

THE UNIVERSITY OF BURDWAN



Syllabus for B.Sc. 3- Year Degree Course in **PHYSIOLOGY (General)** (w.e.f. 2010-2011).

PART -I

TOTAL MARKS - 100

Paper -I (Theoretical) 100 MARKS

TOPICS	No. of Lectures
1. Physiology as a science of excellence	3
2. Units of Human System	5
3. Biophysical and Biochemical Principles involved in human system	12
4. Conservation of matter and energy in human systems	40
5. Blood and body fluids	18
6. Cardiovascular System	25
7. Respiratory system	25

PART - II

TOTAL MARKS - 200

Paper - II (Theoretical) 100 MARKS

1. Nerve Muscle Physiology	15
2. Nervous System	30
3. Sensory Physiology	15
4. Renal Physiology	10
5. Skin and body temperature regulation	10
6. Endocrine System	20
7. Reproductive Physiology	15

Paper - III (Practical) 100 MARKS

1. Histology
2. Biochemistry
3. Experimental Physiology

PART - III

TOTAL MARKS - 100

Paper - IVA (Theoretical) 65 MARKS

1. Clinical Biochemistry	6
2. Microbiology	8
3. Immunology & immunization programme	6
4. Work & Sports Physiology	12
5. Social Physiology	10

6. Environmental Physiology	8
7. Biostatistics	8

Paper – IVB (Practical) 35 MARKS

1. Hematological tests
2. Biochemical tests
3. Human Experiments
4. Field Study

Detailed Syllabus :

PART – I

Paper-I (Theoretical)

Marks :100

1. **Physiology as a Science of Excellence :** (3 Lectures)
Role of physiology as a basic science. Role of Physiology in improvement of health, nutrition, family planning and physical performance. Role of Physiology in the interaction between man, machine and environment.
2. **Units of Human system :** (5 Lectures)
Structure function relationship of a cell and different tissues, structure, distribution, characteristic features of epithelial, connective, muscular and nervous tissues.
3. **Biophysical and Biochemical Principles involved in human system:** (12Lectures)
Physiological importance of the following physical processes : Diffusion, dialysis, osmosis, ultra filtration, surface tension, absorption and adsorption ; cell membrane transportation-active and passive transport. A brief idea about acids, bases, indicators, pH, buffer system-definition and examples, Colloids- definition and examples, classification, properties and physiological importance, Enzymes-definition, classification, properties, physiological importance, inhibitors, activators, proenzymes, coenzymes and isozymes.
4. **Conservation of matter and energy in human systems :** (40 Lectures)
 - (a) Alimentation : Structures in relation to functions of alimentary canal, digestive glands and organs. Composition, function and regulation of secretion of digestive juices : origin and formation of hydrochloric-acid in the stomach : Composition, formation, secretion, storage and functions of bile, jaundice. A brief idea of the physiology of the mastication and deglutition, movements of the G.I. tract, types and their function. Digestion and absorption of carbohydrates, lipids and proteins.
 - (b) Chemistry and Metabolism : classification and important properties of carbohydrate, lipids and proteins. Carbohydrate- Glycolysis, Glycogenesis, Glycogenolysis, Neoglucogenesis, TCA cycle, a brief idea of HMP pathway, Cori cycle, Lipids: Depot fat, Fatty acid oxidation, Ketosis and its significance. Proteins : Deamination, Transamination, Functions of amino acids in the body, Formation of Urea.
 - (c) Nutrition. Basic constituents of food and their nutritional significances, Vitamins : classification, functions, deficiency symptoms, daily requirements hypervitaminosis : Specific Dynamic Action (SDA): Definition and, determination by Benedict Roth apparatus, factors affecting. Respiratory Quotient (RQ): Definition, factors affecting and significance. Essential

fatty acids-their nutritional significances : Essential amino acids- their significances ; Biological value of protein. Minimum protein requirement ; positive and negative nitrogen balance. Source, requirement and brief idea of physiological role of iron, iodine, calcium & phosphorus.

- (d) Dietetics : Principles of dietetics, energy cost of various types of activities ; Principle of calculation of calorie requirement of an individual and distribution of carbohydrate, fat and protein in their diet. Formulation of balanced diet of college students and pregnant woman.

