.

Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the post graduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

Practical Examination to be organized as per details given below:

- Dissection on cadaver
- Histology spotting
- Histological techniques
- Surface Marking
- Radiology
- Teaching ability
- Thesis presentation

Oral / Viva-voce Examination

Grand viva

On dissected parts of the whole human body including nervous system, and Embryology models, teratology, skeletal system including short bones, embalming techniques and genetics, radiographs, MRI, CT & ultrasonography.

Day 1	GROSS ANATOMY	
	1. 3 hours Window dissection of the allotted gross anatomy topic on human cadaver	50 Marks
	2. Display and discussion of the allotted dissection exercise on a human cadaver	80 Marks
	3. Surface anatomy	20marks
	TOTAL	150Marks
	HISTOLOGY	
	1. Identification and discussion of 10 stained slides (general histology, systemic histology, neuroanatomy) including Human Genetics charts	100 Marks 10 marks per slide X 10 number]
	2. Tissue preparation and staining i. Preparation of a paraffin block	10 Marks
	ii. Taking serial sections from blocks provided	10 Marks
	iii. Staining of given section with H & E and discussion	20 Marks
iv. Discussion on histological techniques	10 Marks	
	TOTAL	150 marks
Day 2	VIVA VOCE	60 Marks
	<ul style="list-style-type: none"> • All the components of the syllabus along with specimens, • Embryology models • Osteology • Radiographs, MRI, CT & ultrasonographs 	
	DISCUSSION ON DISSERTATION TOPIC submitted for the examination	20 Marks
	PEDAGOGY:	20 Marks

	Demonstration of teaching skill / techniques	
	TOTAL	100 Marks

Max marks for M.D Anatomy	Theory	Practical's	Viva-voce	Marks
	400	300	100	800

Recommended reading:

Books

(latest edition)

Gross

Anatomy:

- Susan Strandring: Gray's Anatomy: The anatomical basis of clinical practice, Churchill Livingstone Elsevier.
- Keith and Moore Clinically Oriented Anatomy. Lippincot Williams and Wilkins.
- R.J. Last. Anatomy Regional and Applied. Churchill Livingston.
- Frank H. Netter. Atlas of Human Anatomy. Saunders Elsevier.
- ML Ajmani. Embalming: Principles and Legal Aspects. Jaypee Brothers.

Histology

- Young B. and Heath J. Wheater's Functional Histology. Churchill Livingstone.
- M.H. E Ross. Histology: A textbook and atlas. Williams and Wilkins.
- Harold A Davenport. Histological and Histochemical Techniques. W.B Saunders Company.

Genetics

- J.S Thompson and Thompson. Genetics in medicine. W.B. Saunders and Co. Philadelphia, London.

Embryology

- TW Sadler. Langman's Medical Embryology. Lippincotts, Williams and Wilkins
- Keith L Moore and T.V.N. Persaud. The Developing Human. Saunders.

Neuroanatomy

- Richard S. Snell. Clinical Neuroanatomy for Medical Students. Williams and Wilkins.

Statistics

- David E. Matthews and Vernon T. Farewell. Using and Understanding Medical Statistics. Karger.

Radiology

- J.B. Walter et.al. Basic Atlas of Sectional Anatomy with correlated imaging. Saunders Elsevier.

Surface anatomy

- SP John, Lumley editors. Surface Anatomy, The Anatomical basis of clinical examination. London: Churchill Livingstone.

Journals

03-05 international Journals and 02 national (all indexed) journals

M.D. BIOCHEMISTRY

Preamble

A competency is the capability to apply or use a set of related knowledge, skills, and abilities required to successfully perform "critical work functions" or tasks in a defined work setting. Competency-based training is a learning model in which the required level of knowledge and skill (competency) on a task must be demonstrated. The purpose of the competency-based postgraduate education in Biochemistry is to create specialists, with the required knowledge, skills, and attitude, who would provide high-quality healthcare complying with the principles of personal integrity and professional ethics and would advance the cause of science through teaching, research & training along with constant updating of his/her knowledge and skills as a lifelong self-directed learner.

The student, after undergoing training in MD Biochemistry, should be able to demonstrate his/her knowledge of the basic concepts and recent advances in the subject, and a defined set of skills including expertise in various laboratory techniques applicable to metabolic and molecular aspects of medicine, planning and executing research projects, writing research papers/ articles demonstrating the acquired training in research methodology. The postgraduate training course should equip the student with skills to become a competent teacher who is also able to demonstrate his/her competence in planning teaching programs and apply those to facilitate the learning of the students in medical and allied health science courses in compliance with the curriculum while advancing the same with needful and feasible innovations. He/she should demonstrate competence in integrating teaching-learning of Biochemistry with other relevant subjects/disciplines to facilitate the holistic application of the subject of Biochemistry in patient care. He/she should be able to demonstrate his/her training in good laboratory practices with the ability to set up/manage a quality-controlled and quality-assured diagnostic laboratory, generate, evaluate, interpret and report the diagnostic laboratory data, with a good understanding of the sources of errors, corrective and preventive actions, hospital and laboratory information system network, and interact with clinicians as may be needed for effective patient care.

This document aims to provide teachers and learners with comprehensive guidelines to achieve a defined set of outcomes through learning and assessment and apply those in a given setup. This document has been framed by the Expert Group of the National Medical Commission with an aim to render a uniform PG medical curriculum to be implemented by all the medical colleges in the country. The curriculum so designed has been named the competency-based PG medical education curriculum in conformity with the purpose and content of PG medical education.

Goal:

The postgraduate course M. D. (Biochemistry) should enable a student to acquire in depth knowledge in basic concepts of biochemistry, recent advances in the subject and skills and expertise in various laboratory techniques applicable to metabolic and molecular aspects of medicine and in research methodology

The goal of the training program in MD Biochemistry is to enable a student to become a competent teacher/facilitator of teaching-learning processes, researcher, problem solver, and healthcare provider. He/she should be able to acquire a defined set of cognition and skills as detailed below and demonstrate his ability to apply the same in a given healthcare setup.

A. Acquisition of Knowledge

The student should be able to explain the molecular, physical, and physiological logic of the processes involved in the maintenance of normal health and their deviation in a disease state. He/she should be able to integrate his/her acquired knowledge in principles and concepts of classical biochemistry, biophysics, and molecular biology, comprehend and apply his/her cognition and skills in a professional patient care setup.

B. Acquisition of Skills

The student should be able to facilitate the UG and PG learning of biochemical concepts and principles and should be able to render hands-on training in the Biochemical laboratory investigations and experimentations relevant to the strengthening of biochemical concepts, scientific and clinical problem-solving, and biomedical research. He/she should be able to analyze, interpret and evaluate the data, and rationalize their application in clinical management and experimental research.

C. Teaching and training

As a competent healthcare personnel, the student should develop his/her learning skills by applying the fundamental principles of medical education, through teaching and assessing the undergraduate students in medicine and allied health science courses and, by contributing to the training of postgraduate students.

D. Diagnostic laboratory skills

The student should be competent in setting up/supervising/managing a diagnostic laboratory in Biochemistry in a hospital or in any other setup (diagnostic units in remote places or independent of a hospital setting) ensuring quality control along with quality assurance and providing reliable healthcare support services. The student should be able to provide consultation to clinicians and also contribute to community healthcare by conducting screening tests.

E. Professionalism, Ethics, Communication skills

The student should be able to develop and sustain work ethics and empathetic behavior with students and colleagues. He/she should be able to demonstrate professional integrity, honesty, and higher ethical standards and be able to display appropriate attitude and communication skills to interact with colleagues, teachers, students, laboratory personnel, and other healthcare professionals. While dealing with the patients and their relatives, he/she should exhibit compassion, care, and concern.

F. Research

The student should be able to demonstrate his/her competence in carrying out research work and related activities from the planning phase to writing (dissertation/thesis, research report/research paper) by applying the principles of research methodology.

At the end of three years of training in the MD Biochemistry course, a postgraduate student should be able to:

- Demonstrate his/her knowledge of Biochemistry, Cell Biology, Molecular Biology, Molecular diagnostics, Biophysics, and applied aspects of all the mentioned branches to contribute to the teaching-learning processes and healthcare management.
- Identify learning needs and set the learning objectives for his/her self-directed learning and acquire and apply the needful learning in subjects like Genetics, Nutrition & Dietetics, Immunochemistry, and Laboratory Medicine in a relevant context.
- Apply the Medical Education principles to effectively contribute to Teaching-Learning processes, Assessment & Integrated learning.
- Demonstrate his/her knowledge about various aspects of the Competency-based UG medical education implemented w.e.f academic year 2019-20.
- Explain, comprehend and analyze the basics of Cellular and Molecular Biochemistry, functional mechanisms of the biomolecules and their logistics in the human body in normal health and their deviations in the disease conditions. He/she should be able to integrate his/her cognition and skills to facilitate medical education for undergraduate, postgraduate, and allied health sciences students and for patient management.
- Demonstrate administrative, decision-making, group activity, teamwork, and leadership skills in (a) setting up a department in the medical institution and (b) diagnostic services in the hospital and managing them as a part of the healthcare team.
- Analyze, interpret and evaluate laboratory data and provide consultancy to the clinician for judicious use of lab tests, with appropriate interpretation whenever needed, to facilitate the diagnosis, treatment, follow-up, and overall management of patients.
- Conduct research and related activities in the field of Biochemistry, Clinical Biochemistry, Molecular diagnostics, and Medical Education.
- Analyze, interpret, evaluate, appraise and present research-related data and publications to identify the best clinical evidence for research and demonstrate his/her competence in scientific /clinical work presentation.
- Describe the principles of evidence-based medicine, evidence-based practice, good laboratory practice, and good clinical practice.
- Communicate effectively to fellow colleagues, teachers, patients & their relatives and other healthcare members for providing services to the community.
- Actively participate in all the teaching-learning-related activities like CMEs/workshops/conferences/hands-on-training/Interdepartmental meets/clinical meetings and acquire interpersonal skills.

