Spiral I	
MODULE TITLE	**Foundation-I**
INTRODUCTION	This module has been designed to introduce new entrants to the basic concepts of the MBBS program, which are essential for understanding a number of topics in medical sciences. It aims to provide 'foundation' knowledge to the students so that they are able to apply it when they come across more advanced topics. This module hence provides a framework within which learners are expected to build future competencies.
RATIONALE	Before students go on to complex issues related to organ systems, it becomes necessary for them to have clear concepts underlying them. This module is designed so that it proceeds from simple to more complex basic issues. Concepts dealt with in this module will be revisited in many other modules in the future.
TARGET STUDENTS	First year M.B.B.S., 2022
DURATION	8 weeks
MODULE OUTCOMES	By the end of the module, students should be able to describe main concepts from each of the disciplines taught
DEPARTMENTS	Anatomy, Physiology, Biochemistry
OBJECTIVES	By the end of the module, students will be able to:

LECTURES / DEMONSTRATIONS

ANATOMY

I. GENERAL ANATOMY

1. Levels of organization of Human Body

- Describe the organization of the body from cellular to system level

2. Anatomical terminologies: positions and planes

- Differentiate among the various positions and planes of the body

3. Terms of movement

- Define the movements occurring at various joints of body (flexion, extension, abduction, adduction, rotation)
- Identify movements occurring at specific joints (pronation, supination, inversion, eversion)
- Identify the planes at which movements occur

4. Bones-I: Classification

- Classify bone on the basis of shapes and region
- Describe the gross structure of young and adult bone

5. Bones-II: Ossification, Blood supply of long bones, Cartilage, Bone Markings

- Explain the ossification of bone
- Identify the centers of ossification and their significance
- Distinguish between intramembranous and endochondral ossification
- Define bone markings with examples
- List the types of cartilage
- Describe the general anatomical features of each type of cartilage with example

6. General Concept of Muscles I

- List the components of muscular system.
- Classify the muscles according to their fascicular architecture with example

7. General Concept of Muscles II

- Classify the muscles according to direction of fibers and their actions with example
- Explain the principles of innervation and blood supply of muscles.

8. General concept of joints

- Define joint
- Classify the joints on the basis of structure (uniting material) with example
- Define a synovial joint
- List the features of synovial joint
- Classify Synovial joints on the basis of shape of articulating surfaces and degree of mobility
- Explain the principles of innervation and blood supply of synovial joints

9. Nervous system- I: Somatic nervous system and typical spinal nerve

- List the basic divisions of Nervous system
- Define the various components of Central and Peripheral nervous systems (CNS and PNS)

- Describe the structure of Neuron
- Classify neurons on the basis of number of processes and length of fibers
- Define a nerve and its coverings
- Differentiate between myelinated and unmyelinated fibers
- List various types of Neuroglia
- State their functions
- Define a spinal nerve
- Enumerate the spinal nerves in different regions
- Identify their location and site of emergence
- Identify various components of a typical spinal nerve
- Describe the fate of rami
- Describe the distribution of gray rami

10. Nervous system-II: Autonomic Nervous System (ANS)

- Describe the anatomical components of ANS
- Differentiate between sympathetic and parasympathetic systems based on gross structure and distribution

11. Introduction to lymphatic system

- Define lymphatic system, lymphatics and lymph nodes
- Describe the structure of lymph nodes and their general distribution
- List various lymphoid tissues and organs
- Identify large lymphatic channels
- Discuss the role of lymphatics in the spread of cancer

12. Integumentary system -I

- Define the term integumentary system
- Discuss the functions of the skin
- Differentiate between epidermis and dermis
- Discuss the significance of tension lines

13. Integumentary system - II

- Discuss the main determinant of skin color
- Identify the appendages of the skin
- Differentiate between superficial & deep fascia

II. GENERAL EMBRYOLOGY

14. Terms of Embryology

- Explain terms related to embryology
- List steps of cell division during mitosis
- Explain the significance of mitosis
- Define Meiosis
- List the steps of meiosis
- Differentiate first and second meiotic divisions
- State the phases of meiotic divisions
- Justify the importance meiosis in both sexes
- Differentiate between mitosis and meiosis