5. **Blood and body fluids :** (18 Lectures)

(a) Blood : Composition and functions Plasma protein : classification, origin & functions, Bone marrow, plasmapheresis. Haematocrit ratio and its importance. Formed elements of blood – RBC, Erythropoiesis its stages with the factors needed. Fe, Cu, Co, Vitamin B₁₂, folic acid and erythropoietin. Function and fate of erythrocyte. Hemoglobin: classification, origin, fate and derivatives, WBC- classification, origin, functions ; Platelets – origin and function. Blood volume- Normal value, determination by dye method and radio isotope method, its regulation : Blood Coagulation-enzymatic mechanism, disorders, natural & artificial anticoagulant, bleeding time, clotting time ; Blood transfusion, Blood groups & their importance in blood transfusion ; Body fluids : Composition, formation and function of lymph and tissue fluids ; structure and function of spleen and lymphatic glands.

6. **Cardiovascular System :** (25 Lectures)

(a) Heart : Anatomy and histology of heart ; Properties of cardiac muscle : origin and propagation of cardiac impulse, heart block, pacemaker, anginal pain ; Cardiac cycle – Definition and different events of cardiac cycle. Heart sounds : origin and significance. Heart rate-neural and humoral control : Cardiac reflexes, Cardiac output- Definition, methods of determination by dye dilution and Fick's Principle , regulating factors. ECG-definition and principles, different types of leads used and their significances. Different waves and their interpretation. (b) Haemodynamics : Structure of artery, arteriole, capillary, vein venule ; Pulse arterial, venous :Blood Pressure- different types e.g. arterial, venous, systolic, diastolic, pulse pressure, pressure pulse, mean pressure ; Methods of measurement : Regulation through baro-receptors and chemo receptors, vasomotor reflexes – a brief idea.

7. **Respiratory system :** (25 Lectures)

Anatomy and histology of the respiratory passage and capacities. Dead space: anatomical and physiological significance : Artificial respiration – its application : Partial pressure and percentage of respiratory gases in inspired, expired, alveolar air and in blood : Chemistry and mechanism of transport of oxygen and carbon dioxide from lungs to tissues and tissues to lungs : Regulation of respiration-neural and chemical, Hering-Breuer reflex. Acclimatization – effects of hypobaric and hyperbaric atmosphere on respiration: Breath holding- oxygen therapy : Eupnoea. Apnoea, Hypoxia, Asphyxia. Hyperpnoea, Periodic breathing, Caisson's disease and cyanosis.

RECOMMENDED TEXTS AND REFERENCES FOR PHYSIOLOGY (GENERAL) Part - I COURSE

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

1. Sharir Bigyan: Jogen Debnath, Sri Dhar Prakasani, Kolkata
2. Human Physiology : C.C. Chatterjee, Medical Allied Agency
3. Applied Physiology : Samson Wright
4. Review of Medical Physiology : W.F.Ganong., Lange Medical Book.
5. Text book of Medical Physiology By A.C.Guyton ; Saunders Publications

PART – II

Paper – II (Theoretical)

Marks:100

1. **Nerve Muscle Physiology :** (15 Lectures)
Structure and classification of nerve fibres; Degeneration and regeneration of nerve fibers ; Nerve impulse- Generator potential, action potential, origin of nerve impulse and its propagation : Properties of nerve fibres-All or none law, rheobase, chronaxie, refractory period ; Synapse-Electron microscopic structure, different types, properties, mechanism of synaptic transmission. Motor unit, motor point, Myoneural junction-Electron microscopic structure, Mechanism of neuromuscular transmission. Muscle-Minute structure of different types of muscle. Red and white muscle, mechanism of contraction, different changes in skeletal muscle during contraction and relaxation, isometric and isotonic contraction ; Properties of muscle- All or none law, beneficial effect, summation, refractory period, tetanus, fatigue.
2. **Nervous System :** (30 Lectures)
A brief outline of organization and basic functions (sensory, motor and association) of the nervous system. Central, Peripheral nervous system (emphasis on structure of spinal cord & brain stem)
 - (a) Central Nervous System : Reflex action : Definition, classification, properties, reflex arcs, receptor, afferent path, inter-neurons, efferent path of motor organs ; Neural paths- The origin, course, termination and functions of Ascending tracts like Tract of Goll and Burdach ; Anterolateral system ; Dorsal and ventral spino-thalamic tract ; Descending tracts, pyramidal tracts and a brief idea of extra pyramidal tracts ; Spinal cord-different nuclei, effects of sectioning of spinal cord and Brown-Sequard syndrome ; Brief idea of medulla, pons and midbrain. Cerebellum, thalamus and hypothalamus ; Different nuclei, structures, connections and functions. Muscle tone sleep and its different stages, EEG and its different waves ; CSF : composition, formation, circulation and functions.
 - (b) Autonomic Nervous System Classification : sympathetic and parasympathetic, their origin, distribution and functions.
3. **Sensory Physiology :** (15 Lectures)
Classification of sensations-General and Special their receptors : Receptor – a biological transducer, structural and functional classification : Muller’s law of specific nerve energies. Weber-Fechner law , adaptation of receptors, neural pathway of smell and taste sensations, mechanism of perception of smell and taste, adaptation and after taste ;
Audition : Structure of external, middle and internal ear, their role in hearing, auditory pathway, tests of hearing and deafness. Vision- anatomical organization of eye ball,

