

ANNEXURE II

Syllabus for NEB Examination (Medical) Standard 3 (for transfer to MBBS Year 3)

ANATOMY

Introduction to:

- History and disciplines of Anatomy
- Radiological, clinical and applied anatomy
- Terms and planes of Gross anatomy
- Developmental anatomy / embryology
- Anatomical positions

Overview of the Skeletal system

- Axial and appendicular skeleton
- Definition and Classification of bones
- Functions of bones
- Parts of a young and adult bone
- Ossification of bones
- Blood supply of bones
- Characteristics and classification of joints
- Characteristics features of a synovial joint
- Classification of synovial joints
- Movements at different joints

Introduction to the Muscular system

- Classification of muscles
- Structure of skeletal muscles
- Parts of a typical skeletal muscle
- Aponeurosis, tendons, bursae, ligaments and sheaths
- Blood supply and nerve supply of muscles

Introduction to the Nervous system

- Classification of nervous system

GENERAL HISTOLOGY

- Different types of microscopes
- Parts of a light microscope
- Structure of an animal cell

- Different organelles and surface projections of a cell
- Basic tissues
- Epithelium, its classification with examples
- Muscle tissue, its classification with examples
- Connective tissue, and structure of various general connective tissues
- Nervous tissue
- Applied anatomy
- Commonest clinical conditions related to each histological practical

GENERAL EMBRYOLOGY AND ASPECTS OF GENETICS

- Cell division and structure of DNA
- Principles of cytogenetics
- Structure of genes and relation to DNA
- Terms used in embryology
- Gametogenesis
- Fertilization, cleavage and implantation of embryo
- Molecular mechanisms involved in embryology
- Development in 2nd and 3rd week of intrauterine life
- Changes in embryo between 4th to 8th week
- Derivatives of germinal layers
- Overview of organogenesis from 3-9th month
- Twinning and teratology

Applied Embryology

- Genetic disorders
- Infertility
- Ectopic pregnancy
- Twinning, placental
- Abnormalities
- Abortion
- Anomalies of organogenesis and foetal period,
- Artificial insemination,
- IVF
- Common genetic malformations

REGIONAL/SYSTEMIC ANATOMY

Neuroanatomy

- Gross and surface anatomy of the skull and cervical vertebrae
- Parts of brain and spinal cord
- Limbic system

- Cranial nerve nuclei and peripheral distribution
- Ascending and descending tracts
- Spinal nerves
- Sensory, motor and autonomic nervous system
- Nerve lesions of cranial and somatic nerves
- Membranes or meninges of brain and spinal cord and dura venous sinuses
- Blood supply of nervous system and clinical manifestations related to blockage and rupture of blood vessels supplying the nervous system
- Cerebrospinal fluid (CSF) and ventricles
- Development of nervous system (normal and abnormal)
- Microscopic anatomy of CNS (nervous tissue, nerve, ganglion and different parts of brain spinal cord)
- Radiological anatomy (CT scan , MRI)
- Applied anatomy
- Meningitis, paralysis, peripheral nerve lesions

Development of the Nervous system

- Development of brain and spinal cord
- Development of peripheral and autonomic nerves
- Development of meninges and ventricles.

Applied anatomy

- Congenital anomalies of brain and spinal cord
- Genes, transcription factors, growth factors and signaling molecules involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors

Head and Neck

- Surface anatomy of head and neck
- Skull, cervical vertebrae and their joints
- Muscles and fasciae of scalp, face and neck with emphasis on organs of special senses (eye, ear, nose and tongue)
- Microscopic structure of cornea, sclera and retina
- Microscopic structure of internal ear (Cochlea)
- Emphasis must be given to applied histology related to clinical medicine and surgery
- Blood supply of head and neck (superficial and deep)
- Lymphatic drainage
- Oral cavity, pharynx, larynx, trachea and oesophagus, thyroid gland, triangles of neck
- Nerve supply (sensory and motor)
- Radiological anatomy

- Development of branchial apparatus including face, lips, nose, palate, tongue, skull and facial skeleton.

