

THE UNIVERSITY OF BURDWAN



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

PART – I Examination

PAPER – I		100 marks
<i>Unit – 01</i>	Structural units of Human System, Biophysical and Biochemical Principles, Biochemistry, Elementary idea of nervous system and ANS.	(50marks)
<i>Unit – 02</i>	Blood and body fluids ; Respiration, Cardiac Physiology, Circulatory System	(50marks)
PAPER – II		100 marks
Practical :	1. Histology	
	(a) Hematology	20 marks
	(b) Fresh –tissue preparation	15 marks
	(c) Identification of permanent slides	20 marks
	2. Biochemistry	
	(a) Qualitative analysis	10 marks
	(b) Quantitative analysis	15 marks
	3. Laboratory Note book	10 marks
	4. Viva-voce	10 marks

PART – II Examination

PAPER - III		100 marks
<i>Unit – 03</i>	Physiology of Digestive System, Metabolism, Nutrition and Dietetics.	(50 marks)
<i>Unit – 04</i>	Environmental Physiology, Microbiology & Immunology, Work Physiology, Sports Physiology and Ergonomics.	(50 marks)
PAPER – IV		100 marks
Practical :	1.Experimental Physiology	
	(a)Experiments on mammals	20 marks
	(b)Experiments on Human	15 marks
	2.Environmental Physiology.....	15 marks
	3.Microbiology	15 marks
	4.Diet Survey.....	15 marks
	5.Laboratory Note book	10 marks
	6.Viva-voce	10 marks

PART – III Examination

PAPER – V **100 marks**
Unit – 05 Nerve-Muscle Physiology, Sensory Physiology,
Renal Physiology. **(50marks)**

Unit – 06 Genetics and Molecular Biology, Central nervous system,
Peripheral nervous system. **(50marks)**

PAPER – VI **100 marks**
Unit – 07 Endocrine System, Chronobiology. **(50marks)**

Unit – 08 Social Physiology, Community Health,
Comparative Physiology, Instrumentation. **(50marks)**

PAPER – VII **100 marks**
Unit – 09 Reproductive Physiology, Developmental Biology. **(50marks)**

Unit – 10 Biostatistics, Computer Application in Physiology,
Skin and Body temperature regulation, Pharmacological Physiology. **(50marks)**

PAPER – VIII **100 marks**
Practical : 1.Biochemistry**15 marks**
2.Biostatistics.....**10 marks**
3.Histology & Histochemistry.....**20 marks**
4.Experiments on toad**20 marks**
5.Field Study Report.....**15 marks**
6.Laboratory Note book**10 marks**
7.Viva-voce**10 marks**

DETAILED SYLLABUS

(The numbers in the parenthesis indicates number of lectures required).

Part I SYLLABUS

Paper- I (Theoretical)- 100 Marks

Unit 01- 50 Marks

Structural units of human system, Biophysical & Biochemical principles, Biochemistry; Elementary idea of nervous system and ANS.

Structural units of human system: [20]

Prokaryotic & eukaryotic cell, Electron microscopic structure & functions of eukaryotic cells. Structure of membrane, models & its modified concepts. Erythrocyte – ghost & its significance. Fluidity & asymmetry of membranes. Artificial membrane liposome & its preparation, structure & biological applications. Endoplasmic reticulum – EM structure & function of smooth & rough ER. Microsomes – basic functional aspect. Golgi complex – its storage & processing functions. Lysosomes & its cellular role. Peroxisomes & its role in destruction of reactive oxygen species (ROS). Mitochondria – EM structure & introduction to its functions. EM structure of nucleus. Structure of nuclear sheath & membrane, nucleolus. Basic idea about chromosome structure. Ribosomes- cytoribosomes & mitoribosomes. Cytoskeleton & its role in stabilizing cell shape. Microtubules & its role in cellular movements & secretions. Chemical factors involved in stabilization & destabilization of cytoskeletal structure. Ameboid property of cell, exocytosis & endocytosis. Gap junction, cell-interaction, tumors & malignant growth- brief idea. Histological structure, classification, distribution & function of different tissues. Organization of cells into organ & systems of human body.