SUBJECT/DOMAIN-SPECIFIC COMPETENCIES

At the end of three years training course, the postgraduate student should be able to demonstrate the competencies under the following three domains:

A. Cognitive domain (Knowledge domain)

1. Describe the biochemical principles and mechanisms to define and explain a healthy, and a diseased state, and execute the application of the biochemical mechanisms in the perception, diagnosis, and treatment of a disease.
2. Describe the biomolecules and their importance in sustaining life processes.
3. Explain the concept of intermediary metabolism, energy transactions, and metabolic and molecular homeostasis in the sustenance of life.
4. Explain the characteristics, components, and functional significance of different metabolic pathways, their specific intermediates, their inter-conversions, pathway- specific, organ-specific, and interrelated regulation of metabolic pathways, and apply that in explaining the biochemical logic in the functioning of the body in health and disease.
5. Describe and apply the concept of nutrition in health and disease, and critically evaluate the role of essential micro- and macro-nutrients, and their interlinks with cellular metabolism.
6. Apply the integrated knowledge and understanding of biochemical principles and mechanisms in clinical problem-solving.
7. Demonstrate knowledge of genetic engineering in various fields of medicine.
8. Apply the principles of biostatistics in research, clinical laboratory practices, community-based health data collection, and epidemiological surveys.
9. Demonstrate knowledge of the establishment of a diagnostic laboratory and its accreditation process.
10. Analyze, interpret and evaluate biochemical laboratory findings in integration with the relevant clinical data to evaluate, analyze and monitor a disease state.
11. Apply the knowledge acquired in the basic principles of research methodology to develop a research protocol.
12. Make use of the latest available statistical tools for analyzing the research data, and interpreting and disseminating the results.
13. Demonstrate familiarity with the advances in artificial intelligence and computer-based modeling as and when required.
14. Describe and implement various components of the Competency-based UG Medical Education.
15. Apply the principles of teaching-learning technology while taking interactive classroom lectures, prepare modules for case-based learning (CBL) and problem-based learning (PBL), organize and conduct CBLs/PBLs, case discussions, small group discussions, seminars, journal clubs, and research presentations.
16. Explain the principles of instrumentation and their automation in the Biochemistry laboratory and demonstrate knowledge about the latest advances in technology.
17. Exhibit knowledge of professional ethics and integrity in his/her day-to-day conduct and services rendered.
18. Apply the updated knowledge to suggest and implement judicious use of clinical laboratory investigations.
19. Demonstrate knowledge on the use of laboratory gadgets and instruments taking⁴

necessary precautions.

20. Demonstrate knowledge on the preparation of solutions and reagents with necessary precautions as may be required for the estimations in experimental and diagnostic laboratories.
21. Display knowledge about recent advances and trends in the core subject area, research, and laboratory practice along with point-of-care testing (POCT) in the field of biochemistry.

B. Affective domain (Attitudes including Communication and Professionalism)

1. Communicate appropriately with peers, teachers, healthcare professionals, and patients coming from a variety of backgrounds to explain the molecular and metabolic basis of health and disease in integration with lifestyle management.
2. Demonstrate care, concern, respect, empathy, and compassion while dealing with patients and their relatives at any point of interaction.
3. Demonstrate progressive improvement in AETCOM in routine endeavors through self- assessment, feedback from the peers, stakeholders and adapting to relevant learning.
4. Explain effectively to the patients/their relatives the precautions and preparations needed for them to comply with for specific biochemical analysis/laboratory tests that they will be subjected to.
5. Ensure that the related technical staff is apprised of the above and is duly trained while dealing with the patients.
6. Apply ethical principles and display proper etiquette in dealing with patients, relatives, and other health personnel.
7. Demonstrate appropriate attitude and ethical behavior in exchanging feedback with peers, teachers, clinicians, patients, and their relatives.
8. Display ethical behavior, and personal and professional integrity in his/her conduct and services.
9. Demonstrate the ability to maintain confidentiality in declaring the laboratory results to the concerned personnel wherever applicable.
10. Display awareness and respect for the rights of the patients.
11. Demonstrate counseling skills, especially in the context of nutritional and genetic counseling.
12. Demonstrate competency in judicious decision-making free from personal beliefs/thoughts, pride, and prejudice and, that, no such limitations impact his/her professional performance.

C. Psychomotor domain

13. Demonstrate the principles and facts of cellular and molecular biochemistry by performing relevant laboratory exercises and analytical tests on body fluids, and other biologically important substances, along with documentation of the test

- procedures, results, and interpretation of findings.
14. Develop a differential diagnosis, wherever applicable, based on the results obtained after performing the requisite tests.
 15. Plan & conduct lectures, practical demonstrations, tutorial classes, and case-based or problem-based small group discussions for undergraduate students of medical and allied disciplines.
 16. Identify, select and perform various biochemical tests in the clinical laboratory which are useful in the diagnosis, treatment, follow-up, and overall management of diseases and be able to interpret the results of such tests.
 17. Perform relevant biochemical, immunological, and molecular biology techniques, wherever applicable.
 18. Demonstrate compliance with the standard operating procedures of various methods and techniques used in a clinical biochemistry laboratory.
 19. Perform enzymatic assays and conduct experiments to study enzyme kinetics affirming the ability to discuss, interpret and document the related data.
 20. Perform routine investigations in hematology and microbiology, as and when required.
 21. Demonstrate presentation skills at academic meetings and scientific paper writing skills.
 22. Prepare research protocols and conduct relevant experimental studies.
 23. Analyze and solve clinical and experimental problems.

By the end of the course, the postgraduate student should be able to demonstrate his competency in performing the following procedures independently:

- Demonstrate the use of all the routine glassware/equipment used in UG teaching-learning in Biochemistry (as per MSR) and advanced instruments used in the clinical laboratory attached to the respective hospital for patient care.
- Preparation of buffers, normal laboratory solutions like molar/molal/normal and reagents with validation.
- Perform all the undergraduate practicals as per the new competency-based medical education prescribed by NMV
- Perform experiments to study selected reactions of carbohydrates, amino acids and proteins, and lipids.
- Perform experiments to demonstrate constituents of milk.
- Perform experiments to demonstrate normal and abnormal constituents of urine.
- Perform Paper chromatography for separation of amino acids.
- Determination of enzyme activity and study of enzyme kinetics, using any two suitable enzymes (e.g., alkaline phosphatase from any liver tissue or acid phosphatase from potatoes).
- Plot standard curve for different estimations.
- Estimate (including calibration) and interpret clinical analytes as detailed below:
 - Blood glucose, glycated hemoglobin, the performance of glucose tolerance test and glucose challenge test,
 - Total protein, albumin, and A:G ratio,

- Electrolytes, arterial blood gas analysis,
- Cholesterol, triglycerides, free fatty acids, low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), phospholipids, Lp(a), and calculated parameters under lipid profile,
- Amylase, lipase,
- Urea, creatinine, uric acid, urinary microalbumin,
- Parameters of liver function tests (bilirubin, hepato-biliary enzymes such as AST, ALT, ALP, GGT, serum proteins/albumin and prothrombin time, CRP),
- Calcium, magnesium, phosphorus, copper (and ceruloplasmin), serum iron, TIBC, and ferritin,
- Markers of myocardial damage (CK, CK-MB, troponins, LDH),
- Vitamin D, B₁₂, and folate,
- Point-of-care testing (POCT).
- Electrophoresis of serum proteins, lipoproteins,
- Separation and molecular weight determination of proteins by SDS-PAGE,
- Electrophoretic separation of LDH isozymes or any other isoenzymes,
- Hb electrophoresis,
- Renal clearance tests,
- CSF and other body fluid analysis,
- Stone analysis,
- Thyroid function tests, Tumor markers, and relevant hormone assays by ELISA/RIA/Chemiluminescence.

Clinical Laboratory

- Demonstrate familiarity with the essentials of a clinical laboratory setup, the working of autoanalyzer, data transfer, statistical considerations, authorizing and reporting results in an advanced clinical laboratory with an ability to enlist the possible sources of errors (pre-analytical, analytical and post-analytical), perform root cause analysis, and undertake corrective actions, and preventive actions (CAPA).
- Perform and demonstrate activities under total quality management (TQM) of the Laboratory:
 - a. Specimen collection, handling, processing, and storage of the sample.
 - b. Methods of standardization & calibration.
 - c. Methods of quality control, quality assurance, CAPA & assessment.
- Demonstrate ability to prepare and interpret a Levy-Jennings chart and plot inter-assay and intra-assay variation for any analyte estimated in the laboratory.
- Implementation and interpretation of Westgard rules followed by their CAPA, as required.
- Determination of reference values for any one parameter for the clinical laboratory.
- Perform inter-instrumental comparison for at least four parameters.
- Perform in-house calibration of pipettes, centrifuge, hot-air oven, thermometer, and thermo-hygrometer.

- Student should undergo internal auditor training as per ISO 15189:2012, NABL (optional).
- Able to prepare a lab quality manual and frame relevant Standard Operating Procedure (SOP) and Work Desk Instructions (WDI), for every procedure followed in a clinical lab.

Molecular laboratory techniques

The student should be able to perform the following:

- Isolation of genomic DNA from blood,
- Isolation of RNA, synthesis of cDNA by reverse transcription,
- PCR and Reverse transcriptase PCR (both conventional and real-time),
- Primer designing,
- Blotting techniques,
- Basic techniques and principles of protein/enzyme purification and determining homogeneity.

By the end of the course, the postgraduate student should be able to perform under supervision or, demonstrate familiarity with, as the case may be, the following procedures (at least any five):

1. Separation of peripheral blood leukocytes using relevant isolation technique,
2. Subcellular fractionation/marker enzymes for organelles to demonstrate fractionation and purity of the fraction,
3. Ultracentrifugation,
4. Isolation of plasmids,
5. Basic techniques and essentials in cell culture and establishing different cell culture facilities,
6. High-performance liquid chromatography (HPLC)/GC-MS/LC-MS,
7. Restriction fragment length polymorphism (RFLP),
8. Fluorescent in-situ hybridization (FISH),
9. DNA fingerprinting,
10. Immunodiffusion techniques,
11. Immuno-electrophoresis,
12. Therapeutic drug monitoring,
13. Flow cytometry,
14. Nephelometry,
15. HLA typing.

SYLLABUS

The course contents are outlined below:

A. Cognitive Domain

Paper I

Biomolecules, Principles of Biophysics and its biomedical importance, Cell biology, Fluid, electrolyte and acid-base balance, Analytical techniques and instrumentation, Biostatistics and research methodology, Basics of medical education in teaching and assessment of Biochemistry.

BIOMOLECULES

Ionization of water, the concept of acid and base, weak acids and bases, pH, pK, Henderson-Hasselbalch equation, buffer and buffering capacity.

Proteins:

- Classification, structure, properties and functions of amino acids and peptides, biologically important peptides,
- Classification, biological significance and structural organization of proteins,
- Structure-function relationship of proteins (haemoglobin, myoglobin, collagen and immunoglobulins),
- Fractionation, purification, structural analysis and characterization of proteins,
- Protein folding and its associated disorders,
- Protein denaturation,
- Protein degradation – lysosomal and proteosomal,
- Plasma proteins.

Carbohydrates:

- Classification, biomedical importance, functions, properties and reactions of carbohydrates,
- Structural aspects of monosaccharides, disaccharides and polysaccharides,
- Mucopolysaccharides/glycosaminoglycans, glycoproteins and glycolipids,
- Glycation, glycosylation and role of carbohydrates in blood group substances.