Applied Anatomy

- Cleft lip and palate
- Fontanelle
- Tracheo-esophageal fistula
- Thyroglossal cyst
- Genes, transcription factors, growth factors and signaling molecules
- involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors.
- peripheral nerve lesions of head and neck

Limbs: Upper limbs

- Surface anatomy
- Bones and joints
- Joint movements and related muscles
- Muscle compartments
- Muscles, aponeuroses, sheaths, ligaments , retinacula
- Blood supply
- Lymphatic drainage
- Nerve supply (sensory and motor) and nerve plexuses
- Histological features of skeletal muscles
- Microscopic structure of tendon, ligament and loose areolar tissue, and osseous tissue
- Histological structure of various types of cartilages

Applied anatomy

- Fractures of clavicle and other long bones
- Colle's fracture
- Frozen shoulder
- Rheumatoid arthritis and osteoarthritis
- Dislocation of shoulder joint
- Brachial plexus injuries

Lower limbs

- Surface anatomy
- Bones and joints
- Joint movements and related muscles
- Muscle compartments
- Muscles, aponeuroses, sheaths, ligaments , retinacula

- Blood supply
- Lymphatic drainage
- Nerve supply (sensory and motor) and nerve plexuses

Applied anatomy

- Inguinal and femoral hernias
- varicose veins
- fracture of lower limb bones and dislocations of joints
- motor and sensory loss
- paralysis of muscles
- Sprain, atrophy
- dystrophy and muscle spasms
- Common fractures
- osteomyelitis and osteoporosis
- dislocation
- subluxation
- frozen joints
- arthritis and injuries.

Development of the Musculoskeletal system

- Development of axial and appendicular skeleton
- Development of skeletal, smooth and cardiac muscles

Applied anatomy

- Common developmental anomalies of muscles and bones
- Genes, transcription factors, growth factors and signaling molecules involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors

Thorax

- Surface anatomy
- Ribs, thoracic vertebrae, sternum and their joints
- Muscles of thoracic cage and extrathoracic muscles attached to thorax
- Mechanism of respiration in context to chest wall muscles and diaphragm
- Blood supply
- Lymphatic drainage
- Mediastinum
- Thoraco-abdominal diaphragm
- Nerve supply (sensory and motor)

Applied anatomy

- Fractures of ribs and vertebrae
- Paralysis of diaphragm and intercostal muscles
- Pleurisy
- Hydrothorax
- Pneumothorax
- ischaemic heart disease
- myocardial infarction
- atrial and ventricular conduction defects.

Respiratory system (gross and microscopic anatomy)

- Nasal and respiratory mucosa
- Larynx (vocal folds)
- Pharynx
- Trachea
- Bronchi
- Lungs and pleural cavities
- Development of upper (nose, pharynx, larynx and trachea) and lower (lungs and bronchi) respiratory organs.

Applied anatomy

- Developmental abnormalities of nasal passage, trachea and lungs
- Genes, transcription factors, growth factors and signaling molecules involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors

Cardiovascular system (gross and microscopic anatomy)

- Pulmonary and systemic blood circulatory systems
- Arterial, venous and Portal blood circulatory systems
- Histological features of cardiac muscles, arterial and venous blood vessels
- Heart and Pericardium

Applied anatomy

- Atherosclerosis
- Varicose veins
- Aneurysms
- Angiography, anastomoses
- Development of heart and pericardium
- Major veins and arteries.

- Development of the foetal circulation and its changes at birth.

Applied anatomy

- Congenital anomalies of heart and vessels
- Genes, transcription factors, growth factors and signaling molecules involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors

Abdomen

- Digestive Systems (gross and microscopic anatomy)
- Surface anatomy of the abdomen
- Lumbar vertebrae
- Abdominal Wall: Anterolateral and posterior abdominal wall
- Abdominal and pelvic peritoneum
- Oral mucosa
- Gums
- Tongue
- Hard and soft palate
- Teeth
- Lips and oropharynx
- Salivary glands
- Abdominal viscera - oesophagus, stomach, duodenum, jejunum, ileum, colon, vermiform appendix, rectum, anal canal, liver and gall bladder, pancreas
- Blood supply of abdominal wall and viscera
- Lymphatic drainage of all abdominal
- Sensory, motor and autonomic nerve supply of abdomen
- Posterior abdominal wall and related structures
- Histological features of smooth muscles
- Radiological anatomy (with ultrasound U/S, computerized tomography CT scan, Barium studies)

Development of the Digestive System

- Development of diaphragm, body cavities and mesenteries
- Development of oesophagus, stomach, small and large intestines and anal canal
- Development of liver, pancreas and gall bladder
- Development of spleen

Applied anatomy

- Developmental defects of diaphragm
- Developmental defects of esophagus, intestines and other abdominal viscera

- Genes, transcription factors, growth factors and signalling molecules
- involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors.