refractive media of the eye, histology of retina, physiological and photochemical changes of retina on exposure to light ; visual pathway-light reflex, Accommodation-its mechanism : Error of refraction and their remedy, positive and negative and after image, light and dark adaptation, night blindness. Elementary idea of color vision and color blindness.

4. **Renal Physiology :** (10 Lectures)
Electron microscopic structure of different parts of a nephron including Juxtaglomerular apparatus and their functions. Normal and abnormal constituents of urine and their significance ; Role of nephron in the formation of urine. Physiology of storage of urine and micturition. Renal regulation of acid base balance ; Renal function tests their significances. Non excretory functions of kidney, ultra filtration, dialysis and artificial kidney.
5. **Skin and body temperature regulation :** (10 Lectures)
Histological structure and functions of skin. Normal body temperature Homeotherm and poikilotherm ; Insensible and sensible perspiration. Physiology of sweat secretion. Regulation of body temperature in homeotherms : Hypothermia, hyperthermia, fever.
6. **Endocrine System :** (20 Lectures)
Definition and classification of endocrine glands and hormones : Pituitary-histological structure of different parts, Hormones, their origin and functions, hyper and hypoactive states of pituitary gland ; Diabetes insipidus, dwarfism and gigantism. Basic concept of regulation and hormone action-positive and negative feedback mechanism. Elementary idea of hormone action.
Thyroid : Electron microscopic structure, origin and functions of thyroxin and calcitonin. Hypo and hyperactive states of thyroid gland. Dwarfism, Gigantism, Myxedema and Goiter. Parathyroid gland – histological structures, origin and functions of parathyroid hormone, Hyper and hypoactive stats of parathyroid gland. Tetany.
Adrenal Cortex : Histological structure, origin and functions of adrenal cortical hormones. Hyper and hypoactive states of adrenal cortex.
Adrenal Medulla : Histological structure, origin and functions of adrenal medullary hormones.
Pancreas : Histological structure of islets of Langerhans. Origin and functions of pancreatic hormones. Blood sugar regulation, diabetes mellitus-insulin dependent and insulin independent : ;Brief idea of the origin and functions of renin and angiotensin, prostaglandins, erythropoietin and melatonin. Elementary idea of gastro-intestinal hormones.
7. **Reproductive Physiology :** (15 Lectures)
Primary and accessory sex organs and secondary sex characters.
Histological structure of testis, stages and controlling factors of oogenesis, Fertilization and implantation. Function of ovarian hormones. Menstrual cycle and its hormonal control. Structure and functions of placenta.
Development of the mammary gland and lactation. Fertility control.

Paper – III (Practical)

Marks : 100

GROUP-A: HISTOLOGICAL TECHNIQUES : (Marks:25)

Microscopic Study of fresh tissues : Study of ciliary movement. Study of columnar epithelium by Methylene Blue staining and areolar tissue by Methylene Blue and Silver Nitrate solution. Study of Adipose tissue by Sudan III staining and skeletal muscle by Methylene Blue staining. Study of Nodes of Ranvier and extra-cellular cell spaces of mesentery/cornea by silver nitrate preparation.

Hematology : Identification of different white blood corpuscles in a human blood film stained by Leishman's stain. Estimation of hemoglobin by hemoglobinometer. Study of haemin crystal.

Identification of Permanent Sections : Tongue, Esophagus, stomach, small intestine, large intestine, salivary gland, pancreas, Trachea, lung, Kidney. Spinal Cord, Cerebellum, adrenal gland, thyroid gland, Testis, Ovary, uterus, liver spleen.

GROUP-B: BIOCHEMICAL TECHNIQUES :- (Marks:25)

Qualitative experiments : Identification of following substances of physiological importance. Glucose, fructose, lactose or maltose, sucrose, starch, dextrin, glycerol, albumin or globulin, gelatin, peptone, HCl acid, lactic acid uric acid, acetone, Bile salts.