15. Introduction to Reproductive Organs

- Identify the male & female reproductive organs
- Describe Ovarian cycle
- Relate ovarian cycle with uterine cycle
- Describe the cyclical changes occurring in uterus, preparation of uterus for implantation, and their endocrine control

16. Oogenesis & Spermiogenesis

- Define gametogenesis (oogenesis & Spermatogenesis)
- Describe the process of oogenesis
- Differentiate between primary and secondary oocytes
- Compare the male and female gametes
- Define gametogenesis
- Describe the sequence events of spermatogenesis
- Discuss the importance of mitosis & meiosis in spermatogenesis
- List the steps in spermiogenesis
- Differentiate between spermatogenesis & spermiogenesis

17. Transportation of Ovum and fertilization

- Explain transportation of sperm and ovum
- Define fertilization
- Discuss phases and results of fertilization
- Discuss the clinical aspects of fertilization

18. 1st week of development after fertilization

- Discuss the formation of zygote
- Explain the transport of zygote from ampulla of fallopian tube to the uterine cavity
- Discuss initial stages of development by the process of cleavage.
- Explain the formation of blastocyst

19. 2nd Week of development

- Define implantation
- Explain the formation of outer and inner cell masses
- Discuss the further development of outer cell mass (trophoblast)
- Differentiate syncytiotrophoblast and cytotrophoblast with its microscopic appearance
- Describe the process of implantation (day by day changes)
- State the differentiation of embryonic pole and development of bilaminar germ disc with formation Epiblast and hypoblast, their cavities (amniotic cavity and primary yolk sac)
- Discuss the development of the chorionic sac and Primary chorionic villi
- Enumerate the abnormal sites for implantation (ectopic pregnancy) and the different diagnostic tools

20. 3rd week of Development: Gastrulation, primitive streak and notochord

- Define gastrulation (formation of three germ layers)
- Discuss the development of primitive streak & related congenital anomalies (Sacrococcygeal Teratoma)
- Describe the development of notochordal process, notochord canal, prechordal plate and cloacal membrane
- Describe the location of allantois and its importance
- Discuss the formation of secondary and tertiary chorionic villi
- Describe the development of intra-embryonic coelom

21. 3rd week of Development: Neurulation and somite formation

- Define neurulation
- Describe briefly the events occurring in neurulation
- Describe briefly the formation of somites

22. Embryonic Period

- Define embryonic period
- Describe folding of embryo in median and horizontal planes

- List the derivatives of germ layers
- List events with the corresponding weeks, occurring during the period

23. Fetal Period

- Define fetal period
- Discus the factors affecting fetal period/growth.
- Explain the week by week development of tissues and organs
- Describe the different milestone in development of fetus
- List the causes of fetal loss

24. Amnion, Chorion, umbilical cord & Yolk-Sac, Disorders of amniotic fluid

- List the fetal membranes
- Describe the structure of amnion & chorion
- Describe the formation, circulation and function of amniotic fluid
- Discuss the development of chorion and its complications
- Discuss the disorder related to amniotic fluid volume
- Describe the relationship of twinning (multiple pregnancies) with fetal membranes
- Describe the umbilical cord (morphology, composite structures, positioning and fate)
- Discuss the fate of umbilical vesicle (yolk sac)

25. Placenta

- Describe the changes in the maternal endometrium with formation of decidua and decidual reaction
- Describe the different types of chorionic villi
- Explain the development of placenta, both the fetal and maternal part
- Describe the placental circulation and barrier
- Describe the functions of placenta

26. Prenatal diagnosis

- Discuss prenatal diagnosis
- List the types of prenatal diagnosis
- Differentiate between amniocentesis, chorionic villus sampling, cordocentesis, ultrasonography, maternal AFP levels in terms of indication, time of performance and technique
- Describe the indications and goals of prenatal diagnosis

27. Congenital Malformations

- Define congenital malformation
- List the types of abnormalities (Disruptions, Deformations)
- Discuss the common congenital anomalies

28. Teratogenesis

- Define Teratogenesis
- Discuss the principles governing teratogenesis
- Describe the teratogenic factors and their effects on the developing tissue

III. GENERAL HISTOLOGY

29. Tissue Preparation and staining

- Describe different stages of tissue preparation
- List various types of stains
- Describe Haemotoxylin and Eosin (H&E) staining