Pelvis and Perineum

- Surface anatomy
- Bony pelvis (male and female)
- Muscles and fascia of pelvis and perineum
- Pelvic viscera
- Perineal regions and fossae

Applied Anatomy

- Rectal Prolapse
- Uterine prolapse
- Abscesses

Urinary system (gross and microscopic anatomy)

- Kidney
- Ureter
- Urinary bladder and urethra
- Development of the Urinary system: kidneys, urinary bladder and urethra

Applied anatomy

- Developmental abnormalities of kidneys, urinary bladder and urethra
- Genes, transcription factors, growth factors and signalling molecules involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors

Reproductive System:

Male (gross and microscopic anatomy)

- Scrotum
- Testes
- Genital ducts
- Seminal vesicles, prostate and bulbourethral glands, penis
- Development of the Male reproductive system: testes and genital ducts

Applied anatomy

- Undescended testicles
- Anomalies of testes and genital ducts
- Anomalies of external genitalia
- Genes, transcription factors, growth factors and signalling molecules involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors

Female (gross and microscopic anatomy)

- Ovaries
- Uterus and fallopian tubes
- Vagina
- Mammary gland
- Foetal membranes
- Placenta, umbilical cord and their anomalies

Development of the Female Reproductive System

- Development of ovaries
- Development of uterus and fallopian tubes
- Development of vagina
- Development of external genitalia

Applied anatomy

- Congenital anomalies of uterus, vagina
- Anomalies of external genitalia
- Undescended ovaries
- Genes, transcription factors, growth factors and signalling molecules involved in the development of all above mentioned organs and congenital anomalies related to mutations in genes and abnormal expression of the genetic factors

Endocrine system (gross and microscopic anatomy)

- Pituitary gland
- Thyroid and parathyroid glands
- Suprarenal glands
- Endocrine part of pancreas
- Enteroendocrine system
- Development of organs/ tissue of endocrine system

Immune system (gross and microscopic anatomy)

- Organization and components of lymphatic system
- Features of lymphatic vessels, Lymph node, Tonsils, Thymus, Spleen, GALT and MALT
- Development of lymphatic vessels, Lymph node, Tonsils, Thymus and Spleen

Applied anatomy

- Oedema, ascites
- lymphangitis
- lymphadenopathy

Integumentary system

- Structure and types of skin, nails and hair.
- Histological structure of thin and thick skin
- Receptors, cutaneous blood and nerve supply
- Superficial and deep fasciae

Applied anatomy

- Acute and chronic skin diseases
- congenital disorders of integument

PHYSIOLOGY

Cell and General Physiology

- Functional organization of human body
- Homeostasis
- Control systems in the body
- Cell membrane and its functions
- Intercellular Connections
- Cell organelles
- Transport through cell membrane
- Membrane transport including active transport, passive transport, simple and facilitated diffusion
- Types of particles in solution
- Importance of selectively permeable membranes, osmosis and osmotic pressure, surface tension, viscosity also in relation to body fluids
- Facilitated diffusion

Clinical/Applied Concepts

- Failure of homeostasis (Illness)
- Abnormalities of the cell and its organelles (apoptosis, mutation, cancer and aging)

Blood

- Composition and functions
- Plasma proteins: albumin, globulin fibrinogen, and their functions
- Red blood cells (Erythropoiesis)
- Haemoglobin and blood indices, iron metabolism, fate of haemoglobin.
- White blood cells, Leucopoiesis, functions
- Platelets
- Haemostasis, clotting factors, anticoagulants
- Blood groups, Blood transfusion and complications
- Reticuloendothelial system – Spleen

Clinical/Applied Concepts

- Anaemia and its types
- Blood indices in various disorders Thalassemia
- Leucopaenia Leucocytosis, leukaemia, AIDS, allergy, vaccination
- Thrombocytopenia
- Clotting disorders (haemophilia etc.)
- Blood grouping/cross matching and significance

Nerve and muscle

- The neuron-structure and functions
- Properties of nerve fibres
- Physiology of action potential including compound action potentials
- Conduction of nerve impulse, nerve degeneration and regeneration
- Synapses
- Types of muscle, functions
- Skeletal muscle contraction
- Isometric and isotonic contraction
- Smooth muscle contraction
- Neuromuscular junction
- Excitation-contraction coupling
- Motor unit
- Neuromuscular junction blockers

