UNIVERSITY OF CALCUTTA

SYLLABI

FOR

THREE-YEAR HONOURS AND GENERAL
DEGREE COURSES OF STUDIES

PHYSIOLOGY

2010
HONOURS

PART –I
Theoretical

Paper – I  (F.M. 100)

Unit -01 : 50 Marks

1. Cell Biology I   08
2. Cell Biology II  12
3. Biophysics       16
4. Enzyme           10
5. Digestive System 14

Unit- 02 : 50 Marks

1. Biochemistry-I  10
2. Biochemistry-II 12
3. Vitamins and Minerals 14
4. Muscle Physiology 12
5. Nerve Physiology 12

Paper – II A:  (F.M. 50)

Unit – 03 : 50 Marks

1. Blood           14
2. Cardiovascular System I 14
3. Cardiovascular System II 10
4. Body Fluids and Regional Circulation 08
5. Respiratory System 14

Paper – II B  Practical  (F.M. 50)
(One practical class is of  3 periods)

Classes required  50

Unit – 04 : 50 Marks

1. Histology
   Haematological Experiments 15 marks
   Permanent slide identification 15 marks

2. Biochemistry
   Qualitative Experiments 10 marks

3. Viva – Voce 5 marks
4. Laboratory Note Books 5 marks
PART – II

Theoretical

Paper – III  (F.M. 100)

Unit -05 : 50 Marks

<table>
<thead>
<tr>
<th>Lectures required</th>
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<td>(Each period of 45 minutes duration)</td>
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1. Nervous System I 10
2. Nervous System II 14
3. Nervous System III 14
4. Nervous System IV 14
5. Molecular neurobiology 08

Unit – 06 : 50 Marks

1. Instrumentation 12
2. Renal Physiology 14
3. Sensory Receptors, Olfaction & Gustation 10
4. Audition 10
5. Vision 14

Paper – IV A  (F.M. 50)

Unit – 07  50 Marks

<table>
<thead>
<tr>
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1. Biological Oxidation and Carbohydrate Metabolism 12
2. Amino acids and Purine & Pyrimidine Metabolism 10
3. Lipid Metabolism and Reactive Oxygen Species 12
4. Methodologies 10
5. Molecular Biology 16

Practical

Paper – IVB  (F.M. 50)

(One Practical class is of 3 periods)  Classes required 50

<table>
<thead>
<tr>
<th>Classes required 50</th>
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<td>(Each period of 45 minutes duration)</td>
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Unit – 08 : 50 Marks

1. Histology
   Fresh Tissue Experiments 10 marks
2. Biochemistry
   Quantitative Estimations 15 marks
3. Experimental Physiology
   Amphibian skeletal muscle experiments 15 marks
   Amphibian unperfused heart experiments
4. Viva – Voce 5 marks
5. Laboratory Note Books 5 marks
PART –III
Theoretical

Paper –V (F.M. 100)
Unit – 09 : 50 Marks

<table>
<thead>
<tr>
<th>Lectures required</th>
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<td>(Each period of 45 minutes duration)</td>
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</table>

1. General Endocrinology I 14
2. General Endocrinology II 12
3. General Endocrinology III 12
4. General Endocrinology IV 14
5. Chronobiology 08

Unit – 10 : 50 Marks

<table>
<thead>
<tr>
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<td>(Each period of 45 minutes duration)</td>
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</table>

1. Reproductive Physiology I 14
2. Reproductive Physiology II 14
3. Developmental Biology 12
4. Nutrition and Dietetics 12
5. Social Physiology 08

Paper VI (F.M. 100)
Unit- 11 : 50 Marks

<table>
<thead>
<tr>
<th>Lectures required</th>
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<td>(Each period of 45 minutes duration)</td>
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</table>

1. Work Physiology and Ergonomics 15
2. Sports Physiology 15
3. Skin and Body Temperature Regulation 10
4. Human and Environment I 10
5. Human and Environment II 10

Unit - 12 : 50 Marks

<table>
<thead>
<tr>
<th>Lectures required</th>
</tr>
</thead>
</table>

1. Microbiology I 12
2. Microbiology II 10
3. Immunology 14
4. Pharmacology 12
5. Biostatistics 12
Practical

Paper – VII  (F.M.100)
(One Practical class is of  3 periods)                        Classes Required 70
(Each period of 45 minutes duration)

Unit - 13
1. Biochemistry 40 Marks
2. Experimental Physiology 25 Marks
3. Microbiology & Biochemical Technique 10 Marks
4. *Viva – Voce* 15 Marks
5. Laboratory Note Books 10 marks

Paper VIII  (F.M. 100)
(One Practical class is of  3 periods)                        Classes Required 70
(Each period of 45 minutes duration)

Unit - 14
1. Histology 15 Marks
2. Experimental Physiology 20 Marks
3. Experiments on Work Physiology and Ergonomics
   using human subjects 15 Marks
4. Biostatistics 10 Marks
5. Social Physiology
   Diet Survey 08 Marks
   Field Study Record 07 Marks
6. *Viva – Voce* 15 Marks
7. Laboratory Note Books 10 Marks
PART-I

Theoretical

PAPER – I (F.M. 100)