Lipids:

- Types, properties and biomedical importance of lipids,
- Fatty acids - nomenclature, classification, properties, reactions including essential fatty acids, polyunsaturated fatty acids and trans fatty acids,
- Mono, di- and triacylglycerols,
- Trans fats,
- Cholesterol - structure, properties and biomedical importance,
- Phospholipids – classification, properties, composition, and biomedical importance of various phospholipids,
- Glycolipids – classification, properties, composition, and biomedical importance,
- Lipoproteins – classification, properties, composition, and functions of various lipoproteins including the role of apoproteins, their importance in health and disease,

- Role of lipids in the structure and function of biological membranes,
- Structure, properties, and biomedical applications of micelles and liposomes.

Nucleotides and nucleic acids:

- Purine and pyrimidine bases in DNA and RNA,
- Nucleosides and nucleotides,
- Biologically important nucleotides (including synthetic analogs of purine/pyrimidine bases and nucleosides used as therapeutic agents),
- Structure, functions, properties, and types of DNA and RNA.

PRINCIPLES OF BIOPHYSICS AND ITS BIOMEDICAL IMPORTANCE

- Diffusion, osmosis, dialysis, surface tension, viscosity, colloids, crystalloids, and suspensions.

CELL BIOLOGY

- Structural organization and functions of a biological cell and different subcellular organelles along with their marker enzymes,
- Molecular organization, functions, and structure-function relationship of a cell membrane,
- Solute transport across biological membranes with related disorders,
- Cell fractionation and separation of organelles,
- Disorders related to cell membrane and subcellular organelles,
- Intracellular traffic and sorting of proteins,
- Intracellular signaling pathways, membrane receptors and second messenger,
- Intercellular junctions, cellular adhesion molecules, intercellular signaling and communication,
- Extracellular matrix: composition, and biomedical importance,
- Components of the cytoskeleton, and their role in muscle contraction and cell motility,
- Cell cycle, its regulation, and mechanism of cell death,
- Structure and functions of specialized cells.

FLUID, ELECTROLYTE, AND ACID-BASE BALANCE

- Fluid, electrolyte, and acid-base balance, mechanism of regulation and associated disorders.

ANALYTICAL TECHNIQUES AND INSTRUMENTATION

- Colorimetry
- Spectrophotometry
- Atomic absorption spectrophotometry
- Flame photometry

- Fluorometry
- Turbidimetry and nephelometry
- Gravimetry
- Electrochemistry (pH electrodes, ion-selective electrodes, gas-sensing electrodes, enzyme electrodes)
- Chemical sensors (biosensors)
- Osmometry
- Chemiluminescence
- Water quality testing (TDS, pH, fluoride) for autoanalyzer
- Electrophoresis (principle, types, applications; isoelectric focusing, capillary electrophoresis; 2-D electrophoresis)
- Chromatography [principle, types (including high-performance liquid chromatography and gas chromatography)]
- Mass spectrometry
- Immunochemical techniques
- Techniques in molecular biology
- Nanotechnology and microfabrication
- Techniques to study *in vivo* metabolism (NMR, SPECT, PET scan, etc.)
- Radioisotope-based-techniques and their applications (permissions, precautions, management of radioactive waste)
- Automation
- Point-of-care testing

BIOSTATISTICS AND RESEARCH METHODOLOGY

- Basic concepts of biostatistics as applied to health science,
- Statistical tests: t-test, analysis of variance, chi-square test, non-parametric tests, correlation and regression,
- Statistical methods of validation of diagnostic tests,
- Types of study designs and sampling methodologies,
- Meta-analysis and systematic reviews,
- Planning and management of research,
- Electronic search of the literature,
- Ethical aspects related to research and publication,
- Brief introduction of software for data analysis,
- Essentials of intellectual property rights, patents and copyrights.

BASICS OF MEDICAL EDUCATION IN TEACHING-LEARNING AND ASSESSMENT OF BIOCHEMISTRY

- Group dynamics,
- Principles of adult learning, the taxonomy of learning,
- Curriculum planning,
- Educational objectives,
- Developing a lesson plan (appropriate to the objective and teaching learning method),
- Interactive and innovative teaching methods for large and small groups,
- Use of appropriate media (for a learning session),
- Principles of self-directed learning and giving feedback,
- Framing appropriate essay questions, short answer questions and multiple-choice questions,
- Item analysis and preparation of question bank,
- Principles and types of assessment,
- Methods of assessing cognitive skills, psychomotor skills, communication skills, and professionalism (including viva voice and OSPE),
- Developing a plan for internal assessment and formative assessment,
- Preparation of blueprint and setting of question paper,
- Microteaching,
- Reflection writing.

Paper II

Enzymes, Bioenergetics, Biological oxidation, Intermediary metabolism and inborn errors of metabolism, Nutrition, Vitamins and Minerals, Detoxification and metabolism of xenobiotics, Free radicals and anti-oxidant defense systems

ENZYMES

- Properties, classification, mechanism of action, coenzymes and cofactors, proenzymes, ribozymes, nanozymes, catalytic antibodies,

- Factors affecting the rate of enzyme-catalyzed reaction,
- Kinetics of enzyme activity, regulation of enzyme activity,
- Isoenzymes and isoforms, role in metabolic regulation,
- Enzyme inhibition,
- Principles of enzyme assays,
- Applications of enzymes: diagnostic, therapeutic and commercial uses of enzymes,
- Enzymes as targets for drug development.

BIOENERGETICS

- Basic concepts of thermodynamics and its laws, as applicable to living systems,
- Exergonic and endergonic reactions and coupled reactions, redox potential,
- High energy compounds,
- Enzymes of biological oxidation,
- Cytochromes.

BIOLOGICAL OXIDATION

- Components, complexes and functioning of the respiratory chain including inhibitors,
- Process and regulation of oxidative phosphorylation including uncouplers,
- Mechanisms of ATP synthesis and regulation,
- Mitochondrial transport systems and shuttles,
- Mitochondrial diseases.

INTERMEDIARY METABOLISM AND INBORN ERROR OF METABOLISM

Metabolism of carbohydrates:

- Digestion and absorption including associated disorders
- Glycolysis and TCA (Kreb's cycle), including regulation
- Glycogen metabolism and its regulation
- Cori cycle, gluconeogenesis and its regulation
- Metabolism of fructose and galactose and their clinical significance
- Pentose phosphate /HMP shunt pathway and uronic acid pathways and their clinical significance

- Polyol/sorbitol pathway
- Regulation of blood glucose, hyperglycemia, hypoglycemia and their clinical significance
- Glucose tolerance test and its interpretation
- Diabetes mellitus – classification, pathogenesis, metabolic derangements and complications, diagnostic criteria and laboratory investigations, principles of treatment (including diet and lifestyle modification)
- Inborn errors and disorders of carbohydrate metabolism.

Metabolism of Lipids:

- Digestion and absorption and associated disorders
- Metabolism of fatty acids, regulation and related disorders
- Metabolism of eicosanoids and their clinical significance
- Metabolism of triacylglycerol, storage and mobilization of fats
- Metabolism of adipose tissue and its regulation
- Metabolism of cholesterol including its transport and hypercholesterolemia
- Metabolism of lipoproteins, atherosclerosis, fatty liver and lipid profile
- Metabolism of methanol and ethanol
- Role of liver in lipid metabolism
- Metabolism of phospholipids and associated disorders
- Metabolism of glycolipids and associated disorders
- Inborn errors of lipid metabolism

Metabolism of amino acids and proteins:

- Digestion, absorption and associated disorders
- Deamination, transamination, disposal of the amino group, catabolism of the carbon skeleton of amino acids
- Formation and disposal of ammonia (including urea cycle) and related disorders and ammonia toxicity
- Metabolism of individual amino acids and associated disorders
- One carbon metabolism
- Biogenic amines
- Inborn errors of amino acid metabolism

Metabolism of nucleotides:

- Metabolism of purines and pyrimidines and their associated disorders.

Metabolism of haem:

- Metabolism of haem and associated disorders.

Inter organ and intra organ interrelationships and integration of metabolic pathways:

- Metabolic adaptation in starvation, diabetes mellitus, obesity, and during exercise.

NUTRITION

- Calorific value, Basal Metabolic Rate (BMR), Specific dynamic action (SDA) of food.
- Nutritional importance of proximate principles of food including sources and RDA.
- Glycemic index.
- Biological value of proteins and nitrogen balance.
- Thermogenic effect of food.
- General nutritional requirements.
- Balanced diet, diet formulations in health and disease, mixed diet.
- Calculation of energy requirements and prescribing diet.
- Nutritional supplements and parenteral nutrition.
- Food toxins and additives.
- Disorders of nutrition, obesity, protein energy malnutrition, under-nutrition and laboratory diagnosis of nutritional disorders.
- National Nutrition Programme.

VITAMINS AND MINERALS

- Structure, functions, sources, RDA, and metabolism of vitamins and minerals and their associated disorders.

DETOXIFICATION AND METABOLISM OF XENOBIOTICS

FREE RADICALS AND ANTI-OXIDANT DEFENSE SYSTEMS

- Detoxification: Phase –I reactions and Phase-II reactions: Oxidation, Hydroxylation, reduction, hydrolysis, Acetylation, Methylation, and Conjugation reactions - Glucuronic acid, Glutathione, Glycine.
- Xenobiotics and disease caused.
- Biotransformation
- Cytochrome P450 system

- Free radicals and anti-oxidant defense systems in the body.
- Associations of free radicals with disease processes.
- Oxygen toxicity.
- Oxidative stress markers in blood, urine, and other biological fluids.

Paper III:

Molecular biology, Molecular and genetic aspects of cancer, Immunology, and Environmental Biochemistry

MOLECULAR BIOLOGY

Structure and organization of chromosomes and chromatin re-modeling

DNA replication:

- DNA replication in prokaryotes and eukaryotes (including important differences between the two).
- End replication problem: Telomere, telomerase and their role in health and disease.
- DNA repair mechanisms and their associated disorders.
- Inhibitors of DNA replication and their clinical significance.
- DNA recombination.
- DNA protein interaction.

Transcription:

- Structure of a gene - exons and introns, promoter, enhancers/repressors and response elements.
- Process of transcription in prokaryotes and eukaryotes.
- Post-transcriptional modifications.
- Inhibitors of transcription.
- RNA editing and stability.

Genetic code, gene polymorphism, and mutation:

- Characteristics of the genetic code.
- Molecular basis of the degeneracy of the genetic code (Wobble hypothesis).
- Mutation and gene polymorphism.
- Mutagens- examples of physical, chemical, and biological mutagens.
- Types of mutations.
- Mutation in health and disease.

Translation:

- Basic structure of prokaryotic and eukaryotic ribosomes.
- Process of protein synthesis (translation) in prokaryotes and eukaryotes.
- Post-translational modifications.
- Protein sorting, protein targeting, protein folding and related disorders.
- Inhibitors of translation in prokaryotes and eukaryotes, and their clinical significance.