Clinical/Applied Concepts

- Nerve conduction studies
- Electromyograms (EMG)
- Nerve injury
- Rigor mortis and contractures
- Myasthenia gravis
- Myopathies/Neuropathies

Cardiovascular system

- Introduction to heart and circulation
- Properties of cardiac muscle
- Action potential in atrial and ventricular muscle and pace-maker potential
- Artificial pacemaker
- Cardiac impulse- origin and propagation
- Cardiac cycle Regulation of cardiac functions
- ECG-recording and interpretation
- Arrhythmias- mechanism of development
- Functional types of blood vessels
- Haemodynamics of blood flow
- Local control of blood flow
- Systemic circulation - basic principles/characteristics and control
- Cardiac output (regulation/measurement) peripheral resistance and its regulation
- Arterial pulse
- Arterial blood pressure (short/long term regulation)
- Heart sounds/murmurs
- Venous return and its regulation
- Coronary circulation
- Splanchnic circulation
- Cerebral circulation
- Cutaneous circulation- Triple response
- Foetal circulation and readjustments at birth
- Cardiovascular changes during exercise

Clinical/Applied Concepts

- Correlation of cardiac cycle with Electrocardiogram (ECG) and heart sounds
Echocardiogram
- Significance of apex beat / abnormalities
- ECG interpretation in cardiac muscle abnormalities and cardiac arrhythmias
- Flutter, fibrillation, ectopic beats
- Conduction defects

- Radial/other pulses
- Hypertension, types and effects
- Clinical evaluation of heart sounds and murmurs
- Jugular venous pulse
- Ischemic heart disease
- Cerebrovascular accidents
- Types of heart failure and circulatory shock

Respiratory system

- Organization/functions of respiratory tract
- Functions of lungs (respiratory and non-respiratory)
- Mechanics of breathing, pulmonary pressure changes
- Surfactant and compliance
- Protective reflexes
- Lung volumes and capacities
- Dead spaces
- Diffusion of gases (gas laws, composition)
- Pulmonary Circulation Ventilation / perfusion
- Transport of O₂ in blood O₂/CO₂ disassociation curves
- Transport of CO₂ in blood
- Regulation of respiration (nervous/chemical)
- Abnormal breathing
- Hypoxia-types and effects
- Physiology of cyanosis
- Physiology of high altitude, space, deep sea diving
- Oxygen debt
- Respiratory changes during exercise

Clinical/Applied Concepts

- Examination of chest
- Types of respiration (intrapleural pressure, pneumothorax, effusion)
- Atelectasis
- Lung function tests (Spirometry)
- Sneezing, yawning, cough
- Obstructive / Restrictive lung disease (FEV₁/FVC)
- Abnormal Ventilation / Perfusion
- Respiratory failure: Types I & II
- Asphyxia
- Hypoxia, cyanosis, dyspnoea, hypo- and hypercapnoea
- Artificial respiration
- Oxygen therapy and its toxicity

- Caisson's disease

Body fluids and kidneys

- Compartments of body fluids and measurement
- Tissue and lymph fluids
- Fluid excess / depletion
- Structure of kidney / nephron
- General functions of kidney
- GFR-factors regulating
- Formation of urine, filtration, reabsorption, secretion
- Plasma clearance
- Concentration and dilution of urine
- Electrolyte balance
- Water balance
- Regulation of blood pressure by kidneys
- Hormones of kidneys
- Acidification of urine
- Acid-Base balance
- Micturition

Clinical/Applied Concepts

- Renal function tests
- Renal failure/uraemia
- Nephrotic syndrome
- Artificial kidney/haemodialysis
- Metabolic acidosis/alkalosis
- Abnormalities of micturition including incontinence

Gastrointestinal tract (GIT)

- Different parts of the GIT and their functions
- Enteric nervous system (gut, brain)
- Mastication, swallowing and their control
- Functions and movements of stomach Functions of pancreas
- Functions and movements of small intestine
- Functions and movements of large intestine
- Hormones of GIT
- Vomiting and its pathway
- Defecation and its pathway Regulation of feeding and energy expenditure
- Functions of liver/gall bladder

Clinical/Applied Concepts

- Dysphagia, achalasia of oesophagus
- Examination of abdomen, peptic ulcer, pancreatitis
- Gastric function tests
- Vomiting and its effects
- Diarrhoea, constipation
- Jaundice, liver functions tests