UNIT : 01 (50 Marks)

1. Cell Biology I:
   Electron microscopic structure and functions of eukaryotic endoplasmic reticuli, ribosome, golgi bodies, mitochondria, lysosomes, peroxisomes cytoskeletal elements, centrosomes and plasma membrane and subcellular membrane. Ion pores, ion pumps, ion channels, ionophores, passive transport – facilitated diffusion, uniport, symport, antiport. Active transport. Artificial membrane – liposome and erythrocyte ghost. Basic idea of tight junctions, gap junctions and cell adhesion molecules. (08 lectures)

2. Cell Biology II:
   (a) Genetics:
   (b) Cell Signalling:
      Cell surface receptor proteins – ion channel coupled, G-protein coupled and enzyme-coupled. Intracellular messengers – cAMP, cGMP, IP3, DAG, Protein kinases, Ca$^{2+}$, CO, NO. Signal transduction pathways – Phosphatidylinosities, MAP kinase, JAK-STAT, SMAD. (12 lectures)

3. Biophysics:

4. Enzymes:
5. Digestive System:


(14 Lectures)

UNIT:02 (50 MARKS)

1. Biochemistry I:

Carbohydrates: Definition and classification. 


Disaccharides – Maltose, Lactose and Sucrose: Structure, Occurrence and Physiological importance. 

Polysaccharides – Starch, Glycogen, Dextrin, Cellulose, Glycosaminoglycans, Glycoproteins, Sialic acids, Lectins, Blood group polysaccharides.


(10 Lectures)

2. Biochemistry II:


Purine and Pyrimidine: Structure, nomenclature and tautomerism.


(12 Lectures)

3. Vitamins and Minerals:


Minerals: Sources, biological functions, metabolism and regulation of sodium, potassium, calcium, phosphorus, iron, zinc, iodine and fluoride.

(14 Lectures)
4. Muscle Physiology:

5. Nerve Physiology:

DISTRIBUTION OF QUESTIONS IN THEORETICAL PAPERS

1. From each unit, **five** questions of 10 marks each with one alternative are to be set from the same sub-unit. The 10 marks question may be subdivided.
2. Candidates have to **attempt all five** questions from each unit amongst the alternatives.
1. Blood:

2. Cardiovascular System – I:

3. Cardiovascular System – II:

4. Body Fluids and Regional Circulation:
   Lymph and tissue fluids—formation, circulation, functions and fate. Lymphatic organs—Histological structures and functions of lymph gland and spleen. Regional circulations—cerebral, coronary, pulmonary and hepatic, skeletal muscle.

5. Respiratory System:

**DISTRIBUTION OF QUESTIONS IN THEORETICAL PAPER**

1. From each unit, five questions of 10 marks each with one alternative are to be set from the same sub-unit. The 10 marks question may be subdivided.
2. Candidates have to attempt all five questions from each unit amongst the alternatives.
Practical

PAPER – IIB (F.M. 50)

Unit – 04 : 50 Marks

1. Histology : 30 Marks
   Demonstration: Haematocrit, MCV, MCH and MCHC. Bleeding time, Clotting time, ESR. 15 Marks
   (b) Study and identification of stained section of different mammalian tissues and organs: Bone, Hyaline cartilage, Trachea, Lung, Spleen, Lymph gland, Parotid gland, Submaxillary gland, Sublingual gland, Tongue, Oesophagus, Stomach, Duodenum, Jejunum, Ileum, Large intestine, Liver, Kidney, Ureter, Pancreas, Adrenal gland, Thyroid gland, Testis, Ovary, Spinal cord, Cerebral cortex, Cerebellum, Skin, Cardiac muscle, Skeletal muscle, Smooth muscle, Artery, Vein, Uterus. 10 Slides-15 Marks

2. Biochemistry Qualitative : 10 Marks
   Tests for identification of physiologically important substances: hydrochloric acid, lactic acid, uric acid, albumin, gelatin, peptone, starch, dextrin, glucose, fructose, lactose, sucrose, urea, acetone, glycerol, bile salts.

3. Viva – Voce : 5 Marks

4. Laboratory Note -Books : 5 Marks
PART – II

Theoretical

PAPER – III (F.M. 100)

UNIT : 05 (50 Marks)

1. Nervous System I:

2. Nervous System II:

3. Nervous System III:

4. Nervous System IV:

5. Molecular neurobiology:
General concept of ionotropic and metabotropic receptors. Structure, sub-types, and functions of nicotinic and muscarinic acetylcholine receptors, adrenoceptors, glutamate receptors (NMDA and AMPA receptors), GABA, opiate, serotonin, dopamine and histamine receptors. (08 Lecturers)
UNIT : 06 (50 MARKS)

1. Instruments:
   - Principles of construction and uses of compound microscope, phase contrast microscope, fluorescence microscope, polarizing microscope, confocal microscopy, transmission and scanning electron microscope, photoelectric colorimeter. Brief idea of CRO, CT scan, fMRI and PET. (12 Lectures)

2. Renal Physiology:

3. Sensory Receptors, Olfaction & Gustation:

4. Audition:

5. Vision:

DISTRIBUTION OF QUESTIONS IN THEORETICAL PAPER

1. From each unit, five questions of 10 marks each with one alternative are to be set from the same sub-unit. The 10 marks question may be subdivided.