Regulation of gene expression in prokaryotes and eukaryotes

Recombinant DNA technology and its applications in modern medicine

Overview of human genome project

Basics of bioinformatics

Principles of human genetics:

- Alleles, genotypes and phenotypes.
- Patterns of inheritance: monogenic and polygenic inheritance.
- Population genetics.
- Genetic factors in causation of diseases.
- Types of genetic diseases: Chromosomal, monogenic and polygenic disorders, mitochondrial disorders, nucleotide repeat expansion disorders, imprinting disorders.
- Screening for genetic diseases and prenatal testing.
- Ethical and legal issues related to medical genetics.

Stem cells and regenerative medicine:

- Basic concepts regarding stem cells
- Types of stem cells: embryonic and induced pluripotent stem cells (IPSC)
- Application in regenerative medicine and disease therapeutics
- Ethical and legal issues related to use of stem cells in medicine.

MOLECULAR AND GENETIC ASPECTS OF CANCER

- Biochemical characteristics of a cancer cell
- Biochemistry of carcinogenesis
- Carcinogens
- Role of oncogenes and tumor suppressor genes
- Genetic alterations and adaptations in cancer
- Tumor markers, cancer risk assessment, and community screening
- Biochemical basis of cancer chemotherapy and drug resistance

- Anti-cancer therapy.

IMMUNOLOGY

- Organization and components of the immune system
- Innate and adaptive immunity- components and functions
- Antigens, immunogens, epitopes and haptens, carriers, adjuvants
- Immunoglobulin: structure, types, and functions
- Mechanism of antibody diversity: organization and expression of immunoglobulin genes, immunoglobulin gene rearrangement, class switching
- Humoral and cell-mediated immunity, regulation of immune responses, immune response to infections
- Major histocompatibility complex, antigen processing, and presentation
- Antigen-antibody interaction, immune effector mechanisms
- Complement system
- Hypersensitivity reactions
- Tolerance, autoimmunity
- Immunodeficiency, immune unresponsiveness, and their clinical implications
- Vaccines
- Immunology of chronic diseases
- Transplantation immunology
- Immunodiagnostics and immunotherapy.

ENVIRONMENTAL BIOCHEMISTRY

Health and pollution

Effects of environmental pollutants on the body

Paper IV

Basic principles and practice of clinical biochemistry, Biochemical analytes, Assessment of organ system functions, and Recent advances in biochemistry

BASIC PRINCIPLES AND PRACTICE OF CLINICAL BIOCHEMISTRY

- Units of measurement, reagents, clinical laboratory supplies, basic separation techniques, laboratory calculations, specimen collection, transport and processing, safety in the laboratory
- Essentials of clinical investigations in Biochemistry, the clinical utility of laboratory tests (including accuracy, precision, sensitivity, specificity, ROC curves, etc),¹⁸

analysis in the laboratory, and selection and evaluation of methods (including statistical techniques)

- Evidence-based laboratory medicine, establishment and use of reference values, pre-analytical, analytical, and post-analytical variables and biological variations, total quality management (TQM), clinical laboratory and hospital informatics, concepts and reporting of critical values.

BIOCHEMICAL ANALYTES

Biochemical analyses and their clinical significance:

- Amino acids, peptides and proteins; non-protein nitrogenous compounds
- Enzymes
- Carbohydrates
- Lipids, lipoproteins and apolipoproteins and other cardiovascular risk markers
- Electrolytes
- Blood gases and pH
- Hormones
- Catecholamines, serotonin, and other neurotransmitters
- Vitamins, minerals, trace and toxic elements
- Hemoglobin, and bilirubin
- Porphyrins
- Bone markers
- Tumour markers.

Body fluid analysis

Stone analysis

Therapeutic drug monitoring

Clinical toxicology

Pharmacogenomics

Pediatric and geriatric biochemical investigations

Biochemistry of aging

ASSESSMENT OF ORGAN SYSTEM FUNCTIONS

Hematopoietic disorders:

- Hemostasis and thrombosis-biochemical mechanism, related laboratory tests, antiplatelet therapy anticoagulant therapy, and fibrinolytic therapy
- Anemia- classification, etiology, laboratory investigations, and management
- Hemoglobinopathies - sickle cell anemia, methemoglobinemia, thalassemia syndromes
- RBC membrane, metabolism, inherited defects in RBC membrane, and enzymes

- ABO blood group system – the biochemical basis of incompatibility and transfusion biology
- Plasma cell disorders
- Other disorders of hematopoietic cells and their progenitors.

Endocrine system:

- Classification and general mechanism of action of hormones
- Biosynthesis, secretion, regulation, transport, and mode of action of hypothalamic peptides, adenohypophyseal and neurohypophyseal hormones, thyroid and parathyroid hormones, calcitonin, pancreatic hormones, adrenocortical and medullary hormones, gonadal hormones, gastrointestinal hormones, opioid peptides, parahormones
- Neuro-modulators and their mechanism of action and physiological significance
- Biochemical aspects of diagnosis and treatment of endocrinal disorders
- Endocrinology of conception, reproduction, and contraception
- Antenatal testing, newborn screening, and inborn errors of metabolism.

Cardiovascular system:

- Atherosclerosis - pathogenesis, risk factors, prevention and treatment
- Biochemistry of cardiac failure, acute coronary syndrome, cardiomyopathies, and cardiac arrhythmias
- Cardiac biomarkers.

Respiratory system:

- Pulmonary gaseous exchanges in health and disease
- Biochemistry of respiratory disorders.

Renal system:

- Biochemistry of kidney functions
- Pathophysiology, biochemistry, laboratory findings and management in acute and chronic kidney diseases
- Nephrolithiasis, biochemical aspects of renal stones
- Biochemistry of renal transplant.

Gastrointestinal system:

- Biochemistry of gastric functions
- Regulatory peptides in the gut

- Digestion and absorption of nutrients, evaluation of malabsorption
- Biochemical aspects of- Peptic ulcer diseases, Zollinger-Ellison syndrome, Celiac disease, Inflammatory bowel disease, Protein losing enteropathy and Neuroendocrine tumors.

Hepato-biliary and pancreatic system:

- Biochemistry of hepato-biliary and pancreatic functions
- Formation, composition and functions of bile
- Pathophysiology, biochemistry, laboratory findings and management in acute and chronic hepato- biliary and pancreatic disorders.

Skeletal system:

- Bone structure, metabolism, associated disorders and markers
- Bone mineral homeostasis.

Nervous system:

- Neurotransmitters and their receptors
- Ion channels and channelopathies
- Neurotrophic factors
- Infective and inflammatory diseases of nervous system (meningitis, encephalitis etc.)
- Protein aggregation, neurodegeneration and related disorders (Alzheimer's disease, Parkinson's disease, Huntington's disease, and others)
- Prions and prion diseases
- Ischemic and hemorrhagic neuro disorders
- Neuro-immune disorders (Guillain-Barre syndrome, Myasthenia gravis, multiple sclerosis and others)
- Pathophysiology and biochemistry of psychiatric disorders

■ *Recent advances in Biochemistry.*

TEACHING AND LEARNING METHODS

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skill oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as ~~2~~ full-time

(junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a logbook for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real-time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used. **The suggested examples of teaching-learning methods are given below but are not limited to these. The frequency of various below-mentioned teaching-learning methods can vary based on the subject's requirements, competencies, workload, and overall working schedule in the concerned subject.**

A. Lectures: Didactic lectures should be used sparingly. A minimum of 10 lectures per year in the concerned PG department is suggested. Topics to be selected as per subject requirements.

All postgraduate trainees will be required to attend these lectures. Lectures can cover topics such as:

1. Subject related important topics as per specialty requirement
2. Recent advances
3. Research methodology and biostatistics
4. Salient features of Undergraduate/Postgraduate medical curriculum
5. Teaching and assessment methodology.

Topic numbers 3,4,5 can be done during research methodology/biostatistics and medical education workshops in the institute.

B. Journal club: Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar: Minimum of once every 1-2 weeks is suggested.

Important topics should be selected as per subject requirements and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence- based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work / Bedside clinics: Minimum-once every 1-2 weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be used. Faculty from the department should participate in moderating the teaching-learning sessions during laboratory work.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main department and other department/s on topics of current/common interest or clinical cases.

G. a. Rotational clinical / community / institutional postings

Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions. The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based Guidelines.

Suggested departments and duration of rotational postings:

- General Medicine - 1 month (includes Endocrinology, Pediatrics, and ICU posting)
 - ✓ Endocrinology [Focus: Clinical correlation and important investigations related to diabetes mellitus and other diseases, dietary advice, point-of- care testing]
 - ✓ ICU/ICCU [Focus: ABG analysis and correlation, electrolyte imbalances, cardiac biomarkers and correlation, markers of septicemia and its management, basics of ventilation]
 - ✓ Pediatrics [Focus: Inborn errors of metabolism and other common diseases, nutritional disorders, and dietary advice]
- Hematology - 15 days
- Immunohematology and blood transfusion (Transfusion Medicine)/Blood bank - 15 days
- Microbiology- 15 days
- Medical Education Unit (MEU) or Department of Medical Education

(DOME)- one week/ shall attend a specific workshop or a training course [Focus: Principles of teaching-learning-assessment and other important aspects of Medical Education].

G. b. Posting under “District Residency Programme” (DRP):

All postgraduate students pursuing MD/MS in broad specialties in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in the District Hospital/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the Postgraduate program and the rotation shall be termed as “District Residency Programme” and the PG medical student undergoing training shall be termed as “District Resident”.

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

Opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with specialists/clinicians in different hospital settings must be scheduled to address antimicrobial resistance issues and strategies to deal with it.

H. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as a guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

I. Training in teaching skills

MEU/DOME should train PG students in education methodologies and

assessment techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

J. Log book

During the training period, the postgraduate student should maintain a logbook indicating the duration of the postings/work done in wards, OPDs, casualty, and other areas of the posting. This should indicate the procedures assisted and performed and the teaching sessions attended. The logbook entries must be done in real-time. The logbook is thus a record of various activities by the student like (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the logbook is to:

- a) help maintain a record of the work done during training,
- b) enable faculty/consultants to have direct information about the work done and intervene, if necessary,
- c) provide feedback and assess the progress of learning with experience gained periodically.

The logbook should be used in the internal assessment of the student, and should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce a completed log book in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in the logbook particularly of the critical incidents. Components of good teaching practices must be assessed in all academic activity conducted by the PG student and atleast two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the NMC (Erstwhile MCI) Logbook Guidelines uploaded on the website.

K. Course in Research Methodology:

All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

Other aspects

- The postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and

- conferences) at least once a year.
- Department shall encourage e-learning activities.
 - The postgraduate trainees should undergo training in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS).
 - The postgraduate trainees must undergo training in information technology and use of computers.