30. Cell Membrane

- Identify the structures of cell membrane
- Describe the phospholipid bilayer and its composition
- Explain the Fluid Mosaic Model of cell membrane

31. Cytoplasm

- Define cytoplasm
- Discuss components and functions of cytoplasm

32. Nucleus

- Describe the structure of nuclear membrane
- Explain the component of nucleus and different types of chromatin material

33. Cell organelles

- Describe various cell organelles

34. Cytoskeleton

- Define Cytoskeleton
- Describe the composition and functions of cytoskeleton
- Enumerate the types, distribution and functions of cytoskeleton
- Describe the details of cytoplasmic filaments and microtubules

35. Cell Cycle

- Define cell cycle
- Explain various stages of cell cycle
- Explain the events of somatic cell division (mitosis)
- Discuss the significance of S phase of cell cycle
- Relate phases of cell cycle with the basis of development of cancer

36. Epithelium

- Describe the types, locations and functions of epithelium
- Describe the structural details of organization of cells in epithelium and other basic tissues of body
- Explain their origin of germinal layer and their derivatives

37. Cell Junctions

- Define cell junction
- Name the junctions along the lateral and basal surfaces of cells
- Discuss the structure and functions of the five main types of cell junction
- List the sites of distribution & components of junctional complex

38. Glands

- Define glands
- Discuss the general feature and structure of exocrine glands
- Classify exocrine glands on the basis of number of cells, their structure & types of secretions

39. Connective Tissues (Components)

- Define connective tissue
- Differentiate connective from epithelial tissue
- Describe the components of connective tissue

40. Connective Tissues (Classification)

- Classify different types of connective tissue
- Identify different types of connective tissue under the microscope
- State the distribution of each type

41. Histology of muscles

- Describe the histological features of different types of muscular tissue and their location

BIOCHEMISTRY

TOPIC 1: WATER

1. Chemical nature of water

- Describe the structure and properties of water.
- Discuss the physicochemical properties of water (e.g. surface tension, viscosity,adsorption)
- Explain the role of water as a Solvent
- Describe the role of water in forming molecular bonds.

2. Distribution of water

- Discuss the water distribution and homeostasis
- Explain the clinical aspects of water disturbances

3. pH and Buffers

- Describe the mechanism of dissociation of water and maintenance of normal pH
- Discuss the change in pH due to the addition of a given quantity of acid or base
- Describe the role of buffers in maintaining pH
- Explain the Henderson–Hassel Balch equation

TOPIC 2: CELL

4. Cell membrane

- Describe the biochemical composition
- Describe the functions of the cell membrane

5. Cell organelles

- Discuss the biochemical structure and function of each organelle

TOPIC 3: CARBOHYDRATE CHEMISTRY

6. Carbohydrate Classification

- Define carbohydrates with examples
- Classify carbohydrates with examples
- Describe the biochemical role of carbohydrates

7. Monosaccharaides

- Classify Monosaccharaides with examples
- Explain chiral carbon and isomerism with examples

- Explain the properties and functions of Monosaccharaides

8. Disaccharides and Oligosaccharides

- Classify Disaccharides with examples
- Explain the properties and functions of Disaccharides
- Classify Oligosaccharides with examples
- Explain the properties and functions of Oligosaccharides

9. Polysaccharides

- Classify Polysaccharides with examples
- Explain the properties and functions of Polysaccharides
- Describe the clinical importance of Polysaccharides

TOPIC 4: LIPID CHEMISTRY

10. Lipid Classification

- Define Lipids with examples
- Classify Lipids with examples
- Describe the biochemical functions of lipids

11. Fatty acids

- Explain the chemical structure of fatty acids.
- Classify fatty acids with examples
- Describe the properties and functions of fatty acids

12. Simple & Compound Lipids

- Classify simple and compound lipids with examples.
- Explain the chemical structure of simple and compound lipids
- Describe the properties and biological functions of simple and compound lipids
- Discuss the clinical importance of Lipid storage diseases
- Discuss the clinical significance of plasma lipoproteins

13. Steroids & Sterols

- Explain the structure and biochemical importance of steroids and sterols.
- List the sources and functions of Cholesterol
- Discuss the clinical importance of Cholesterol