2. Candidates have to attempt all five questions from each unit amongst the alternatives.
UNIT : 07 (50 MARKS)

1. Biological Oxidation and Carbohydrate Metabolism :
   Biological oxidation – Redox Potential, Mitochondrial Electron Transport Chain,
   Oxidative Phosphorylation – Inhibitors and uncouplers.
   Carbohydrate - Glycolysis, R-L cycle, TCA cycle, Gluconeogenesis - Cori cycle, Glucose-Alanine
   Glycogenesis and Glycogenolysis.
   Hormonal regulation of the above mentioned biochemical pathways/cycle not required. (12 Lectures)

2. Amino acids and Purine & Pyrimidine Metabolism :
   Amino acids - Amino acid pool. Deamination, transamination, amination and decarboxylation.
   Synthesis of Urea and Nitric oxide. Basic idea of glucogenic and ketogenic amino acids. Metabolism of
   glycine, sulfur-containing amino acids, tryptophan and phenylalanine.
   Purines and Pyrimidines – Biosynthesis : de novo and salvage pathways. Catabolism.
   Regulation of the above mentioned biochemical pathways/cycle not required. (10 Lectures)

3. Lipid Metabolism and Reactive Oxygen Species :
   Lipid – β-oxidation and biosynthesis of saturated and monounsaturated fatty acids. Metabolism
   of Triglycerides. Biosynthesis of Lecithin, Cephalin and Cholesterol. Metabolism of Adipose Tissue.
   Role of lipoproteins in transport and storage of lipids.
   Formation of Reactive Oxygen Species and the role of Catalase, Superoxide Dismutase, Glutathione
   Peroxidase and Glutathione Reductase in combating oxidative stress – role of vitamins.
   Hormonal regulation of the above mentioned biochemical pathways/cycle not required. (12 Lectures)

4. Methodologies :
   Chromatography: Principles and uses of : TLC, Gel filtration, Affinity chromatography
   ion-exchange chromatography. Electrophoresis: Principles and method, uses of Agarose gel
   electrophoresis, SDS – PAGE. Ultracentrifugation: moving boundary and density gradient
   ultracentrifugation. Radioactivity – Classification and properties. Their use – radiolabelling of
   biomolecules and its detection by autoradiography. Principles of radioimmunoassay (RIA),
   ELISA. Immunoblotting. (10 Lectures)

5. Molecular Biology :
   DNA replication—Meselson and Stahl Experiment, DNA Polymerases, Ligases and other
   regulatory proteins. Transcription – RNA Polymerase and other regulatory mechanism in prokaryotes.
   Genetic code – properties and wobble hypothesis. Translation – codon-anticodon interaction and
   mechanism in prokaryotes. Regulation of gene expression : operon concept – the lac operon. Gene
   mutation – agents and types. DNA repairing processes. Concept of oncogenes and properties of cancer
   cells. Elementary idea of recombinant DNA technology and its applications – gene therapy,
   transgenic animal. Northern and Southern blotting. (16 Lectures)

DISTRIBUTION OF QUESTIONS IN THEORETICAL PAPER

1. From each unit, five questions of 10 marks each with one alternative are to be set from the
   same sub-unit. The 10 marks question may be subdivided.

2. Candidates have to attempt all five questions from each unit amongst the alternatives.
UNIT : 08

1. **Histology :** 10 Marks

   Fresh tissue experiments : Suitable staining and examination of fresh tissues – epithelial, areolar, adipose (Sudan III or IV) and muscle tissues. Silver nitrate preparation of cornea and urinary bladder for cell spaces and sciatic nerve for nodes of Ranvier.

2. **Biochemistry Quantitative :** 15 Marks

   Quantitative estimation of glucose and sucrose by Benedict’s method. Quantitative estimation of amino nitrogen (Sorensen’s formol titration method). Percentage and total quantity to be done. Estimation of percentage quantity of lactose in milk by Benedict’s method.

3. **Experimental Physiology:** 15 Marks

   a) Study and use of kymograph, induction coil, key and tuning fork. 
   b) Gastrocnemius-sciatic preparation and kymographic recording of isotonic muscle twitch. 
   c) Effect of temperature on muscle twitch. 
   d) Effect of two successive stimuli on muscle twitch. 
   e) Effect of load (after-load) on muscle twitch. Calculation of work done by the muscle. 
   f) Normal tracing of unperfused heart beat of toad. 
   g) Effects of temperature on unperfused heart beat toad. 

   **Demonstration :** 1. Gastrocnemius-sciatic preparation and its use in recording effects of make and break shocks of progressively rising intensity. 
   2. Effect of load (free-load) on muscle twitch. 
   3. Determination of nerve conduction velocity by kymographic recording of simple twitches. 