During the training program, patient safety is of paramount importance; therefore, relevant clinical skills are to be learned initially on the models, and later to be performed under supervision followed by independent performance. For this purpose, the provision of skills laboratories in medical colleges is mandatory.

ASSESSMENT

The assessment for postgraduate student in Biochemistry will be of two types; Formative and Summative

FORMATIVE ASSESSMENT

Formative assessment is the assessment conducted during the training with the primary purpose of providing feedback for improving learning. It should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning, and ability to practice in the system. The formative assessment will be used to determine the existing knowledge base and future needs, and identify priority areas.

General Principles

The Internal Assessment will include both theory and practical examination. It should be frequent, cover all domains of learning, and should be used to provide feedback to improve learning; it should also cover professionalism and communication skills.

Formative assessment during the MD training should be based on:

- Case presentation/case work up : once a week
 - The student will present a case from ward/lab along with investigations done in the clinical laboratory
- Laboratory performance : once a week

- The student will analyze an unknown sample on an autoanalyzer, starting with calibration, quality control of the machine, and then loading the sample. He/she will do the reporting and interpret the results and will be evaluated the next day.
- He/she will be evaluated separately for practicals listed in the undergraduate syllabus.
- He/she will be evaluated at the end of each postgraduate practical session as listed under the psychomotor domain.
- Journal club : once a quarter
 - The student will present and critically evaluate an original research article. The article should be preferably from outside his/her area of work so that he/she can learn newer techniques. The focus should be on understanding the research question and evaluating whether appropriate study design, methodology, and statistical tools were used to find answers to the same.
- Seminar : once a fortnight
 - The student will present a topic from the syllabus and will try to research and include recent advances on that topic. He/she will also present recent advances (not included in the syllabus) periodically.
- Micro-teaching : Once a week
 - The teaching skills of the student will be evaluated. Special topics can be given, and the student will teach that topic to the evaluators or he/she may be evaluated during pre-practical briefing of undergraduate students.
- Interdepartmental case or seminar : once in 3 months
 - This should be organized at the institute level and appropriate vertical and horizontal integration should be ensured.

Note: These sessions may be organized and recorded as an institutional activity for all postgraduates.

- AETCOM : Once in every six months
 - The postgraduate student can be evaluated during the AETCOM sessions of the undergraduates.
 - Case scenarios should be provided and the postgraduate will be asked to demonstrate how he/she will respond to the situation.
- Attendance at Scientific meetings, CME programme (at least 02 each during the course)

The student is to be assessed periodically as per categories listed in the appropriate (non-clinical/clinical) postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT

Assessment at the end of training to evaluate whether the student has acquired sufficient knowledge and skills to be awarded MD degree.

Essential pre-requisites for appearing for examination include:

1. Logbook of work done during the training period including rotational postings, departmental presentations, and reports of the internal assessment conducted during the training period should be submitted.
2. **At least two presentations at national-level conferences. One research paper should be under submission for publication/ accepted for publication/ published in an indexed journal.** (It is suggested that the local or University Review committee assess the work sent for publication).

The summative examination would be carried out as per the rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. The theory examination shall be held in advance before the clinical and practical examination so that the answer books can be assessed and evaluated before the commencement of the clinical/practical and oral examination.

Marks distribution shall be as follows:

Subject	Theory	Practical	Viva-Voce	Total
Biochemistry	400	300	100	800

The postgraduate examination shall be in three parts.

1. Dissertation

Dissertation shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A postgraduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory examination:

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and certify post-graduate student's level of knowledge, skill, and competence at the end of the training, as given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS.

Obtaining a minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing the examination as a whole. The examination for M.D./ M.S shall be held at the end of the 3rd academic year.

There shall be 4 theory papers each of three hours duration and each paper shall have TEN short essay questions of 10 marks (10x10=100).

Paper	Syllabus
Paper I	Biomolecules, Principles of Biophysics and its biomedical importance, Cell biology, Fluid, electrolyte and acid-base balance, Analytical techniques, and instrumentation, Biostatistics and research methodology, Basics of medical education in teaching and assessment of Biochemistry.
Paper II	Enzymes, Bioenergetics, Biological oxidation, Intermediary metabolism and inborn errors of metabolism, Nutrition, Vitamins and Minerals, Detoxification and metabolism of xenobiotics, Free radicals, and anti-oxidant defense systems
Paper III	Molecular biology, Molecular and genetic aspects of cancer, Immunology, and Environmental Biochemistry
Paper IV	Basic principles and practice of clinical biochemistry, Biochemical analytes, Assessment of organ system functions, and Recent advances in biochemistry

Questions on recent advances may be asked in any or all papers.

Note: The distribution of chapters / topics shown on the papers are suggestive only and may overlap or change.

3. Practical and oral/viva voce examination:

Practical examination: 300 marks

The practical examination should be spread over two days and include various major components of the syllabus focusing mainly on the psychomotor domain. One day should be for conducting practical examination including table viva that will focus on the nuances of laboratory techniques and quality assurance.

The practical examination should include:

One Clinical / Paper case: An unknown sample will be analyzed by the student, and he/she will have to prepare the report along with the interpretation of the same. It should include both serum and urine analysis. 100 marks **60 marks**

One practical exercise on any molecular biology technique. 40 marks

One practical exercise on immunology technique. 40 marks

OSPE: It shall be conducted on various topics which have not been covered in the above-mentioned practical and should include, if possible, evaluation of AETCOM (Attitude, Ethics, and Communication) skills of the students. 60 marks **100 marks**

Evaluation of laboratory management skills. 60 marks

Viva-voce Examination: 100 Marks

A. Thesis presentation: 40 marks

The ability of the student to justify the methodology, and findings with interpretation, should be evaluated. (Of about 15 mins duration)

B. Pedagogy Exercise: 20 marks (20 mins duration plus 10 mins for questions)

Micro-teaching: The essentials of classroom teaching skills should be evaluated. A topic would be given to each candidate along with the practical examination question paper on the first day. Student is asked to make a presentation on the topic on the second day for 20 minutes.

G. Grand Viva Voce: 40 marks

Viva voce on defined areas should be conducted by each examiner separately. The oral examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject focusing on the cognitive and affective domains.

VI. RECOMMENDED BOOKS (LATEST EDITIONS):

Sl.No	Name of the Textbook	Authors	Publishers
1.	Harrison's principles of internal medicine	Fauci, braunwald,kaper, haurer, longo, jameson,lascalgo	Mc Graw hill Companies
2.	Oxford Textbook of medicine	David A Warrell, Timothy Cox, John Firth	Oxford university press
3.	Harper's Review of Biochemistry	Murray.K.	Appleton & Lange
4.	Lehninger's Principles's of Biochemistry.	David L Nelson	CBS
5.	Biochemistry	Lubert Stryer	WH Freeman
6.	Text Book of Biochemistry with clinical correlations	Devlin TM	Wiley Liss
7.	Biochemistry	Voet D & Voet J	John Wiley & Sons
8.	Biochemistry A Functional approach	McGilvery RW	WB Saunders
9.	Medical Biochemistry	N V Bhagawan	Jones & Bartlett
10.	Biochemistry A case oriented Approach	Montgomery	C V Mosby
11.	Duncan's Diseases of Metabolism	Bondy	Academic press
12.	Molecular cell Biology	Harvey Lodish	W.H.Freeman & Company
13.	Clinical Biochemistry.	Latner	WB Saunders
14.	Practical Clinical Biochemistry	Varley	Heinemann Medical Books
15.	Teitz Text Book of Clinical Biochemistry	Burtis	WB Saunders

16.	Clinical Chemistry, Theory, Analysis & Correlation.	Kaplan	Academic Press
17.	Clinical Chemistry	Marshall	Churchill Livingstone
18.	Molecular Biology of THE CELL.	Bruce Alberts	Garland Science, New York
19.	Text Book of Biochemistry	West & Todd	Oxford & IBH
20.	Metabolic basis of inherited diseases..	Stab Bury	Churchill Livingstone
21.	Biochemistry.	APPS	WB Saunders
22.	Principles of Biochemistry.	Abrham White	Mac Graw Hill Inc.
23.	Clinical Chemistry	Henry	Churchill Livingstone
24.	Krauses Food, Nutrition & Diet Therapy.	L.Kathleen Mahan	WB Saunders
25.	Clinical Physiology of acid-base and electrolyte disorders.	Rose BD	McGraw Hill
26.	Clinical chemistry.Principles,Procedures & Correlations	M.L.Bishop	Lippincott
27.	The Principles & Practice of Diagnostic Enzymology	Henry Wilkinson	Arnold Publishers Ltd
28.	Text Book of Immunology. An Intoduction to immunochemistry & immunobiology.	James T. Barrett	C.V.Mosby.Compan y

VII. RECOMMENDED JOURNALS:

SI.No	Name of the Journal
1	Annual Review of Biochemistry.
2	Clinical Chemistry (J).
3	Trends in Biochemical Sciences.
4	Clinical Chemistry Reviews.
5	Medical Biochemistry (J).
6	Recent Advances in Endocrinology and Metabolism.
7	Recent Advances in Clinical Chemistry.
8	Essays in Biochemistry, Biochemical Society, UK.
9	Indian Journal of Clinical Biochemistry (J).
10	Indian Journal of Medical Research (J).

	assessments										
1.6	Self-directed Learning										
2	Work related to training										
2.1	Practical skills that are appropriate for the level of training										
2.2	Respect for processes and procedures in the work space										
2.3	Ability to work with other members of the team										

2.4	Participation and compliance with the quality improvement process at the work environment										
2.5	Ability to record and document work accurately and appropriate for level of training										
3	Professional attributes										
3.1	Responsibility and Accountability										

3.2	Contribution to growth of learning of the Team										
3.3	Conduct that is ethically appropriate and respectful at all times										
4	Space for additional comments										
5	Disposition										
	Has this assessment pattern been discussed with the trainee?	Yes	No								
	If not explain.										
	Name and Signature of the assessee										
	Name and Signature of the assessor										
	Date										

**COMPETENCY BASED
POSTGRADUATE TRAINING
PROGRAMME FOR
MD IN PHYSIOLOGY**

Preamble

The purpose of postgraduate medical education in Physiology is to produce experts with necessary knowledge, skills and attitude to function as competent physiologists who actively contribute towards growth of the subject through research and intellectual contribution, participate in the training of budding health professionals, participate meaningfully in patient care and lifestyle disorders, stay abreast with the advancements in the field and serve the community at large. Physiology being the basis of entire practice of Medicine, a postgraduate in Physiology needs to acquire all necessary competencies that would enable him or her to function efficiently in domains of preclinical, para- clinical and clinical sciences.