Nervous system

- Organization of nervous system
- Classification of nerve fibres
- Properties of synaptic transmission
- Neurotransmitters and neuropeptides
- Types and function of sensory receptors
- Functions of spinal cord and tracts
- Reflex action/reflexes
- Muscle spindle/muscle tone
- Tactile, temperature and pain sensations Structure of cerebral cortex
- Sensory Cortex
- Motor Cortex
- Motor pathways (pyramidal and extra pyramidal)
- Basal ganglia, connections and functions
- Cerebellum, connections and functions
- Vestibular apparatus/regulation of posture and equilibrium
- State of brain activity Reticular formation
- Physiology of sleep
- Electroencephalogram (EEG) Physiology of memory
- Physiology of speech
- Thalamus- nuclei and functions
- Hypothalamus and limbic system
- Cerebrospinal fluid
- Regulation of body temperature
- Function of skin
- Autonomic nervous system

Clinical/Applied Concepts

- Significance of dermatomes
- Receptors and neurotransmitters (applied aspect)
- Interpretation of reflexes
- Injuries and diseases of spinal cord, analgesia system

- Disorders of cranial nerves
- Hemiplegia / paraplegia, Upper and lower motor neuron lesions: features and localisation
- Parkinsonism and other lesions of basal ganglia
- Cerebellar disorders
- Postural disorders
- Epilepsy
- Sleep disorders
- Higher mental function assessment
- Alzheimer's disease
- Abnormalities of speech
- Thalamic syndrome
- Lesion of hypothalamus
- Hydrocephalous
- Heat Stroke

Special senses

- Structure and functions of eyeball
- Principles of optics
- Accommodation of eye
- Visual acuity
- Photochemistry of vision
- Colour vision
- Dark and light adaptation Neural function of retina
- Visual pathway, light reflex and pathway Visual cortex
- Eye movements and control
- Physiological anatomy of cochlea
- Functions of external and middle ear
- Functions of inner ear- organ of Corti
- Auditory pathway
- Physiology of smell - receptors and pathway
- Physiology of taste
- Olfaction/taste abnormalities

Clinical/Applied Concepts

- Glaucoma
- Errors of refraction
- Colour blindness, fundoscopy
- Field of vision and lesions of visual pathway, visual evoked potentials and electroretinogram
- Rinne's and Weber's tests
- Hearing test audiometry, types of deafness, auditory evoked potentials

Endocrinology

- General principles (classification, mechanism of action, feedback control)
- Biosynthesis, transport, metabolism, actions and control of secretion
- of hormones of:
 - Hypothalamus
 - Anterior pituitary
 - Posterior pituitary
 - Thyroid gland
 - Parathyroid, calcitonin and calcitriol
 - Adrenal medulla
 - Adrenal cortex
 - Pancreas
 - GIT
 - Pineal gland
 - Thymus
 - Kidney
- Physiology of growth

Clinical/Applied Concepts

- Hormonal assays
- Panhypopituitarism, dwarfism acromegaly, gigantism, Sheehan's syndrome
- Diabetes insipidus, syndrome of inappropriate ADH secretion
- Myxoedema, cretinism, thyrotoxicosis
- Tetany
- Pheochromocytoma
- Cushing's syndrome, Conn's syndrome, Addison's disease, adrenogenital syndrome
- Diabetes mellitus and hypoglycemia, Zollinger Ellison's syndrome

Reproduction

- Functional anatomy of male reproductive system
- Spermatogenesis
- Semen analysis
- Erection and ejaculation
- Testosterone
- Male puberty
- Functional anatomy and physiology of female Reproductive system, gonads and oogenesis
- Oestrogen and progesterone
- Menstrual cycle
- Puberty and menopause

- Pregnancy- physiological changes in mother's body during pregnancy
- Placenta
- Parturition
- Lactation
- Foetal and neonatal physiology

Clinical/Applied Concepts

- Chromosomal abnormalities
- Male infertility
- Female infertility
- Contraception
- Pregnancy Tests

BIOCHEMISTRY

Cell Biochemistry

- Introduction to biochemistry
- Biochemical composition and functions of the cell
- Biochemistry of eukaryotes, prokaryotes and archaea
- Cell membranes and their chemical composition
- Importance of lipids and proteins in cell membranes
- Signaling pathways and receptors
- Methods to study cell biochemistry (microscopy, centrifugation, Spectrophotometry, chromatography, electrophoresis and thermal cycler)

Body fluids and pH regulation

- Ionization of water, weak acids and bases
- pH and pH scale
- pK values, dissociation constant and titration curve of weak acids
- Body buffers and their mechanism of action
- Henderson – Hasselbach's equation
- Acid base regulation in human body
- Biochemical mechanisms for control of water and electrolyte balance.