3. **Viva-Voce :** 5 Marks

4. **Laboratory Note-Books :** 5 Marks
PART – III  

**Theoretical**

**PAPER – V (F.M. 100)**

UNIT : 09  (50 MARKS)

1. **General Endocrinology I :**
   

   (14 Lectures)

2. **General Endocrinology II :**
   

   (12 Lectures)

3. **General Endocrinology III :**
   

   (12 Lectures)

4. **General Endocrinology IV :**
   

   (14 Lectures)

5. **Chronobiology :**
   

   (08 Lectures)
UNIT : 10        (50 MARKS)

1. Reproductive Physiology I:


2. Reproductive Physiology II:


3. Developmental Biology:


4. Nutrition and Dietetics:


5. Social Physiology:


Distribution of Questions in Theoretical Papers

1. From each unit, five questions of 10 marks each with one alternative are to be set from the same sub-unit. The 10 marks question may be subdivided.

2. Candidates have to attempt all five questions from each unit amongst the alternatives.
PAPER –VI (F.M. 100)

UNIT :11 (50 MARKS)

1. **Work Physiology and Ergonomics**:
   Physical work—its definition and nature—isotonic, isometric and isokinetic, positive and negative work. Concept of physiological work. Power and capacity relation. Work-load – light, moderate(submaximal) and heavy (maximal) depending on intensity and duration of work. Exercise inducing equipment – bicycle ergometer, treadmill and stepping stool. Energetics of work – sources of energy and energy demand for different activities. Assessment of energy cost of various physical work – direct and indirect methods with their limitations. Physiological responses to work – cardiovascular, respiratory, metabolic and muscular – short-term and long-term. Work-rest cycle and importance of rest pause. Ergogenics aids. Basic concept of ergonomics and its application in industry to improve efficiency and industrial safety as well as to restrict occupational health hazards. Anthropometry and its implication in ergonomics in general. (15 Lectures)

2. **Sports Physiology**:

3. **Skin and Body Temperature Regulation**:

4. **Human and Environment I**:

5. **Human and Environment II**:
   G force, ionizing and non-ionizing radiations - physiological effects and preventive measures. Air, noise and water pollutions – causes, effects, prevention measures and control. Brief idea of the hazards of pesticides, carcinogens, mutagens, neurotoxins and war gases. Impact of green house effects on life. (10 Lectures)
UNIT : 12  (50 MARKS)

1. Microbiology I:
   Classification of microorganisms. Techniques employed for the identification of microorganisms -- microscopic and biochemical methods. Control of microbial growth: Physical and Chemical methods used in sterilization, disinfection and pasteurization.
   Bacteriology: Bacterial classification based on staining techniques (Gram stain and Acid-fast stain) and morphological aspect. Bacterial structure: cell-wall, LPS layer, pili, flagella, chromosome, plasmid spores and cysts. Culture of bacteria: nutritional requirement – complex and synthetic media, preparation of media; physical factors required for growth (temperature, pH and gaseous requirement); bacterial growth curve: different phases and their significance; quantitative estimation of bacterial growth; continuous growth culture and its utility.
   Food microbiology: beneficial and harmful microorganisms in food, causative organisms of food-borne infections- mode of transmission and methods of prevention. (12 Lectures)

2. Microbiology II:
   Bacterial metabolism: fermentation, glyoxalate cycle and Entner-Doudoroff pathway.
   Virology: Viral structure – virion, prion and bacteriophages; classification of viruses based on nucleic acid composition and host system, replication of bacteriophages – lytic and lysogenic cycles. (10 Lectures)

3. Immunology:
4. **Pharmacology:**


Anaesthetics: types and mechanism of action of general anaesthetics.
Sedatives - hypnotics: benzodiazepine, zolpidem.
Diuretics - Carbonic anhydrase inhibitor, loop diuretic, potassium sparing and osmotic diuretics.
Neuromuscular blockers: Tubocurarine and succinyl choline.
Organ system effects and mechanism of action of adrenoceptor agonists and antagonists:

- **Adrenergic stimulants**: Amphetamine and ephedrine. α-adrenergic stimulants – Methoxamine and clonidine. β-adrenergic stimulants – Metaproterenol and salbutamol.
- **Adrenergic antagonists**: Labetolol. α-adrenergic blockers – Phenoxybenzamine and phentolamine. β-adrenergic blockers – Propranolol and atenolol.

Antianginal drugs: Nitroglycerine and calcium-channel blocker – Nifedipine and verapamil. (12 Lectures)

5. **Biostatistics:**


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2. Candidates have to attempt all five questions from each sub-unit amongst the alternatives.
Practical

PAPER – VII (F.M. 100)
UNIT : 13

1. Biochemical Estimation : 40 Marks
   i) Blood Sugar by Folin-Wu Method ; ii) Serum Protein by Biuret Method ; iii) Serum Albumin using Bromocresyl Green ; iv) Estimation of RNA by orcinol method ; v) Blood Uric Acid by cyanide-free method ; vi) Serum urea by DAM method.

2. Experimental Physiology : 25 Marks
   Preparation of amphibian Ringer solution. Kymographic recording of perfused heart beat of toad. Study of the effects of changes in perfusion fluid pressure, excess calcium and potassium ion concentration, acetylcholine, adrenaline.

3. Microbiology & Biochemical Technique : 10 Marks
   (b) Isolation of amino acids from an artificial mixture using paper chromatography.