The purpose of this document is to provide teachers and learners illustrative guidelines to achieve defined outcomes. The Expert group of the National Medical Commission has endeavored to render uniformity without compromise to purpose and content of this document. The revision within the document are mainly aimed to introduce competencies that ensure application of Physiology beyond preclinical boundaries and thereby improve health outcomes, embrace research and pedagogy as a vital part of training and reduce redundancy of contents. This document envisions a competent Physiologist who performs the roles of a Medical Teacher, Researcher, Member of Health Care Team (Clinical Physiologist), Administrator and Life Long learner with equal zeal and efficiency.

SUBJECT SPECIFIC LEARNING OBJECTIVES

Goal:

The goal is to have uniform standards in the teaching of Physiology at the postgraduate level throughout the country. The guidelines will help in achieving such standards which will ensure availability of competent physiologists equipped with required skills for teaching, patient care (diagnostic, therapeutic and rehabilitative) and applied research.

Learning Objectives

A postgraduate student having qualified for the MD (Physiology) examination should be able to:

1. Achieve comprehensive knowledge of general, systemic and applied Physiology.
2. Teach effectively the basic physiological mechanisms of human body in the context of pathophysiological basis of evolution, clinical presentation and management of disease states to undergraduate and postgraduate medical, dental and paramedical courses.
3. Acquire in-depth knowledge of physiology while catering to the learning needs of specific courses such as sports physiology, speech pathology etc.
4. Understand general principles of medical education (use of appropriate teaching techniques and resources) and apply theoretical frameworks in pedagogy.
5. Interpret and evaluate research publications critically.
6. Conduct research in core physiology, applied physiology and Education which may have significant application towards improving health, patient care and student learning.
7. Generate credible evidence towards advancement of Physiology and its application in basic and applied significance.
8. Acquire skills in conducting collaborative research in the field of physiology with allied sciences, clinical sciences and biomedical engineering.
9. Explain how the knowledge of physiology can be effectively applied in diagnostic and therapeutic clinical settings.
10. Integrate physiology with Diagnostic, Therapeutic, Preventive and Rehabilitative Medicine.
11. Interact with the allied departments and render services in advanced laboratory investigations.

12. Interact effectively with other paraclinical, clinical and allied health sciences departments to develop integrated modules in basic sciences and teach competencies related to the same.
13. Acquire administrative skills to set up concerned department / laboratories and initiate purchase procedures and procure necessary items for running such laboratories.
14. Be an efficient Leader and member of academic, research and health care team.
15. Participate actively in various workshops/seminars/journal clubs of allied subjects to acquire various skills for collaborative research.

SUBJECT SPECIFIC COMPETENCIES

At the end of the course, the postgraduate student should be able to:

A. Predominant in Cognitive Domain

1. Demonstrate in-depth understanding of basic physiological concepts, their clinical applications and physiological demands in special circumstances such as sports, environmental changes, yoga, meditation etc.
2. Demonstrate comprehensive knowledge of physiology of specific organ systems to cater to the learning needs of specialized courses such as speech pathology, kinesiology, aerospace physiology etc.
3. Impart knowledge about the basic physiological mechanisms of human body with reference to their implications in the pathophysiology of disease and the physiologic basis of their management to undergraduate medical and paramedical students.
4. Demonstrate knowledge of integrated study of basic sciences as per the needs of current CBME.
5. Demonstrate higher order thinking and problem-solving skills to exhibit interactive teaching techniques and facilitate contextual study of physiology in various teaching learning sessions.

6. Demonstrate knowledge and ability to participate in the present student centric TL strategies of CBME such as ECE, SDL, AETCOM and AITo (Aligned and Integrated Topic).
7. Demonstrate knowledge of the current assessment practices in undergraduate CBME such as DOAP.
8. Demonstrate knowledge of research methodologies and statistics.
9. Conduct such clinical and experimental research, as would have a significant bearing on human health and patient care.
10. Incubate ideas and contribute towards generation of patents and copyrights related to the subject.
11. Interact with other departments by rendering services in advanced laboratory investigations and relevant expert opinion.
12. Participate actively in various workshops/seminars/journal clubs/demonstration in the allied departments, to acquire various skills for collaborative research.
13. Contribute to society by imparting physiological understanding of health problems. Disseminate knowledge of human physiology, the clinical applications and research as per the needs or specific demands of the society at large.
14. Outline the components of a basic physiology curriculum, demonstrate ability to develop or implement the same in future academic career.
15. Serve as interface with society at large.

B Predominant in Affective domain

At the end of the course, the postgraduate student should be able to:

1. Demonstrate responsibility, professionalism and ethical conduct in all professional undertakings.
2. Demonstrate ethical conduct in biomedical or animal research.

3. Follow ethical guidelines with regards to research and publications.
4. Demonstrate appropriate behavior of not letting his/her personal beliefs, prejudices and limitations come in the way of duty.
5. Display principles of integrity and social accountability as a teacher.
6. Appreciate the issues of equity and social accountability while exposing students to early clinical exposure (Equity and social accountability).
7. Mentor/ counsel students to facilitate their holistic development.
8. Communicate effectively with peers, students and teachers in various curricular [teaching-learning, research] activities.
9. Function effectively as a member of the department, professional bodies and maintain professional conduct in interactions with students, peers, patient and staff.
10. Demonstrate the ability to give effective student feedback to undergraduate students.
11. Demonstrate the ability to receive feedback from teachers and peers.
12. Develop the capacity to reflect on own academic progress, develop self- directed learning skills and assess own learning needs.

C. Predominant in Psychomotor Domain

The postgraduate student should acquire practical competencies in the following tasks:

At the end of the course the postgraduate student should be able to

1. Demonstrate physiological concepts of various organ systems by performing amphibian experiments using simulated models
2. Demonstrate physiological concepts of specific organ systems by performing mammalian experiments using simulated models.
3. Perform and interpret a complete hematological profile
4. Perform clinical examination of various organ systems
5. Perform human experiments pertaining to specific organ systems and interpret results of the same

6. Perform human experiments related to physiological challenges such as exercise, yoga and meditation
7. Perform studies in stimulated environment - microgravity; high altitude; hot and cold environment.

Syllabus

Course contents:

A: Cognitive domain

Paper-I: *General and Cellular Physiology including Genetic Basis and Historical perspectives:*

1. Physiology of cell, various cellular mechanisms and genetic control mechanisms.
2. Various principles of Physics and Physical Chemistry involved in physiological phenomenon e.g. haemo-dynamics, bio-electrical potentials, body fluids, methods of measurements.
3. History of Physiology, Noebl laureates and discoveries.
4. Biostatistics, Biophysics, Biochemistry, Micro-anatomy.
5. Growth and Development including aging.

6. Excretion, pH, water and electrolyte balance.
7. Comparative Animal Physiology

Paper-II: *Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology.*

1. Blood and Immunity.
2. Cardiovascular System.
3. Respiratory System.
4. Gastro- Intestinal Tract (GIT) and dietary requirements.

Paper-III: *Systemic Physiology (system concerned with procreation, regulation and neural control)*

1. Nerve-Muscle Physiology including muscle mechanics
2. Endocrine Physiology
3. Nervous System (Central, peripheral and autonomic)
4. Special Senses
5. Reproduction & family planning/fetal & neonatal Physiology

Paper-IV: *Applied Physiology including recent advances*

1. Recent advances relevant to Physiology
2. Patho-physiology pertaining to systemic Physiology
3. Physiological basis of various clinical investigation tests

4. Interaction of human body in ambient environment- high altitude, space and deep sea
5. Exercise & Sports physiology
6. Transgender Physiology
7. Integrated Physiology
8. Yoga and Meditation
9. Social responsibilities of physiologists
10. Application of Artificial Intelligence in Physiology

B: Psychomotor domain:

A. The postgraduate student during the training period must PERFORM independently the following procedures:

i. Hematological profile

1. Estimation of hemoglobin
2. Determination of Total Erythrocyte (RBC) Count and RBC Indices (Blood Standards)
3. Determination of Total Leucocytes (WBC) Count : TLC
4. Preparation of a peripheral Blood Smear and Determination of Differential Leucocyte Count: DLC
5. Determination of Arneht Count
6. Determination of Bleeding Time (BT) and Clotting Time (CT)
7. Determination of Blood groups (A, B,O and Rh system)
8. Determination of Erythrocyte Sedimentation Rate (ESR) and Packed cell volume (PCV)
9. Determination of Osmotic Fragility of Red Blood Cells
10. Determination of Platelet Count
11. Determination of Reticulocyte Count

ii. Human Physiology

a. Clinical Physiology

1. Detailed clinical examination of various systems.

b. Nerve muscle physiology

1. Ergography and hand grip spring dynamography and study of human fatigue.
2. Recording of electromyography (EMG) and its application.
3. Recording of nerve conduction.

c. Cardiovascular system (CVS)

1. Clinical examination of CVS
2. Examination of arterial & venous pulses
3. Measurements of arterial blood pressure and effect of head-up/head-down tilt
4. Recording of 12 lead Electrocardiography (ECG) and its interpretation
5. Measurement of blood flow
6. Heart rate variability
7. Ambulatory Blood pressure monitoring

d. Respiratory system

1. Clinical examination of respiratory system.
2. Stethography – study of respiratory movements and effect of various factors.
3. Assessment of respiratory functions (spirometry, vitalography, and gas analysis).
5. Measurement of BMR.
6. Cardio pulmonary resuscitation (CPR) and Artificial respiration.

e. Gastrointestinal system:

1. Clinical examination of abdomen.

f. Integrative Physiology / Excretory system

1. Recording of body temperature/effect of exposure to cold and hot environment

g. Reproductive system

1. Determination of ovulation time by basal body temperature chart and pregnancy diagnostic test - Immunological Tests.
2. Semen analysis: sperm count, motility and sperm morphology.

h. Nervous System including Special senses

1. Clinical examination of the nervous system and its physiological basis.
2. Examination of higher mental functions.
3. Examination of cranial nerves.
4. Examination of sensory system.
5. Examination of motor system including reflexes.
6. Clinical examination of special senses:
 - (i) Smell and Taste
 - (ii) Test for hearing to differentiate deafness
 - (iii) Physiology of eye:
 - (a) Clinical examination of the eye and pupillary reflex
 - (b) Visual acuity
 - (c) Perimetry – mapping out of visual field and blind spot
 - (d) Accommodation
 - (e) Fundoscopy
 - (f) Colour vision and colour blindness
7. Reaction (visual and auditory) and reflex time.
8. Electroencephalography (EEG) and Polysomnography
9. Autonomic Nervous System (ANS) Testing.
10. **Neuro-electrodiagnostic techniques:** Nerve conduction study, Visual evoked potential (VEP), Brainstem auditory evoked potential (B.A.E.P), Somato-sensory evoked potential (SEP), Motor evoked potential (MEP).
11. Use of various test batteries for psychological evaluation of subject.

i. Sports Physiology

Tests for physical fitness: Cardio – respiratory responses to steady state exercise using:

- (i) Body Composition
- (ii) Conducting the Clinical Exercise Test
- (iii) Harvard step test
- (iv) Bicycle Ergometry
- (v) Treadmill test for determination of VO₂ max

j. Yoga and Meditation Physiology

- i. Physical, Mental and Emotional well being
- ii. Effect of yoga and pranayama on physiological parameters
- iii. Mindfulness
- iv. Concentration, anxiety and stress
- v. Counseling in health and diseases

k. Others

1. Construction of dietary chart for growing children, pregnant woman, elderly individuals, hypertensive patients, & diabetes mellitus patients.
2. Basic Life Support and Cardiac Life Support
3. Effective Digital presentation, medical photography, Good Clinical Practice, Humanities and Bioethics.

iii. Amphibian (Frog) Experiments

All animal experiments must be compliant with Government of India Regulations, notified from time to time). Experiments in Amphibian/Dog/Cat should be conducted by computer assisted simulation models/ facilities. Other experiments should be performed as permissible by CPCSEA guidelines.