14. Eicosanoids

- Define Eicosanoids with examples
- Classify Eicosanoids with examples
- Explain the functions of Eicosanoids
- Explain the synthesis of Eicosanoids.
- Discuss the clinical significance of Eicosanoids

TOPIC 5: PROTEIN CHEMISTRY

15. Amino acids

- Describe the structure and classification of amino acids with example
- Describe the properties of amino acids
- Describe the functions of amino acids

16. Peptides and Polypeptides

- Describe the structure and classification of Peptides and Polypeptides with examples
- Describe the characteristics of the Peptide bond
- Describe the functions and biomedical importance of Peptides and Polypeptides

17. Chemistry of Proteins

- Define proteins with examples
- Classify proteins with examples
- List the sources and properties of proteins
- Describe the functions and biomedical importance of individual proteins

18. Protein Structure

- Explain the structure of proteins

TOPIC 6: NUCLEIC ACID CHEMISTRY

19. Nucleotides

- Describe the structure and classification of nitrogenous bases with examples
- Compare the structures of nucleotides and nucleosides
- Discuss the biomedical functions of nucleotides
- Explain the biomedical significance of nucleotide derivatives and synthetic analogues.

20. Chemistry of Nucleic acids

- Classify DNA and RNA with examples
- Explain the properties of nucleic acids

- Describe the structure and functions of DNA and RNA

TOPIC 7: ENZYME CHEMISTRY

21. Classification of Enzymes

- Define enzymes with examples
- Classify enzymes with examples
- Describe the structure and properties of Enzymes
- Explain Co-enzymes, Co factors, zymogens, prosthetic group and Isoenzymes

22. Enzyme Kinetics

- Explain the energy of activation
- Explain the two hypothesis enzyme substrate binding.
- Explain mechanism of action of enzymes
- Explain the Michaelis Menten Model of enzyme kinetics

23. Factors affecting enzyme activity

- Discuss factors inhibiting and promoting enzyme activity
- Define enzyme inhibitors with examples
- Classify enzyme inhibitors with examples

24. Clinical Enzymology

- Explain the diagnostic importance of enzymes and isoenzymes
- Outline different ways of measuring plasma enzymes
- List enzymes and isoenzymes commonly assayed for diagnostic purposes
- Discuss the clinical importance of isoenzymes of LDH, CPK, Troponin, Alkaline phosphatase and Aldolase

25. TOPIC 8: VITAMINS

- Define vitamins with examples
- Classify vitamins with examples
- Discuss the overall role of vitamins and their importance in normal body functions
- Describe the chemical structure and functions of individual vitamins
- List the sources, daily requirement, digestion absorption of individual vitamins
- Describe the clinical significance of deficiency and toxicity of vitamins

PHYSIOLOGY

1. Extracellular fluid & internal environment

- Describe functional organization of human body and fluid compartments

2. Homeostasis and control system of body

- Recognize the role of physiochemical aspects in the maintenance of homeostasis

3. Functional importance of Cell membrane

- Explain composition and basic structure of cell membrane its functional importance and adaptation

4. Cell organelles 1

- Describe the structure and functions of Ribosomes, Endoplasmic reticulum, Golgi apparatus

5. Cell organelles 2

- Describe the structure and functions of Lysosomes, Mitochondria, peroxisomes, cytoskeleton

6. Transport across cell membrane (Passive)

- Describe types and process of passive transport across the membrane and their effects
- Describe diffusion and its physical basis

7. Transport across cell membrane (Active)

- Describe the types and effects of membrane transport mechanism

8. Cell Adaptation

- Explain the process of endocytosis, exocytosis and transcytosis

9. Cell signaling mechanism

- Discuss the chemistry of signals, receptors and importance of lipid and proteins in membranes

10. Locomotion and Apoptosis

- Define Apoptosis
- Describe the process of apoptosis and cell locomotion

11. Introduction to Autonomic Nervous System

- Define Autonomic Nervous System
- Describe the function of divisions of ANS and the neurotransmitters involved