Quantitative experiments : Identification of following substances of physiological importance. Glucose, fructose, lactose or maltose, sucrose, starch, dextrin, glycerol, albumin or globulin, gelatin, peptone, HCl acid, lactic acid, uric acid, urea, acetone, Bile salts.

Quantitative experiments : Estimation of glucose by Benedict's titration method (total quantity and percentage) , estimation of amino-nitrogen by Sorensen's formal titration method (total and percentage)

GROUP-C: EXPERIMENTAL PHYSIOLOGY :- (Marks:25)

Study of the instruments used in experimental physiology, practical classes.

Experiments on Animals : Recording of a simple muscle curve (isotonic) with gastrocnemius-sciatic nerve preparation of a toad and determination of latent period, period of contraction, period of relaxation and maximum height of contraction. Study of the changes in the heart rate on application of warm and cold saline (within physiological limit) on the contraction of unperfused toad's heart.

Experiments on Human : Measurement of systolic blood pressure, diastolic pressure, pulse pressure, mean pressure of an individual with the help of sphygmomanometer and stethoscope. Study and graphic plotting of the following changes after exercise by modified Harvard step test method till recovery of (a) Heart rate at an interval of one minute.

(c) Systolic arterial blood pressure at an interval of five minutes.

Laboratory Notebook:

(Marks:10)

Biochemistry – 4 , Histology-3, Experimental physiology – 3.

Vivavoce: (Marks:15)
a) Practical syllabus – 10, b) Instrument used in practical classes -5

RECOMMENDED TEXTS AND REFERENCES FOR PHYSIOLOGY (GENERAL) Part - II COURSE
(The latest edition available should be used for all books)

1. Sharir Bigyan: Jogen Debnath, Sri Dhar Prakasani, Kolkata
2. Human Physiology : C.C. Chatterjee, Medical Allied Agency
3. Applied Physiology : Samson Wright
4. Review of Medical Physiology : W.F.Ganong., Lange Medical Book.
5. Text book of Medical Physiology By A.C.Guyton ; Saunders Publications
6. Byabaharik Sharir bigyan : Jogen Debnath.

**DURATION OF PRACTICAL EXAMINATION AND DISTRIBUTION OF QUESTIONS
AND MARKS IN PRACTICAL PAPERS**

The practical examination should be SIX hours duration

Questions are to be set as under:

GROUP A : HISTOLOGICAL TECHNIQUES	25 Marks
(a) Identification of five slides	10 marks
(b) One histological preparation	15 marks
GROUP-B: BIOCHEMICAL TECHNIQUES :	25 Marks
(a) Identification of one sample	10 marks
(b) Estimation of one sample	15 marks
GROUP-C : EXPERIMENTAL PHYSIOLOGY:	25 Marks
(a) One experiment on animal	15 marks
(b) One experiment on human	10 marks
GROUP-D: LABORATORY NOTE BOOK	10 Marks
(a) Biochemistry	4 marks
(b) Histology	3 marks
(c) Experimental Physiology	3 marks
GROUP-E: VIVA-VOCE	10 Marks
(a) On practical syllabus	8 marks
(b) On the instruments used in practical classes	2 marks

Part-III

Paper - IVA (Theoretical)

(Marks:65)

1. **Clinical Biochemistry :** (6 lectures)
 - (a) Techniques in the Biochemical investigations of disease. Collection of specimens :- Arterial and venous blood, preparation of serum and plasma, uses of anticoagulants, urine and its preservation. General techniques for analysis (principle only) colorimetric techniques. Photoelectric colorimetry, Spectrophotometry. Special technique for analysis, Principle of electrophoresis, principles of chromatography.
 - (b) Clinical importance of serum lipoproteins, triglycerides, cholesterol.

(c) Pathophysiological significances of the following blood constituents : glucose, urea, creatine, uric acid, bilirubin, SGOT, SGPT, alkaline and acid phosphatases, ketone bodies, N.P.N.