4. Viva - Voce : 15 Marks

5. Laboratory Note - Books : 10 Marks

PAPER –VIII (F.M. 100)
UNIT : 14

1. Histology : 15 Marks
   Staining of sections by haematoxylin-eosin and iron-haematoxylin. Demonstration: Preparation of permanent slides – fixation, dehydration, paraffin embedding, block preparation, cutting and staining.

2. Experimental Physiology: 20 Marks
   Kymographic recording of normal movements of rat’s intestine in Dale’s apparatus. Effects of hypoxia, acetylcholine and adrenaline on normal intestinal movements.
3. **Experiments on Work Physiology and Ergonomics using human subjects**: 15 Marks
   a) Sphygmomanometric measurement of arterial blood pressure at rest and after exercise.
   b) Modified Harvard step test and determination of physical fitness. Recording of recovery heart-rate after standard exercise and graphical plotting.
   c) Pneumographic recording of effects of talking, drinking, laughing, coughing, exercise, hyperventilation and breath - holding.
   d) Spirometric measurement of vital capacity.
   e) Measurement of some common anthropometric parameters- stature, weight, eye height, shoulder height, eye height (sitting), elbow height, sitting height, elbow rest height (sitting), knee height (sitting), shoulder elbow length, arm reach from wall, elbow-to-elbow breadth, knee-to-knee breadth (sitting), shoulder breadth, head length, head breadth, head circumference and neck circumference, mid-arm circumference, waist circumference, hip circumference, chest circumference.
   f) Calculation of Body Surface Area (using nomogram), Body Mass Index and Ponderal Index from anthropometric measurements.

2. **Biostatistics**: 10 Marks
   Computation of mean, median, mode, standard deviation and standard error of the mean with physiological data like body temperature, pulse rate, respiratory rate, height and weight of human subjects. Graphical representation of data in frequency polygon and histogram. Student’s t test for significance of difference between means.
   *Demonstration*: Statistical analysis and graphical representation of biological data with computer application program (Microsoft Excel).

3. **Social Physiology : Diet survey and Field Study record**: 15 Marks
   a) Diet survey report (hand-written) of a family (as per ICMR specification) : Each student has to submit a report on his/her own family. 8 Marks
   b) A report (hand-written) on the basis of field survey from ONE of the followings: 7 Marks
      1. Physiological parameters of human (at least three parameters).
      2. Anthropometric measurements on human (at least three parameters).
      3. Epidemiological studies on human.
      4. Project work on animals involving physiological parameters (at least three parameters).
   c) Optional : Visit to Institute of national importance engaged in physiological, biomedical, biochemical and nutritional research.

4. **Viva Voce**: 15 Marks

5. **Laboratory Note - Books**: 10 Marks
**RECOMMENDED BOOKS FOR PHYSIOLOGY (HONOURS) Parts I, II & III Courses**

(The latest edition available should be used for all books)

15. Core Text Book of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibell & E.A. Pfeiffer; Prentice-Hall of India Pvt Ltd.
23. Cellular & Molecular Biology, by EDP De Robertis & EMF De Robertis; Lea & Febiger.
28. Handbook of Experimental Physiology and Biochemistry, by P.V. Chadha; Jaypee Brothers Medical publishers.
29. Neurobiology, by G.M. Shepherd, Oxford University Press
33. William’s Text Book of Endocrinology Larsen et al.; An Imprint of Elsevier.
34. Endocrinology, Mac E. Hadley, Pearson Education.
35. The Kidney-An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
41. Pesticides by P.K. Gupta, Interprint.
42. Environmental Chemistry by P.V. De. Wiley Eastern Ltd.
44. Essentials of Exercise Physiology by L.G. Shaver, Surject Publications.
45. Text Book of Environmental Physiology by C. Edger Folk Jr. Lea and Febiger.
46. Goodman & Gilman’s The Pharmacological Basis of Therapeutics, McGraw-Hill.
63. The Clocks That Time Us, by M.C. Moore-Ede and others, Harvard University Press.
64. Circadian Rhythms and the Human, by D.S. Minors and J.M. Waterhouse. Wright. PSG.
65. The Physiological Clock: Circadian Rhythms and Biological Chronometry, E. Bunning, Springer-Verlag.
68. An Introduction to Biological Rhythms, by D. Palmer, Academic Press
Note Books of Practical Biochemistry, Experimental Physiology and Histology

(Published by the Physiological Society of India, Kolkata)

**Note**: In order to maintain the uniformity of practical knowledge among the students of different Colleges, Physiological Society of India has published Practical Note Books in Physiology comprising syllabi of different Universities including Calcutta University with the help of experienced teachers including dignitaries of both Honours and General teaching degree colleges. Hence, members of the Undergraduate Board of Studies in Physiology recommend the aforesaid Note Books (Experimental, Biochemistry and Histology) for use by the students in undergraduate degree course (Honours practical) in Physiology.
# GENERAL

