

## **Syllabus for First professional M.B.B.S in Physiology including Biophysics**

Lecture	:	160 hrs.
Practical	:	160 hrs.
Tutorial including Group discussion, Seminar, Items	:	160 hrs.

**TOTAL** : 480 hrs.

1 <sup>st</sup> Semester	:	1. General Physiology
Lecture & Tutorial	:	2. Nerve muscle Physiology
(Topics of Physiology – Paper 1)	:	3. Blood
		4. G.I System
		5. Respiratory System
		6. Cardiovascular System.

Practical	:	1. Haematology – Practicals
		2. Amphibian Practicals

Total No. of weeks : 400 weeks

Per week allotment : 12 hrs.

Lecture : 04 hrs.

Practicals : 04 hrs.

Tutorials etc. : 04 hrs.

**Courses and Curriculum:****06 hrs.**

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**1. General Physiology & Biophysics**

- a. Molecular structure of cell membrane and its functions. Types of transport across cell membrane.
- b. Intercellular connections.
- c. Resting membrane potential and Action potential.
- d. Homeostasis.
- e. Physical principles governing flow of blood in heart and blood vessels (to be taught with CVS).
- f. Physical principles governing air flow in respiratory passage (to be taught with Respiratory System).

**2. Nerve muscle physiology:****08 hrs.**

- a. Neurone: Structure, degeneration, regeneration, denervation hypersensitivity, electro genesis of action potential.
- b. Neuro muscular transmission and its clinical application.
- c. Functional anatomy of skeletal muscle. Mechanism of muscle contraction and relaxation, contracture, rigor mortis, isotonic & isometric contraction, energy sources and metabolism, motor unit, size principle, recruitment.
- d. Types of smooth muscles and mechanism of contraction.

**3. Blood:****20 hrs.**

- a. Composition and functions of blood.
- b. Plasma proteins – types, origin, functions, applied importance
- c. R.B.C – morphology, erythropoiesis, functions, fate
- d. ESR and its clinical importance
- e. Haemoglobin – structure, types, compounds of haemoglobin, abnormal haemoglobin, RBC indices - PCV, MCV, MCH, MCHC, Colour index.
- f. Anaemia - Types with examples
- g. Polycythemia
- h. Iron metabolism
- i. WBC Types, morphology, leucopoiesis, functions
- j. Immunity: Humoral & cellular, mechanism of immune response, immunoglobulins.

- k. Monocyte – Macrophage system.
- l. Platelets: structure and functions
- m. Haemostasis: Role of platelets, Blood coagulation, anticlotting mechanisms, anticoagulants.
- n. Bleeding disorders: Purpura, Hemophilia, Vitamin K deficiency, tests for bleeding disorders.
- o. Thrombotic disorders: Thrombosis embolism
- p. Blood group: different systems, Blood grouping & cross matching and clinical importance.
- q. Blood transfusion: Hazards of blood transfusion, storage of blood

**4. Gastrointestinal System:****14 hrs.**

- a. Characteristics of G.I wall
- b. Neural control of G.I function.
- c. G.I. Hormones
- d. Saliva: Composition, Functions, control of secretion.
- e. Gastric juice: Composition, mechanism of secretion, functions, regulation of secretion, mucosal barrier, peptic ulcer, gastrectomy, Dumping Syndrome, gastric function tests (to be taught in Biochemistry)
- f. Pancreatic juice: Composition, functions, regulation, applied importance
- g. Liver & Gall Bladder: Composition & functions of bile, control of secretion, functions of gall bladder, gall stones, enterohepatic circulation, jaundice, functions of liver & L.F.T.
- h. Small intestine: Composition & regulation of secretion and functions of intestinal juice.
- i. Large intestine: Functions
- j. Digestion & Absorption: (to be taught in Biochemistry)
- k. Movements of GI tract: Mastication deglutition, gastric motility and emptying, intestinal motility with reference to BER, small bowel wave, peristalsis, paralytic ileus defecation.

**5. Respiratory Systems:****16 hrs.**

- a. Functional Anatomy and functions of respiratory system.
- b. Mechanics of respiration.
- c. Lung volumes and capacities: definition, normal values, their measurement and clinical importance
- d. Pulmonary ventilation,, alveolar ventilation, dead space.
- e. Diffusion of gases across alveocapillary membrane, diffusing capacity.
- f. Pulmonary circulation.