Effect of temperature on simple muscle twitch.

1. Effect of two successive stimuli (of same strength) on skeletal muscle.
2. Effect of increasing strength of stimuli on skeletal muscle.
3. Effect of increasing frequency of stimuli on skeletal muscle (genesis of tetanus).

4. Effect of free load and after load on skeletal muscle.
5. Effect of repeated stimuli on skeletal muscle (study of phenomenon of Fatigue).
6. Study of isometric contraction in skeletal muscle.
7. Determination of conduction velocity of sciatic nerve and effect of variables on it.
8. Properties of cardiac muscle – Refractory period, All-or-None Law, extra-systole and compensatory pause, beneficial effect.
9. Regulation of Heart, Vagus dissection and effect of Vagal and WCL stimulation.
10. Effect of physiological and pharmacological variables on intact frog's heart.
11. Perfusion of isolated frog's heart-role of sodium, potassium, calcium ions and drugs.

B. The postgraduate student during the training period must ASSIST in the following procedures:

Human Physiology

i. Cardiovascular system (CVS)

- Cardiac TMT Holter Monitoring
- Collection and Assessment of Arterial blood gas

ii. Nervous System including Special senses

- Intra operative neuro monitoring (IONM)

C. The postgraduate student during the training period must OBSERVE the following procedures:

i. Hematological profile

- Determination of Absolute Eosinophil Count
- Study of Haemopoietic Cells present in the Bone Marrow
- Other high end hematological investigations (specify): Flow cytometry, Platelet functions, D Dimers, coagulation profile etc.

ii. Human Physiology

□ Cardiovascular system (CVS)

- Echocardiography
- Central venous line insertion, CVP monitoring

□ Respiratory system

- Introduction to working of continuous positive airway pressure and Bilevel positive airway pressure (CPAP & BiPAP) Therapy
 - Ventilator setting

□ Gastrointestinal system:

- GI Manometry

□ Reproductive system

- Ovulation study by using ultrasonography

□ Integrative Physiology / Excretory system

- Pressure and PH studies in esophagus, stomach, intestine and rectum

□ Others

- Genetic testing and introduction to procedural skills for clinical genetics/ prenatal diagnosis/ adult genetics - birth defects, genetic hematology, dysmorphology, skeletal dysplasia, neurological and

muscular disorders, primary immunodeficiency diseases, autoimmune and multi-factorial disorders, biology and genetics of cancer.

- Interaction of human body in ambient environment - high altitude, space and deep sea
- Exercise & Sports physiology
- Integrated Physiology
- Yoga and Meditation
- Social responsibilities of physiologists
- Application of Artificial Intelligence in Physiology

iii. Mammalian Experiments (Dog/Rabbit/Guinea pig/Rat/Mice)

- General management of mammalian experiments.
- Recording of heart rate, blood pressure and respiration and study the effects of various factors; drugs; asphyxia; occlusion of common carotid artery.
- Effect of stimulation of central and peripheral end of vagus on arterial blood pressure and respiration after vagotomy.
- Effect of stimulation and distension of carotid sinus on blood pressure and respiration.
- Effect of stimulation of splanchnic nerve.
- Effect of stimulation of peripheral somatic nerve (sciatic nerve).
- Study of hypovolemic shock and its reversal.
- Perfusion of isolated mammalian heart and study the effects of drugs and ions.

- Recording of Isolated Intestinal movement and tone and studying the effect of drugs and ions.
- Study of various stages of menstrual cycle, cervical smear and vaginal smear.

Departmental resources

1. Clinical Neurophysiology Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

- (i) Electroencephalography
- (ii) Evoked potential recording
- (iii) Electromyography
- (iv) Nerve conduction studies
- (v) Autonomic nervous system (ANS) testing
- (vi) Any other newer technology like Functional Near infrared spectroscopy (fNIRS), Intra operative neuro monitoring (IONM), polysomnography
- (vii) Diabetic neuropathy assessment kit
- (viii) Reaction time apparatus
- (ix) Electroretinography

2. Cardio-Respiratory Laboratory

The department should generate liaison with clinical department and provide routine services for health monitoring and diagnostics (disease).

- (i) Electrocardiography
- (ii) Blood-gas Analysis
- (iii) Computerized multifunctional spirometry
- (iv) Laboratory for measuring pulmonary diffusion capacity and functional residual capacity (FRC)

- (v) Whole-body plethysmography
- (vi) Laboratory for Blood flow measurements (Impedance plethysmograph/Laser flow meter/ Doppler flow meter)
- (vii) Ankle brachial pressure index/ Vascular Doppler

3. Exercise Physiology Laboratory

The department should generate liaison with sports authorities and clinical departments to provide services for testing and grading exercise and physical efficiency for health monitoring and diagnostics (disease). This should be done by using the following techniques:

- (i) Two step test exerciser
- (ii) Bicycle Ergometry
- (iii) Tread mill
- (iv) Respiratory gas analysis and measurement of basal metabolic rate (BMR)

4. Metabolic/Endocrinology/Reproductive Bio-medicine laboratory

This laboratory should perform various tests pertaining to gastrointestinal, renal, metabolic, endocrinal and reproductive bio-medicine. The department should generate liaison with clinical departments and provide routine services for health monitoring and diagnostics (disease).

1. Body Fat Analysis
2. Spectrophotometer
3. pH meter
4. Elisa Reader/Washer
5. Luminometer
6. Semi-autoanalyzer
7. Artificial reproductive techniques/ semen laboratory/ infertility laboratory

Post graduate students should be posted in the above laboratories and extend the required services on routine basis.

TEACHING AND LEARNING METHODS

General principles

Acquisition of competencies being the keystone of doctoral medical education, such training should be skills oriented. Learning in the program, essentially autonomous and self-directed, and emanating from academic and clinical work, shall also include assisted learning. The formal sessions are meant to supplement this core effort.

All students joining the postgraduate (PG) courses shall work as full-time (junior) residents during the period of training, attending not less than 80% of the training activity during the calendar year, and participating in all assignments and facets of the educational process. They shall maintain a log book for recording the training they have undergone, and details of the procedures done during laboratory and clinical postings in real time.

Teaching-Learning methods

This should include a judicious mix of demonstrations, symposia, journal clubs, clinical meetings, seminars, small group discussion, bed-side teaching, case-based learning, simulation-based teaching, self-directed learning, integrated learning, interdepartmental meetings and any other collaborative activity with the allied departments. Methods with exposure to the applied aspects of the subject relevant to basic/clinical sciences should also be used.

A. Lectures: Didactic lectures should be used sparingly. A minimum of 10 lectures per year in the concerned PG department is suggested. Topics to be selected as per subject requirements All postgraduate trainees will be required to attend these

lectures. Lectures can cover topics such as:

1. Subject related important topics as per specialty requirement
2. Recent advances
3. Research methodology and biostatistics
4. **Salient features of** Undergraduate/Postgraduate medical curriculum
5. Teaching and assessment methodology.

(Topic numbers 3, 4, 5 can be done during research methodology/biostatistics and medical education workshops in the institute.)

B. Journal club: Minimum of once in 1-2 weeks is suggested.

Topics will include presentation and critical appraisal of original research papers published in peer reviewed indexed journals. The presenter(s) shall be assessed by faculty and grades recorded in the logbook.

C. Student Seminar: Minimum of once every 1-2 weeks is suggested.

Important topics should be selected as per subject requirements and allotted for in-depth study by a postgraduate student. A teacher should be allocated for each seminar as faculty moderator to help the student prepare the topic well. It should aim at comprehensive evidence-based review of the topic. The student should be graded by the faculty and peers.

D. Student Symposium: Minimum of once every 3 months.

A broad topic of significance should be selected, and each part shall be dealt by one postgraduate student. A teacher moderator should be allocated for each symposium and moderator should track the growth of students. The symposium should aim at an evidence-based exhaustive review of the topic. All participating postgraduates should be graded by the faculty and peers.

E. Laboratory work / Bedside clinics: Minimum - once every 1-2 weeks.

Laboratory work/Clinics/bedside teaching should be coordinated and guided by faculty from the department. Various methods like DOAP (Demonstrate, Observe, Assist, Perform), simulations in skill lab, and case-based discussions etc. are to be

used. Faculty from the department should participate in moderating the teaching-learning sessions during clinical rounds.

F. Interdepartmental colloquium

Faculty and students must attend monthly meetings between the main Department and other department/s on topics of current/common interest or clinical cases.