## PART - I

### THEORETICAL

**Paper I** (F.M. 100)

#### Unit - 01: 50 Marks

<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>1. Units of human system</td>
<td>06</td>
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<tr>
<td>2. Biophysical and Biochemical Principles</td>
<td>10</td>
</tr>
<tr>
<td>3. Digestive System</td>
<td>12</td>
</tr>
<tr>
<td>4. Biochemistry and Metabolism</td>
<td>14</td>
</tr>
<tr>
<td>5. Nutrition and Dietetics</td>
<td>08</td>
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#### Unit – 02: 50 Marks

<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>1. Blood and Body Fluids</td>
<td>10</td>
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<tr>
<td>2. Heart</td>
<td>10</td>
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<tr>
<td>3. Circulation</td>
<td>10</td>
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<tr>
<td>4. Respiratory system</td>
<td>10</td>
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<tr>
<td>5. Renal Physiology</td>
<td>10</td>
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## PART - II

### THEORETICAL

**Paper – II** (F.M. 100)

#### Unit - 03: 50 Marks

<table>
<thead>
<tr>
<th>Topic</th>
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<tbody>
<tr>
<td>1. Muscle Physiology</td>
<td>08</td>
</tr>
<tr>
<td>2. Nerve Physiology</td>
<td>10</td>
</tr>
<tr>
<td>3. Nervous system I</td>
<td>10</td>
</tr>
<tr>
<td>4. Nervous system II</td>
<td>10</td>
</tr>
<tr>
<td>5. Sensory Physiology</td>
<td>12</td>
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#### Unit – 04: 50 Marks

<table>
<thead>
<tr>
<th>Topic</th>
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</thead>
<tbody>
<tr>
<td>1. Skin and Regulation of Body Temperature</td>
<td>08</td>
</tr>
<tr>
<td>2. Endocrine system I</td>
<td>12</td>
</tr>
<tr>
<td>3. Endocrine system II</td>
<td>12</td>
</tr>
<tr>
<td>4. Reproductive Physiology I</td>
<td>09</td>
</tr>
<tr>
<td>5. Reproductive Physiology II</td>
<td>09</td>
</tr>
</tbody>
</table>
PRACTICAL

Paper – III (F.M.100)

(One practical class is of 3 periods) Classes required 70
(Each period of 45 minutes duration)

Unit 05
1. Histology :
   a) Haematological Experiments 30 Marks
   b) Fresh tissue experiments (except haematological experiments) 20 Marks
   c) Identification of histological permanent slides 10 marks

2. Biochemistry :
   a) Qualitative Experiments 30 Marks
   b) Quantitative Experiments 10 marks

3. Experimental Physiology (Including Human Experiments) 15 Marks
   a) Amphibian skeletal muscle and heart experiments
   b) Experiments on Human

4. Viva voce 15 Marks
5. Laboratory note books 10 Marks

PART - III

THEORETICAL

Paper – IV A (F.M. 70) Lectures required
(Each period of 45 minutes duration)

Unit – 06: 70 Marks

1. Haematology 10
2. Biochemistry & Molecular Biology 14
3. Microbiology and Immunology 10
4. Social Physiology 08
5. Work Physiology 10
6. Environmental Physiology 10
7. Biostatistics 08

PRACTICAL

Paper - IVB F.M. 30
(One practical class is of 3 periods) Classes required 20
(Each period of 45 minutes duration)

Unit – 07: 30 Marks
1. a) Haematology 18 Marks
   b) Biochemistry
   c) Human Experiments

2. Field Study Report 4 Marks
3. Viva voce 5 Marks
4. Laboratory Note-Books 3 Marks

PART - I
THEORETICAL

Paper I (F.M. 100)

Unit - 01: 50 Marks

1. Units of Human System:
   Structure and functions of plasma membrane, nucleus and different cell organelles – Endoplasmic reticulum, Golgi bodies, Mitochondria, Lysosome and Peroxisome. Structure, function and classification of Epithelial, Connective, Muscular and Nervous tissues. (06 lectures)

2. Biophysical and Biochemical Principles:
   Physiological importance of the following physical processes: Diffusion, Osmosis, Dialysis, Ultrafiltration, Surface tension, Adsorption and Absorption. A brief idea about acids, bases, buffers, indicators. pH – definition, significance and maintenance of pH in the blood. Colloids – definition, classification and physiological importance. Enzymes: definition, classification, factors affecting enzyme action. Concept of coenzymes and isozymes. (10 lectures)

3. Digestive System:
   Structure in relation to functions of alimentary canal and digestive glands. Composition, functions and regulation of secretion of digestive juices including bile. Digestion and absorption of carbohydrate, protein and lipid. Movements of the stomach and small intestine. (12 lectures)

4. Biochemistry and Metabolism:


5. Nutrition:
Unit – 02 : 50 Marks

1. Blood and Body Fluids :

2. Cardiovascular Physiology I :

3. Cardiovascular Physiology II :

4. Respiratory Physiology :

5. Renal Physiology :

**DISTRIBUTION OF QUESTIONS IN THEORETICAL PAPER**

1. From each unit, five questions of 10 marks each with one alternative will be set from the same sub-unit . Each 10 marks question may be sub-divided.  