- g. Oxygen & carbon dioxide transport in blood.
- h. Pressure changes during ventilation, pressure volume relationship including surfactant and compliance, airway resistance, work of breathing
- i. Control of respiration: neural control, chemical control, response to exercise, periodic breathing.
- j. Hypoxia including high altitude physiology and acclimatization, asphyxia, cyanosis, oxygen therapy and toxicity.
- k. Effects of increased barometric pressure – nitrogen narcosis, high pressure nervous syndrome, decompression sickness (Caissons disease).
- l. Artificial respiration
- m. Lung function tests.

**6. Cardio-vascular system:****22 hrs.**

- a. Functional anatomy of heart and blood vessels.
- b. Properties of cardiac muscle.
- c. Origin & spread of cardiac impulse, heart block, cardiac arrhythmias.
- d. ECG: leads, principles of normal recording, normal waves & internal & their interpretations, electrical axis of the heart including left and right axis deviation, clinical uses of ECG.
- e. Cardiac cycle: Mechanical events, pressure changes in atria, ventricles, aorta, pulmonary artery and jugular vein. End diastolic volume, end systolic volume, ejection fraction.
- f. Heart sounds: normal character, physiological basis of splitting, murmur.
- g. Cardiac output: definition, determination, factors regulating, venous return.
- h. Arterial pulse: normal & abnormal
- i. Physical principles governing flow of blood in heart & blood vessels, laminar flow, turbulent flow, Reynolds number, peripheral resistance, Poiseuille-Hagen formulae.
- j. Arterial pressure: total pressure, lateral pressure, Bernoulli's principle, importance of different pressure, measurement, factors controlling B.P effects of gravity, posture and exercise on B.P Hypertension & hypotension
- k. Regulation of CVS: local regulation including auto regulation of blood flow, vasoconstrictors & vasodilators, substances secreted by endothelium including NO. systemic regulation – humoral & neural, innervation of heart and blood vessels, cardiovascular centers, cardiovascular reflexes, regulation of B.P & heart rate.

- l. Regional circulation: coronary circulation, cutaneous circulation, pulmonary cerebral, renal circulation will be taught in respective systems.
- m. Cardio – vascular adjustments in health & disease: effects of exercise, haemorrhage & shock.

**7. Endocrine system: 20 hrs.**

- a. General organization of endocrine glands & control system
- b. Mechanism of hormone action.
- c. Biosynthesis, regulation of secretion, transport, fate and actions hormones secreted from Hypothalamus, Pituitary, Thyroid, Adrenal cortex, adrenal medulla, Parathyroid (along with calcium metabolism) and endocrine pancreas, importance to be given to clinical conditions associated with hypo and hyper functions of these glands.

**8. Reproductive system 10 hrs.**

- a. Sex differentiation and development of Reproductive system.
- b. Aberrant sexual differentiation, chromosomal abnormalities, developmental abnormalities
- c. Puberty, precocious and delayed puberty
- d. Climacteric.
- e. Male reproductive system: Spermatogenesis, endocrine functions of testis, abnormalities of testicular function, cryptorchidism, male hypogonadism, sterility.
- f. Female reproductive system: ovary, oogenesis, ovulation, corpus luteum, ovarian hormones – oestrogen, progesterone, relaxin, control of ovarian functions by hypothalamic and pituitary hormones.
- g. Menstrual cycle: ovarian cycle, uterine cycle, hormonal basis, abnormalities of menstruation, infertility
- h. Pregnancy: Fertilization, implantation, placental hormones, pregnancy tests, parturition.
- i. Lactation
- j. Contraception.