Carbohydrates

- Definition, biochemical function and classification
- Structure and functions of monosaccharides and their derivatives
- Disaccharides and their important examples
- Oligosaccharides and their combination with other macromolecules
- Polysaccharides and their important examples and biochemical role

- Biochemical importance of carbohydrates

Proteins

- Definitions, biochemical importance and classification of proteins based on physiochemical properties
- Amino acids and their structure, properties and functions
- Classification and nutritional significance of amino acids
- Dissociation, titration and importance of amino acids
- Structure of proteins and their significance in pH maintenance
- Separation of proteins e.g. salting out, electrophoresis, chromatography, centrifugation
- Immunoglobulins and their biomedical significance
- Plasma proteins and their clinical significance

Nucleotides and Nucleic Acids

- Chemistry of purines and pyrimidines, their types, structure and function
- Chemistry and structure of nucleoside and nucleotide and their biochemical role
- Derivatives of purines and pyrimidines, their role in health and disease
- Nucleic acids, their types, structure and functions (gout)

Lipids and Fatty Acids

- Classification of lipids and their biochemical functions
- Structure and biochemical function of phospholipids, glycolipids and sphingolipids
- Classification of fatty acids and their biochemical functions
- Functions of essential fatty acids
- Identification of fats and oils (saponification, acid number)
- Eicosanoides and their function in health and disease (overview)
- Steroids and their biochemical role
- Cholesterol, its structure, chemistry and functions
- Lipid peroxidation and its significance

Enzymes

- Classification/nomenclature
- Properties of enzymes and catalysts
- Functions of enzymes and catalysts
- Co-enzymes and co-factors
- Isozymes and their clinical importance
- Factors affecting enzyme activity (Michaelis – Menten and Lineweaver burk equations) Classification of enzyme inhibitors and their biochemical importance
- Therapeutic use and application of enzymes in clinical diagnosis

Porphyrins and Haemoglobin

- Chemistry and biosynthesis of porphyrins and related disorders
- Structures, functions and types of haemoglobin
- Oxygen binding capacity of haemoglobin, factors affecting and regulating the oxygen binding capacity of haemoglobin
- Degradation of haeme, formation of bile pigments, its types, transport and excretion
- Hyperbilirubinemia, biochemical causes and differentiation
- Haemoglobinopathies (Hb-S, Thalassemia etc.) and their biochemical causes

Vitamins and minerals

- Vitamins and their different types
- Classification of vitamins, their chemical structure and biochemical function
- Absorption of vitamins and minerals
- Daily requirements, sources of water and fat soluble vitamins
- Effects of vitamin deficiency
- Role of vitamins as co-enzymes
- Hypo- and hyper-vitaminosis
- Minerals in human nutrition, sources, biochemical actions and recommended daily allowance (RDA).
- Sodium, potassium, chloride, calcium, phosphorus, magnesium, sulfur, iodine, fluoride
- Trace elements (Fe, Zn, Se, I, Cu, Cr, Cd and Mn)

Nutrition

- Caloric requirements of the body
- Balanced diet
- Nutritional requirements in:
 - pregnancy
 - lactation
 - newborn, youth and old age
- Nutritional disorders and protein energy malnutrition (Marasmus, Kwashiorkor and Marasmic-Kwashiorkor)

Bioenergetics and Biological Oxidation:

- Endergonic and exergonic reactions, coupling through ATP
- Oxidation and reduction, methods of electron transfer, redox potential, enzymes and coenzymes of biologic oxidation and reduction
- Respiratory chain and oxidative phosphorylation, components of respiratory chain, electron carriers

- ATP synthesis coupled with electron flow
- ADP coupled to electron transfer
- ATP synthase- relation to proton pump, PMF, and active transport
- Uncouplers and inhibitors of oxidative phosphorylation