2. Candidates have to attempt all five questions from the unit amongst the alternatives.
PART - II
THEORETICAL

Paper II (F.M. 100)

Unit – 03 : 50 Marks

1. Muscle Physiology :
   Different types of muscle and their structure. Red and white muscle. Muscular contraction: structural, mechanical and chemical changes in skeletal muscle during contraction and relaxation. Isotonic and isometric contractions. Properties of muscle: all or none law, beneficial effect, summation. refractory period, tetanus, fatigue. A brief idea about the muscle spindle.
   (08 lectures)

2. Nerve Physiology :
   (10 lectures)

3. Nervous System I :
   (10 lectures)

4. Nervous System II :
   (10 lectures)

5. Sensory Physiology :
   Classification of general and special senses and their receptors. Receptors as biological transducer.
   (b) Audition: Structure of ear, auditory pathway, mechanism of hearing.
   (12 lectures)
Unit – 04 : 50 Marks

1. Skin and Regulation of Body Temperature:
   Structure and functions of skin. Insensible and sensible perspiration Regulation of body temperature – physical and physiological processes involved in it. Physiology of sweat secretion and its regulation. (08 lectures)

2. Endocrine System I:
   Hypothalamus: Basic concept of neurohormone. Hypothalamo-hypophyseal tract and portal system.
   Thyroid: Histological structure. Functions of thyroid hormones (T₄T₃) Thyrocalcitonin. Hypo and hyper-active states of thyroid.
   Parathyroid: Histological structure, functions of parathyroid hormone. Tetany. (12 lectures)

3. Endocrine System II:
   Adrenal Cortex: Histological structure and functions of different hormones. Hypo and hyper-active states of adrenal cortex.
   Adrenal Medulla: Histological structure and functions of medullary hormones. The relation of adrenal medulla with the sympathetic nervous system.
   Brief idea of the origin and functions of renin-angiotensin, prostaglandins. erythropoietin and melatonin. Elementary idea of gastrointestinal hormone. (12 lectures)

4. Reproductive Physiology I:
   Primary and accessory sex organs and secondary sex characters. Testis: histology, spermatogenesis, testicular hormones and their functions. Ovary: histology, oogenesis, ovarian hormones and their functions. (09 lectures)

5. Reproductive Physiology II:

**DISTRIBUTION OF QUESTIONS IN THEORETICAL PAPER**

1. From each unit, **five** questions of 10 marks each with one alternative will be set from the same sub-unit. Each 10 marks question may be sub-divided.

2. Candidates have to **attempt all five** questions from the unit amongst the alternatives.
Practical

Paper III (F.M. 100)
Unit – 05

1. Histology: 30 Marks
   Only ONE question will be set from the following two groups [ i) & ii)] in the examination (20 Marks):
   i) Haematological experiments:
      a) Leishman's staining of human blood film and identification of different types of blood corpuscles.
      b) Preparation of Haemin crystals.
   ii) Fresh tissue experiments:
      a) Examination and staining of fresh tissues (other than blood) squamous, cornified, ciliated and columnar epithelium, skeletal muscle, cardiac muscle by methylene blue stain.
      b) Silver nitrate preparation of node of Ranvier.
   Demonstration: Staining of adipose tissue by Sudan III or IV.
   iii) Identification of permanent slides: Bone, Lung, Trachea, Spleen, Lymph gland, Liver, Salivary gland, Pancreas, Adrenal gland, Thyroid gland, Spinal cord, Cerebellum, Cerebral cortex, Kidney, Skin, Testis, Ovary, Tongue, Oesophagus, Stomach, Small intestine, Large intestine. (5 slides - 10 Marks)

2. Biochemistry: 30 Marks
   Qualitative Experiments: 10 Marks
   Qualitative tests for identification of starch, dextrin, lactose, sucrose, glucose, fructose, albumin, gelatin, peptone, lactic acid, hydrochloric acid, uric acid, acetone, glycerol, bile salts, urea.

   Quantitative Experiments: 20 Marks
   a) Quantitative estimation of glucose by Benedict's method.
   b) Quantitative estimation of amino-nitrogen by Sorensen’s formol titration method.
   Percentage and total quantity to be done.

   Demonstration:
   a) Quantitative estimation of Sucrose by Benedict's method.
   b) Analysis of wheat, rice, milk and oil to test the presence of carbohydrate, protein and fat.
   c) Salivary amylase activity on starch at body temperature (37.5°C), above 40°C and in presence of HCl.

3. Experimental Physiology with Human Experiment: 15 Marks
   a) Use of kymograph, induction coil and key.
   b) Recording of simple muscle curve with sciatic-gastrocnemius muscle preparation of toad and determination of latent period, period of contraction and period of relaxation and maximum height of contraction.
   c) Normal tracing of toad's unperfused heart beat.
   d) Effect of warm saline on toad's unperfused heart beat.
   e) Measurement of systolic and diastolic arterial pressure by sphygmomanometer and determination of pulse pressure and mean pressure during rest and exercise.

   Demonstration:
   a) Effect of temperature on simple muscle twitch.
   b) Effect of calcium and potassium ions on unperfused toad's heart beat.
   c) Effect of adrenaline/acetylcholine on unperfused toad's heart beat.