(d) Significance of Glucose tolerance test and liver function test

2. **Microbiology:** (8 lectures)
Virus – DNA and RNA, Bacteria-structure and morphological classification, pathogenic and non-pathogenic, Gram positive and Gram negative bacteria : Sterilization and pasteurization ; Antibiotics ; Bacteriostatic and Bactericidal agents with example, Basic structure of DNA and RNA, Elementary idea of gene, genome.
3. **Immunology & immunization program:** (6 lectures)
Elementary idea of immunity, classification of immunity, active and passive, innate and acquired, humoral and cell mediated : Principle and importance of vaccination : Principle and importance of immunization program in infants, elementary idea of hypersensitivity and autoimmune diseases.
4. **Works & Sports physiology :** (12 lectures)
Elementary idea of work, Cardiac index, Work index, oxygen pulse, VO_2 max, Oxygen debt, dynamic and static work their industrial application, effect of ambient temperature, humidity, work and rest period; energy sources in muscular exercise, cardiovascular and respiratory changes during exercise, principle of training, Dope test, significance of lung function tests.
5. **Social Physiology :** (10 lectures)
Elementary concepts of health and treatment. Brief idea about communicable and non communicable diseases and their prevention. Primary nutritional disease- mal nutrition, Kwashiorkor, Marasmus and their prevention, under nutrition and the preventive measures. Anemia – classification and their prevention, causes and ; management of the following disease: diabetes, thalassemia, AIDS, atherosclerosis, endemic goiter, malaria, STD, hepatitis B and C, obesity, silicosis, asbestosis, emphysema, pneumoconiosis etc. Elementary idea of occupational hazards and their prevention, elementary idea of drug abuse and addiction, alcohol, marijuana, LSD and heroin.
6. **Environmental Physiology:** (8 lectures)
A brief idea of environment and biosphere, ecology, measurement of temperature, relative humidity, air velocity. Heat Index, pollutants-primary, secondary and tertiary and their sources. Effect of sound , air and water pollution on human body and their protection. Radioactive pollutants: their sources and hazards, Green house effects, ozone hole, Global warming, pesticides- their effects on human ecology.
7. **Biostatistics :** (8 lectures)
Sampling and its methods, Frequency distribution and its graphical representation, properties and computation of mean, properties, and computation of standard deviation an standard error.

Paper –IVB (Practical)

(Marks: 35)

Hematology : Differential count of W.B.C. Determination of Blood group- ABO system and Rh-

factor, Bleeding time, Clotting time. Biochemistry. Identification of following abnormal constituent of urine : Glucose, Protein, Acetone, blood & bile pigments. Identification of some common food adulterants : metanil yellow, Aluminum foil, chalk powder in sugar, water in milk, sugar solution in honey, starch in chana (Marks: 10).

Human Experiments : Pneumographic recordings of respiratory movements along with the effect of drinking water, talking, forced hyperventilation and breath holding. Test for colour blindness. Test for visual acuity using Snell's chart, exploration of conductive and perceptive deafness by tuning fork method.

Measurement of some anthropometric parameters :-

- (a) In standing posture : Stature, eye height, shoulder height, elbow height, shoulder elbow length, arm reach from wall.
- (b) In sitting position/ posture sitting height, eye height, elbow rest height, knee height, calculation of body surface area (using nomogram) and body mass index (BMI) from anthropometric measurements.
- (c) Field Study : Students have to conduct a fieldwork in a group or individually to study any physiological parameter in the near locality under the direct supervision of a teacher of the department. The study report, signed by the teacher concerned has to be submitted at the time of final examinations. (Marks: 10)

Field Report : (Marks : 5)

Laboratory Notebook : (Marks: 5)

Viva-voce : (Marks: 5)

RECOMMENDED TEXTS AND REFERENCES FOR PHYSIOLOGY (GENERAL) Part - III COURSE

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

1. Sharir Bigyan: Jogen Debnath, Sri Dhar Prakasani, Kolkata
2. Paribesh O Dushan : Gautam Paul, Dasgupta & Co.
3. Human Physiology : C.C. Chatterjee, Medical Allied Agency
4. Applied Physiology : Samson Wright.
5. Biostatistics : D. Das
6. Byabaharik Sharir bigyan : Jogen Debnath.

GUIDELINES FOR PRACTICAL PAPER FOR PART-III

DURATION OF PRACTICAL EXAMINATION AND DISTRIBUTION OF QUESTIONS AND MARKS IN PRACTICAL PAPERS

Practical examination shall have duration of Three hours. Questions are to be set as under

1. Any two Questions are to be set from Group A,B & C 10 X 2 = 20
2. Laboratory NOTE BOOK
 - (a) Haematology 2 marks
 - (b) Biochemistry 2 marks
 - (c) Human Experiment 1 mark
3. Field Report 5 marks
4. Viva Voce 5 marks