Introduction to metabolism

Metabolism of carbohydrates

- Glycolysis
- Phases and reactions of glycolysis
- Energetics of aerobic and anaerobic glycolysis and their importance
- Regulation of glycolysis
- Cori's cycle
- The fate of pyruvate
- Citric Acid Cycle
- Reactions, energetics and regulation and importance of citric acid cycle
- Amphibolic nature of citric acid cycle (tricarboxylic acid cycle –
- TCA or the Krebs's cycle)
- Anaplerotic reactions and regulations of TCA cycle
- Gluconeogenesis
- Important three by-pass reactions of gluconeogenesis
- Entrance of amino acids and intermediates of TCA cycle and other nutrients as gluconeogenic substrates
- Significance of gluconeogenesis
- Glycogen metabolism
- Reactions of glycogenesis and glycogenolysis
- Importance of UDP-Glucose
- Regulation of glycogen synthase and glycogen phosphorylase
- Glycogen phosphorylase A and the blood glucose sensor
- Disorders of glycogen metabolism (glycogen storage diseases)
- Secondary pathways of carbohydrate metabolism
- Hexose Mono Phosphate (HMP) shunt, its reactions and importance
- Glucuronic acid pathway, its reactions and importance
- Metabolism of fructose, galactose and lactose
- Regulation of Blood Glucose level
- Hyperglycemia, hypoglycemia and their regulating factors
- Biochemistry of Diabetes Mellitus, its laboratory findings and diagnosis

Metabolism of Lipids:

- Mobilization and transport of fatty acids, triacylglycerol and sterols
- Oxidation of fatty acids
- Activation and transport of fatty acid in the mitochondria

- β -oxidation, fate of acetyl CoA, regulation of β -oxidation
- Other types of oxidation, i.e. α -oxidation, ω -oxidation, peroxisome
- oxidation, oxidation of odd number carbon-containing fatty acids and unsaturated fatty acids etc.
- Ketogenesis
- Mechanism and utilization of ketone bodies and significance
- Ketosis and its mechanism
- Biosynthesis of fatty acids
- Eicosanoids, synthesis from arachidonic acid, their mechanism and biochemical functions
- Triacylglycerol synthesis and regulation
- Synthesis and degradation of phospholipids and their metabolic disorders
- Cholesterol synthesis, regulation, functions, fate of intermediates of cholesterol synthesis, hypercholesterolemia, atherosclerosis
- Plasma lipoproteins, VLDL, LDL, HDL, and chylomicrons, their transport, functions and importance in health and disease
- Glycolipid metabolism and abnormalities

Metabolism of Proteins and Amino acids:

- Amino acid oxidation, metabolic fates of amino acid, transamination, deamination decarboxylation, deamidation and transamination
- Transport of amino group, role of pyridoxal phosphate, glutamate, glutamine, alanine
- Ammonia intoxication, nitrogen excretion and urea formation, urea cycle and its regulation, genetic defects of urea cycle
- Functions, pathways of amino acid degradation and genetic disorders of individual amino acids

Integration and regulation of metabolic pathways in different tissues

Metabolism of nucleotides:

- De novo purine synthesis
- Synthesis of pyrimidine
- Recycling of purine and pyrimidine bases (Salvage pathway)
- Degradation of purine, formation of uric acid
- Disorders of purine nucleotide metabolism

Biochemical genetics (informational flow in the cell):

- The structural basis of the cellular information
- DNA, chromosomes - discovery and organization of DNA in genomes
- Nucleosome structure and function
- Super-coiling of DNA
- DNA replication (DNA-dependent DNA synthesis)
- DNA polymerase, its components and functions

- Initiation, elongation and termination of replication
- DNA repair, mutation and cancers
- Transcription (DNA-dependent RNA synthesis)
- RNA polymerase, its components and functions
- Initiation, elongation and termination of transcription
- RNA processing
- RNA-dependent synthesis of RNA and DNA
- Reverse transcription DNA synthesis from viral RNA
- Retroviruses in relation to cancer and AIDS
- Translation (Protein synthesis)
- The genetic code
- Initiation, elongation and termination of protein synthesis
- Post-translational modification
- Regulation of gene expression
- Molecular biology technology
- DNA isolation
- DNA-recombinant technology
- Hybridization, blotting techniques
- Epigenetics
- Genetic disorders

Biochemistry of Endocrine system:

- Synthesis, secretion, mechanism of action and regulation of hormones
- Hormone effect on carbohydrate, lipid, protein, mineral metabolism
- Disorders of various endocrine glands

Biochemistry of Water and Electrolyte Imbalance and Acid-Base balance