G. a. Rotational clinical / community / institutional postings

- Depending on local institutional policy and the subject specialty needs, postgraduate trainees may be posted in relevant departments/ units/ institutions including Medical Education Unit (MEU) or Department of Medical Education (DOME). The aim would be to acquire more in-depth knowledge as applicable to the concerned specialty. Postings would be rotated between various units/departments and details to be included in the specialty-based Guidelines.
- **Clinical Postings:** Compulsory clinical postings in following departments must be undertaken as per specified number of days in table 1 depicted below:

Table 1: Plan of Clinical postings for MD Physiology

Pr of Ye ar	Department	Period of postin g	Focus areas
1 st year	Biochemistry	15 days	1. Auto & Semi auto Analyzer, Electrophoresis, Chromatography, RIA, Study of serum chemistry (proteins, Lipid, glucose, electrolytes, enzymes etc.) – 8 days 2. Constituents of normal and abnormal urine, liver function tests, Renal function tests, Gastric function tests – 7 days
I st year	Pharmacology	20 days	1. Animal House (to learn technique

			<p>of Animal Handling, Blood sampling, anesthesia, Euthanasia, effective</p> <p>Analgesia and infection control after</p>
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			<p>surgery. Study of Animal behavior like eating, drinking, locomotion, sexual activity etc.)</p> <p>2. Experimental Pharmacology lab to study ongoing animal experimental procedures including dissection for rat phrenic nerve hemidiaphragm and others – 10 days</p> <p>2. Study various guidelines related to ethical use of animals in experiments. To study preparation of different animal models and various tests to study physiological parameters. – 15 days</p>
I st year	Pathology	30 days	<p>1. Blood bank - Cross matching, blood Storage, Immunohistochemistry, Immunological tests – 15 days</p> <p>2. Central Lab. - Tests for bleeding & clotting disorders, study of Haemopoietic Cells present in the Bone Marrow – 10 days</p> <p>3. Semen analysis, determination of ovulation time by basal body temperature chart and pregnancy diagnostic tests – 5 days</p>
I st year	Microbiology	10 days	<p>1. Fluorescent microscopy, use of Elisa reader & Washer – 5 days</p> <p>2. Immuno-physiology and other facilities available in the dept. – 5</p>

			days
II nd year	Ophthalmology	15 days	<ol style="list-style-type: none"> 1. Direct and indirect Ophthalmoscopy, Retinoscopy – 8 days 2. Slit lamp microscopy, Tonometry, Pachymetry, Study of corneal topology, Optometry, Auto-refractometer – 7 days
II nd year	Tuberculosis & Chest Disease (Pulmonary Medicine)	15 days	<ol style="list-style-type: none"> 1. Whole body plethysmography – 8 days 2. Bronchoscopy & other facilities available in the dept. – 7 days
II nd year	ENT	15 days	<ol style="list-style-type: none"> 1. Audiometry – 7 days

			<ol style="list-style-type: none"> 2. Oto-rhino-laryngoscopy, direct and Indirect Laryngoscopy, BERA, BSAEP – 8 days
III rd year	General Medicine	20 days	<ol style="list-style-type: none"> 1. TMT, Holter analysis, ABG, ECG – 10 days 2. EMG, NCV – 10 days
III rd year	Psychiatry	10 days	<ol style="list-style-type: none"> 1. EEG 2. Biofeedback
III rd year	Casualty	15 Days	<ol style="list-style-type: none"> 1. To know basics of how to handle emergency 2. Minor procedures

Every posting should have its defined learning objectives. It is recommended that the departments draw up objectives and guidelines for every posting offered in conjunction with the collaborating department/s or unit/s. This will ensure that students acquire expected competencies and are not considered as an additional

helping hand for the department / unit in which they are posted. The PG student must be tagged along with those of other relevant departments for bedside case discussion/basic science exercises as needed, under the guidance of an assigned faculty.

G b. Posting under “District Residency Programme” (DRP):

All postgraduate students pursuing MD/MS in broad specialities in all Medical Colleges/Institutions shall undergo a compulsory rotation of three months in District Hospitals/District Health System as a part of the course curriculum, as per the Postgraduate Medical Education (Amendment) Regulations (2020). Such rotation shall take place in the 3rd or 4th or 5th semester of the postgraduate programme and the rotation shall be termed as “District Residency Programme” and the PG medical student undergoing training shall be termed as “District Resident”.

Opportunities to present and discuss infectious disease cases through bedside discussion and ward/grand rounds with specialists / clinicians in different hospital settings must be scheduled to address antimicrobial resistance issues and strategies to deal with it.

I. Teaching research skills

Writing a thesis should be used for inculcating research knowledge and skills. All postgraduate students shall conduct a research project of sufficient depth to be presented to the University as a postgraduate thesis under the supervision of an eligible faculty member of the department as guide and one or more co-guides who may be from the same or other departments.

In addition to the thesis project, every postgraduate trainee shall participate in at least one additional research project that may be started or already ongoing in the department. It is preferable that this project will be in an area different from the thesis work. For instance, if a clinical research project is taken up as thesis work, the additional project may deal with community/field/laboratory work. Diversity of knowledge and skills can thereby be reinforced.

J. Training in teaching skills

MEU/DOME should train PG students in education methodologies and assessment

techniques. The PG students shall conduct UG classes in various courses and a faculty shall observe and provide feedback on the teaching skills of the student.

K. Log book

During the training period, the postgraduate student should maintain a Log Book indicating the duration of the postings/work done in Wards, OPDs, Casualty and other areas of posting (as specified in table 1) . This should indicate the procedures assisted and performed and the teaching sessions attended. The log book entries must be done in real time. The log book is thus a record of various activities by the student like: (1) Overall participation & performance, (2) attendance, (3) participation in sessions, (4) record of completion of pre-determined activities, and (5) acquisition of selected competencies.

The purpose of the Log Book is to:

- a) help maintain a record of the work done during training,
- b) enable Faculty/Consultants to have direct information about the work done and intervene, if necessary,
- c) provide feedback and assess the progress of learning with experience gained periodically.
- d) The Log Book should be used in the internal assessment of the student, should be checked and assessed periodically by the faculty members imparting the training. The PG students will be required to produce completed log book in original at the time of final practical examination. It should be signed by the Head of the Department. A proficiency certificate from the Head of Department regarding the clinical competence and skillful performance of procedures by the student will be submitted by the PG student at the time of the examination.

The PG students shall be trained to reflect and record their reflections in log book particularly of the critical incidents. Components of good teaching practices must be

assessed in all academic activity conducted by the PG student and at least two sessions dedicated for assessment of teaching skills must be conducted every year of the PG program. The teaching faculty are referred to the MCI Logbook Guidelines uploaded on the Website.

L. Course in Research Methodology: All postgraduate students shall complete an online course in Research Methodology within six months of the commencement of the batch and generate the online certificate on successful completion of the course.

Other aspects

- The postgraduate trainees must participate in the teaching and training program of undergraduate students and interns attending the department.
- Trainees shall attend accredited scientific meetings (CME, symposia, and conferences) at least once a year.
- Department shall encourage e-learning activities.
- The postgraduate trainees should undergo training in Basic Cardiac Life Support (BCLS) and Advanced Cardiac Life Support (ACLS).
- The postgraduate trainees must undergo training in information technology and use of computers.

During the training program, patient safety is of paramount importance; therefore, relevant clinical skills are to be learnt initially on the models, later to be performed under supervision followed by independent performance.

ASSESSMENT

FORMATIVE ASSESSMENT, i.e. assessment to improve learning
Formative assessment should be continual and should assess medical knowledge, patient care, procedural & academic skills, interpersonal skills, professionalism, self-directed learning and ability to practice in the system.

General Principles

Internal Assessment should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

The Internal Assessment should be conducted in theory and practical/clinical examination, should be frequent, cover all domains of learning and used to provide feedback to improve learning; it should also cover professionalism and communication skills.

Quarterly assessment during the MD training should be based on:

- Case presentation, case work up,
case handling/management : once a week
- Laboratory performance : twice a week
- Journal club : once a week
- Seminar : once a fortnight
- Case discussions : once a fortnight/month
- Interdepartmental case or seminar : once a month

Note: These sessions may be organized and recorded as an institutional activity for all postgraduates.

- Attendance at Scientific meetings, CME programs (at least 02 each)

The student to be assessed periodically as per categories listed in appropriate (non-clinical/clinical) postgraduate student appraisal form (Annexure I).

SUMMATIVE ASSESSMENT, ie., assessment at the end of training

Essential pre-requisites for appearing for examination include:

1. **Log book** of work done during the training period including rotation postings, departmental presentations, and internal assessment reports should be submitted.
2. At least **two presentations** at national level conference. One research paper should be published / accepted in an indexed journal. (**Local or University Review committee assess the work sent for publication**).

The summative examination would be carried out as per the Rules given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. The theory

examination shall be held in advance before the Clinical and Practical examination, so that the answer books can be assessed and evaluated before the commencement of the clinical/Practical and Oral examination.

The postgraduate examination shall be in three parts:

1. Thesis

Thesis shall be submitted at least six months before the Theory and Clinical / Practical examination. The thesis shall be examined by a minimum of three examiners; one internal and two external examiners, who shall not be the examiners for Theory and Clinical examination. A postgraduate student in broad specialty shall be allowed to appear for the Theory and Practical/Clinical examination only after the acceptance of the Thesis by the examiners.

2. Theory examination

The examinations shall be organized on the basis of 'Grading' or 'Marking system' to evaluate and to certify postgraduate student's level of knowledge, skill and competence at the end of the training, as given in the latest POSTGRADUATE MEDICAL EDUCATION REGULATIONS. Obtaining a

minimum of 50% marks in 'Theory' as well as 'Practical' separately shall be mandatory for passing examination as a whole. The examination for M.D./ M.S shall be held at the end of 3rd academic year.

There shall be four theory papers (as per PG Regulations).

Paper I: Basic sciences as applied to the subject (General and Cellular

Physiology including Genetic basis and historical perspectives)

Paper II: Systemic Physiology (system providing transport, nutrition and energy) including comparative Physiology

Paper III: Systemic Physiology (system concerned with regulation, neural control and procreation)

Paper IV: Recent advances in the subject (including applied Physiology)

3. Practical/clinical and Oral/viva voce examination

Practical examination

Practical examination should be spread over **two** days and include various major components of the syllabus focusing mainly on the psychomotor domain.

Oral/Viva voce examination on defined areas should be conducted by each examiner separately. Oral examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject focusing on psychomotor and affective domain.

The practical examination should include:

- Case presentation pertaining to major systems
- Stations for clinical, procedural and communication skills
- Log Book Records and reports of day-to-day observation during the training
- It is emphasized that Oral/viva voce examination shall be comprehensive enough to test the postgraduate student's overall knowledge of the subject

Recommended Reading:

Books (latest edition)

1. A.C. Guyton – Text book of Medical Physiology
2. W.F. Ganong – Review of Medical Physiology

3. William's Textbook of Endocrinology
4. J.E. Cotes- Respiratory Physiology
5. D.T. Harris – Experimental Physiology
6. Wintrobe's – Clinical Hematology
7. Principles of medical physiology by Sircar
8. Brown B.L. – Cell signaling, Biology and medicine of signal transduction
9. Berne and Levy- Medical Physiology

10. Textbook of Medicine by Harrison
11. Principles of Neural sciences edited by E. R. Kandel, J. H. Schwartz and T. M. Jessell
12. Williams Hematology edi. by M.A. Lichtman, E. Beutler, K. Kaushansky, T.J. Kipps, U. Seligsohn, J. Prchal
13. Medical Physiology: by W. F. Boron and E. L. Boulpaep
14. Medical Physiology: by A. Rhodes and G. A. Tanner
15. Neuroscience : by Dale Purves

Practical Books:

1. Hutchison's Clinical Methods: An Integrated Approach to Clinical Practice.
2. Macleod's clinical Examination
3. Textbook of Practical Physiology: by Dr. G. K. Pal and Dr. Pravati Pal
4. Textbook of Practical Physiology: by Dr. C. L. Ghai
5. Textbook of Practical Physiology: by Dr. Ranade
6. Textbook of Practical Physiology: by Dr. A. K. Jain

Journals:

03-05 International Journals and 02 National (all indexed) journals