**9. Excretory System: 12 hrs.**

- a. Functional anatomy of kidney, nephron-structure, parts, function, types,
- b. Juxtaglomerular apparatus: autoregulation, peculiarities, measurement.
- c. Glomerular filtration: filtration barrier, forces governing filtration, measurement.
- d. Tubular functions: reabsorption, secretion, T<sub>m</sub> values
- e. Regulation of ECF – volume, osmolality and electrolytes

- f. Acid base balance (to be taught in biochemistry)
- g. Micturition
- h. Renal function tests, renal clearance, abnormal constituents of urine
- i. Excretory functions of skin

**10. Nervous system:**

- a. Organisation of nervous system, functional anatomy of brain and spinal cord, neuron, neuroglia
- b. Cerebral circular, CSF, blood-brain barrier
- c. Synapse – types, properties, synaptic transmission, neurotransmitters
- d. Sensory receptors: classification, generator potential, properties,
- e. Reflex action: definition, reflex arc, stretch reflex, inverse stretch reflex, withdrawal reflex
- f. Sensory system: touch, pain, temperature, vibration, proprioception, ascending tracts, sensory cortex
- g. Pain: types, visceral pain, pain inhibiting mechanism, gating of pain, opioids, analgesia, hyperalgesia, thalamic syndrome
- h. Motor system: motor cortex, descending tracts – pyramidal & extrapyramidal tracts, upper motor neurone lesion, lower motor neurone lesion, hemiplegia, paraplegia, monoplegia.
- i) Injuries of spinal cord: complete transaction, hemisection.
- j) Tabis dorsalis, syringomyelia, section of anterior root & posterior root.
- k) Cerebellum: structure, parts, connections, functions, features of cerebellar lesion.
- l) Basal ganglia: components, connections, functions, applied.
- m) Muscle tone, posture, equilibrium, regulation of muscle tone & posture, vestibular apparatus.
- n) Autonomic nervous system: organization and functions.
- o) Hypothalamus: structure & functions, temperature regulation.
- p) Physiology of thalamus, reticular formation, RAS.
- q) EEG, sleep and wakefulness.
- r) Physiology of limbic system.
- s) Higher functions of the brain: learning & memory, speech.

**11) Special Sense:****10hrs.**

- a) Smell: receptor, pathway.
- b) Taste: taste buds, pathway.

c) Vision: structure of eyeball, structure of retina, visual pathway and effects of lesion, image forming mechanism, light reflex, accommodation, errors of refraction, electrophysiology of eye, colour vision, colour blindness, dark adaptation.

d) Hearing: functional anatomy of the ear, functions of middle ear, organ of corti, hair cell physiology- endocochlear potential, auditory pathway, sound localization, pitch discrimination, deafness.

### **Practical Physiology**

#### **I) Haematology:**

**60 hrs.**

a) Compound microscope.

b) Preparation of blood film.

c) Staining with Leishman's stain.

d) Identification of blood cell.

e) Differential count of WBC.

f) Total count of WBC.

g) Total count of RBC.

h) Haemoglobin estimation.

i) Total count of platelets.

j) Blood grouping.

k) Bleeding time and clotting time.

l) Haemin crystal.

m) Demonstration of: PCV, ESR, Osmotic fragility, Prothrombin time.

#### **2) Amphibian Practicals:**

**20 hrs.**

a) Demonstration of instruments : Related to amphibian nerve muscle and heart experiments.

b) Demonstration of experiments:

1) Effect of single induction shock.

2) Effect of two successive stimuli.

3) Effect of repeated stimuli for genesis of clonus and tetanus.

4) Effect of temperature on simple muscle curve.

5) Effect of load on simple muscle curve.

6) Recording of normal cardiogram.

7) Effect of temperature on heart.

8) Stannius ligature.

9) Stimulation of vagus and vagal escape.

10) Effects of drugs on heart- Ach, adrenaline.

**3) Mammalian Practicals:****10 hrs.**

- a) Dales tissue organ bath for record of intestinal movements and effects of drugs.
- b) Demonstration for the record of BP and respiration by long extension kymograph:
  - 1) Normal record.
  - 2) Effect of common carotid artery occlusion.
  - 3) Effect of adrenalin, noradrenalin, acetyl choline.