TUTORIALS

BIOCHEMISTRY

REVESION TUTORIAL: Revisit/discuss the topics covered during lectures

PRACTICALS

ANATOMY

1. **Introduction**
   - Identify different parts of microscope
2. **Cell**
   - Identify various types of cell
3. **Epithelium**
   - Identify various types of epithelium under microscope
4. **Glands**
   - Identify various glands
5. **Connective tissue**
   - Identify connective tissue cell, fibers under microscope
6. **Muscles**
   - Identify the various types of muscular tissues
7. **Skin**
   - Identify different layers of skin under the microscope

BIOCHEMISTRY

1. **Introduction to Biochemistry Lab: Lab protocols & Solutions**
   - Explain the Biochemistry Laboratory protocols & Lab hazards
   - Identify the signs and symbols related to Laboratory hazards
   - Prepare different types of Solutions (Normal, Molar, Molal, Percent)
   - Identify the clinical uses and hazards of different types of solutions
   - Correlate the laboratory investigations with relevant clinical conditions

2. Carbohydrates practical 1: Detection of Carbohydrates and Polysaccharides

- Outline the scheme for detection of carbohydrates in a sample
- Identify the chemical tests and bio-techniques to detect proteins
- Detect Carbohydrates in the given sample
- Detect Polysaccharides in the given sample

3. Carbohydrates practical 2: Detection of Mono & Disaccharides

- Identify the chemical tests and bio-techniques to detect proteins
- Detect Monosaccharides in the given sample
- Detect Disaccharides in the given sample
- Correlate the laboratory investigations with relevant clinical conditions

4. Proteins practical 1: Detection of Proteins

- Outline the scheme for detection of Proteins in a sample
- Identify the chemical tests and bio-techniques to detect proteins
- Detect Proteins in the given sample (General tests)
- Correlate the laboratory investigations with relevant clinical conditions

5. Proteins practical 2: Detection of individual amino acids

- Identify the chemical tests and bio-techniques to detect the different amino acids
- Detect individual amino acids in the given sample
- Correlate the laboratory investigations with relevant clinical conditions

6. Proteins practical 3: Detection of individual Proteins

- Identify the chemical tests and bio-techniques to detect the different amino acids
- Detect individual Proteins in the given sample
- Correlate the laboratory investigations with relevant clinical conditions

7. Lipids: Detection of Lipids

- Outline the method for detection of Lipids in a sample
- Identify the chemical tests and bio-techniques to detect Lipids
- Detect Lipids in the given sample
- Correlate the laboratory investigations with relevant clinical conditions

8. Enzymes: Detection of Factors affecting Enzyme activity

- Outline the scheme for detection of factors affecting enzyme activity

- Identify the chemical tests and bio-techniques to detect the factors affecting enzyme activity
- Detect the effect of factors affecting the activity of salivary amylase

PHYSIOLOGY

1. Extracellular fluid

- Identify the effects of osmotic variations in Extracellular fluid (ECF) on cell

INTERNAL ASSESSMENT	Continuous monitoring of attendance and practical assessment in short groups. It will be in the form of MCQs, assignments, stages/sub-stages, projects, quiz or OSPE. Internal evaluation carries 20% weightage in summative semester examination.
FINAL EXAM	Final Annual exam will consist of MCQs (One Correct & One Best) and OSPE (observed + unobserved stations)

SUGGESTED READINGS	
SUBJECT	***RESOURCES/TEXTBOOKS***
ANATOMY	**A. GROSSANATOMY** 1. K.L. Moore, Clinically Oriented Anatomy **B. HISTOLOGY** 1. B. Young J. W. Health Wheather's Functional Histology **C. EMBRYOLOGY** 1. Keith L. Moore. The Developing Human 2. Langman's Medical Embryology
BIOCHEMISTRY	**1.** Harper's Illustrated Biochemistry **2.** Lippincott's Illustrated reviews of Biochemistry **3.** Lehninger's Principles of Biochemistry **4.** Biochemistry by Devlin
PHYSIOLOGY	**A. TEXTBOOKS** 1. Textbook of Medical Physiology by Guyton and Hall 2. Human Physiology by Lauralee Sherwood 3. Berne & Levy Physiology 4. Best &Taylor Physiological Basis of Medical Practice **B. REFERENCEBOOKS** 1. Ganong's Review of Medical Physiology