4. Laboratory Note Books: 10 Marks
   i) Biochemistry - 4 marks; ii) Histology - 3 marks; iii) Experimental - 3 marks

5. Viva – voce 15 Marks
   a) Questions are to be asked from the experiments given in the examination.
      i) From Biochemistry - 4 marks; ii) From Histology - 4 marks;
      iii) From Experimental - 3 marks; iv) From Instruments – 4 marks
      (Questions are to be asked on the different instruments used in the practical classes.)
PART - III
THEORETICAL

Paper IV A (F.M. 70)                 Unit – 06 : 70 Marks

1. Haematology :

2. Biochemistry and Molecular Biology :
   Brief idea of HMP shunt and its significance (detailed enzymatic reactions are not required). Lipoproteins - types and functions. Purine and pyrimidine bases, nucleosides, nucleotides and polynucleotides. Structure of DNA and RNA. Elementary idea of gene, genome, transcription, genetic code, translation and genetic engineering. (10 lectures)
   Pathophysiological significance of the following blood constituents: glucose, urea, creatinine, uric acid, cholesterol, bilirubin, SGPT and SGOT, alkaline and acid phosphatases and ketone bodies. (4 lectures)

3. Microbiology and Immunology :

4. Social Physiology :

5. Work Physiology :
   Physical work - definition and units of measurement. Concept and classification of physical work -- static and dynamic work, positive & negative work. Cardiovascular and respiratory changes during physical exercise. Brief idea of maximal aerobic power and excess post-exercise oxygen consumption. Basic idea of doping. EMG. Physical fitness index - Harvard step test. ECG -- normal waves and leads. Anthropometry and its uses. (10 lectures)

6. Environmental Physiology :

7. Biostatistics :
   Basic concepts – variable, population, parameter, sample, statistic. Classification of data – qualitative and quantitative, continuous and discontinuous. Presentation of data--frequency distribution, bar diagram, pie diagram, frequency polygon and histogram. Mean, median, mode, standard deviation and standard error. (08 Lectures)
**DISTRIBUTION OF QUESTIONS IN THEORETICAL PAPER**

1. From each unit, **seven** questions of 10 marks each with one alternative will be set from the same sub-unit. Each 10 marks question may be sub-divided.
2. Candidates have to **attempt all seven** questions from the unit amongst the alternatives.

**PRACTICAL**

Paper IV B (F.M. 30)

Unit – 07 : 30 Marks

1. Any two questions from the following three groups (A, B and C) are to be set in the examination: 

   9 \times 2 = 18 \text{ marks}

   **A. Haematology:**
   a) DC of WBC, estimation of haemoglobin, blood group determination, bleeding time and coagulation time.
   
   **Demonstration:** Haematocrit, MCV, TC of RBC and WBC, ESR.

   **B. Biochemistry:**
   a) Identification of normal constituents of urine - chloride, sulphate, phosphate, creatinine and urea. Identification of abnormal constituents of urine - glucose, protein, acetone blood and bile salts.
   
   **Demonstration:** Blood sugar estimation (Folin -Wu method )

   **C. Human Experiments:**
   a) Determination of Physical Fitness Index (PFI) of an individual by modified Harvard step test and recording of recovery heart-rate after standard exercise.
   b) Pneumographic recording of respiratory movements along with the effect of drinking of water, talking, forced hyperventilation and breath holding.
   c) Measurement of some common anthropometric parameters : stature, weight, eye height, shoulder height, elbow height, sitting height, elbow rest height (sitting), knee height (sitting), arm reach from wall, mid-arm circumference, waist circumference, hip circumference, neck circumference, head circumference, chest circumference.
   d) Calculation of Body Surface Area (using a nomogram) and Body Mass Index from anthropometric measurements.
   
   **Demonstration:**
   a) Tests for colour blindness, test for visual acuity using Snellen’s Chart.
   Exploration of conductive and perceptive deafness by tuning for method.

2. **Field Study Report:** 4 Marks

   Any one of the followings:
   a) Diet survey of a family as per ICMR specification.
   b) Population study of physiological parameters such as height, weight, heart-rate, blood pressure, respiratory rate, PFI, TC of RBC, estimation of haemoglobin, DC of WBC as far as practicable.

3. **Viva- Voce:** 5 Marks

4. **Laboratory Note- Book :** 3 Marks
RECOMMENDED TEXT AND REFERENCE BOOKS FOR PHYSIOLOGY (GENERAL) COURSE
(The latest edition available should be used for all books)

    II. *The Living Body*, O. H. Best & N. B. Taylor, Williams & Wilkins.
17. *Immunology* by D. M. Weir, ELBS.
21. Note Books on Practical Biochemistry, Experimental Physiology and Histology
    (Published by the Physiological Society of India, Kolkata.)

*Note:* In order to maintain the uniformity of practical knowledge among the students of different Colleges, Physiological Society of India has published Practical Note Books on Physiology comprising syllabi of different Universities, including Calcutta University with the help of experienced teachers of both Honours and General teaching degree colleges. Hence, members of Undergraduate Board of Studies in Physiology recommend the aforesaid Note Books (Experimental, Biochemistry and Histology) for use by the students in undergraduate degree course (General) practical in Physiology.