**4) Human Practicals:****70 hrs.**

- a) Clinical examination of respiratory system: vocal fremitus, vocal resonance, breath sounds.
- b) Clinical examination of CVS: Arterial pulse, apex beat, heart sounds, recording of blood pressure and effects of posture and exercise on BP.
- c) Clinical examination of nervous system:
  - 1) Examination of cranial nerves.
  - 2) Examination of sensory system.
  - 3) Examination of motor system- examination of superficial and deep reflexes, examination of muscle tone and power.
- d) Spirometry- Measurement of lung volumes and capacities.
- e) Stethography- Effect of breath holding and deglutition on respiration.
- f) Measurement of BMR.
- g) Demonstration of ECG, EEG, EMG, ophthalmoscope, bicycle ergometer and arterial blood gas analysis.

**Model Question****First M.B.B.S. 200--.****PHYSIOLOGY.****First paper.****Full marks: 50****Time- 2hrs.**

The figures in the margin indicate full marks.

Answer all questions.

1. Explain pacemaker potential. How does cardiac impulse spread from S.A. node to all parts of the heart? What is second degree A.V. nodal block? 3+5+2=10

or

Describe the stages of erythropoiesis and the factors regulating it. Comment on fragility of R.B  
4+4+2=10



2. Write short notes on (any five) 3x5=15.

- Gastric mucosal barrier.
- Oxygen-dissociation curve.
- Vasodilator secreted from endothelium.
- Excitation-contraction coupling.
- Buffer nerves of heart.
- Rh incompatibility.

3. Explain the physiological basis of the following (any five):

- Low dose of aspirin prevents intravascular thrombosis.
- When blood pressure decreases below 70mm of Hg, chemoreceptors play important role in control of B.P.
- Murmurs may be produced in valvular defects of the heart
- Blood coagulation may be hampered in Liver disease.
- Oedema may occur in hypoproteinemia.
- Steatorrhoea may occur in obstructive jaundice.

4. Write the differences between the two (any five): 3x5=15

- Vital capacity and Timed Vital capacity
- Adult haemoglobin and Faetal haemoglobin
- Isometric and Isotonic contraction
- Action potential in skeletal muscle and cardiac muscle.
- Preload and afterload condition of the heart.
- Hypoxic hypoxia and anaemic hypoxia.

### Model Question

First M.B.B.S. , 200—

### PHYSIOLOGY

### Second Paper

**Full marks: 50**

**Time: 2hrs.**

The figure in the margin indicate full marks

Answer all questions.

1. Describe the structure of muscle spindle. Explain stretch reflex and inverse stretch reflex. What are the effects of gamma motor neuron discharge? 2 ½ +2 ½ +2 ½ +2 ½ = 10

Or

Discuss the role of hormones regulating calcium metabolism. Describe Tetany.

7+3=10

2. Write short notes on (any five): 3x5=15
- a)Angiotensin II      b)Organ of corti  
 c) Ovulation            d) G.F.R  
 e) Myopia                f) R.E.M sleep

3. Explain the physiological basis of the following(any five): 2x5=10
- a) In uncontrolled diabetes mellitus polyphagia is present  
 b) Visceral pain is often referred to a somatic structure.  
 c) Dose of steroid administered for treatment is usually decreased gradually before final withdrawal.  
 d) A pituitary tumour may cause bitemporal hemianopia.  
 e) Renal threshold for glucose is less than the predicted value.  
 f) Rhythm method as a contraceptive measure.

- 4 Write the differences between the two (any five): 3x5=15
- a)Upper motor neuron lesion and Lower motor neuron lesion.  
 b) Static tremor and Intention tremor.  
 c)F.S.H and L.H.  
 d)Cortical nephron and Juxta medullary nephron.  
 e) Rod cells and Cone cells of Retina.  
 f)Somatostatin and Somatomedin.

### Suggested books in Physiology for 1<sup>st</sup> MBBS course

#### Theory

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|----|------------------------------|---|---------------------------|
| 1. | Medical physiology           | → | A. C. Guyton              |
| 2. | Review of medical physiology | → | W. F. Ganong              |
| 3. | Human physiology             | → | Vander, Sherman & Luciano |

#### Practical

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|----|--------------------------------|---|----------------------------|
| 1. | Practical physiology           | → | C. L. Ghai                 |
| 2. | Hutchison's clinical methods   | → |                            |
| 3. | Melleod's clinical examination | → |                            |
| 4. | Practical physiology           | → | Pal & Pal (Orient Longman) |