Biophysical & Biochemical Principles: [50]

Covalent bonds, ionic & hydrogen bonds, van der waal`s forces & hydrophobic interactions. Law of mass action, orders of reactions. Properties of water. Significance & physiological applications of the following phenomena : Solution- polar, non-polar & their solubilities, solute activity, amphipathic substances, cell fractionation, homogenisation & ultrasonification. Ultracentrifugation for separation of cell fractions, differential & density gradient. Solubility product & precipitation, surface tension, surfactants & stalagmometer. Specific gravity & its determination from blood, urine & milk. Viscosity & Ostwald viscometer. Brownian movement, diffusion, osmosis as a colligative property. Ultrafiltration. Absorption & adsorption by physical & carrier mediated transports. Dialysis, electro-osmosis. Colloids- properties & significances, sol & gel, lyophilic & lyophobic, sol, electrokinetic properties. Gibbs- Donnan membrane equilibrium. Acids & bases as proton donors & acceptors. Conjugate acid – base pairs, buffers. pH its determination & significance. Role of buffers. Kidney & lungs in maintaining body pH . Isoelectric pH & isoelectric precipitation, indicators , optical activity, polarimetry & its applications. Photometry, colorimetry & Beer- Lambert`s law. Radioactivity- radioactive emissions, radioactive decay, causes of radioactive emissions, interactions of matter & radiation, biological effects of radiation. Biomedical applications of radiations. Radioactivity in clinical diagnosis & therapy, use of radioisotopes in physiological studies, radioimmunoassay, autoradiography. Principles of determination of radioactivity. Ultracentrifugation- moving boundary & density gradient ultracentrifugation. Ultrafiltration, Electrophoresis – principles of electrophoresis . Chromatography- principles of chromatography. First & second laws of thermodynamics, closed & open system. Living body as a thermodynamic system. Entropy, enthalpy, maintenance of physiological steady state. Gibb`s concept of free energy. Enzymes- definition, chemical nature, classification, mechanism of enzyme action , active site, specificity & enzyme – substrate complex. Enzyme kinetics, hyperbolic kinetics, Michaelis constant.

Effect of temperature, pH . Sigmoid kinetics & allosteric modulation. Feedback & feedforward regulation, inhibition, reversible, irreversible, competitive, noncompetitive & uncompetitive inhibition. Coenzymes & prosthetic group.

Reversible covalent modification. Activation of proenzyme, isoenzyme, rate limiting enzyme, ribozyme. Enzymes in clinical diagnosis. Basic concepts of induction & repression of enzymes.

Biochemistry :

[10]

Chemistry of carbohydrates, lipids, proteins. Primary, secondary tertiary and quaternary structures of proteins, and bonds stabilizing them. Purine, pyrimidine, nucleic acids. Isotopes in the study of metabolism.

Elementary idea of Nervous system and ANS :

[10]

Divisions of human nervous system:- Central nervous system: Outline, organization & basic function. Brain : cerebral hemispheres, cerebellum, brain stem. Telencephalon & basal ganglia, diencephalons or interbrain: thalamus & hypothalamus, cavities within brain.

Spinal cord: Outline, organization & function.

Peripheral nervous system: Cranial nerves, spinal nerves, function.

Autonomic nervous system: Outline organization & functions.

Neurohistology:

[10]

Cells of the nervous system- neurons, structure & types. Neuroglia: types, specific structure & functions. Nerve fibers : Myelinated, & non- myelinated, peripheral nerve sheaths, ganglia, synapses. Receptors organs: exteroceptors & interoceptors. Encapsulated & non- encapsulated (free, nerve ending) receptors, muscle spindle innervation & function.

Unit 02 : 50 Marks:-

Blood and body fluids; Cardiac Physiology, Circulatory system, Respiration

Blood & Body Fluids:

[40]

Basic idea about intracellular & extracellular compartments of body fluids. Body water intake & excretion of water. Volumes of body water compartments & their estimation. Water balance & their regulation, dehydration oedema.

Erythrocytes :- morphology, life cycle, factors in erythropoiesis, functions & fate of haemoglobin, chemistry, biosynthesis, functions, catabolism, oxyhaemoglobin, methaemoglobin, carbomonoxy haemoglobin & haemin. Abnormal haemoglobin, thalassemia, sickle cell anaemia, porphyrins.

Leucocytes – Morphology, classification, life cycles, functions, Human leucocyte antigen (HLA).

Arneht count, Shilling- index. Platelet count & reticulocyte count- significance. Megakaryocytes, Anaemia, Megaloblastic & microcytic polycythemia. ESR, TC, DC, PCV, MCH, MCHC, MCV.

Blood velocity & its determination. Blood flow & its determination by ultrasonic & electromagnetic methods. Factors affecting blood volume. Blood p^H & blood buffers.

Hemostasis, blood coagulation mechanism, coagulating factors, factors hastening & retarding coagulation, anticoagulants, disorders of coagulation, coagulation time, bleeding time, prothombin time, hemolysis.

Blood groups- ABO system :- Rh antigens, blood transfusion & its hazards. AIDS, hepatitis B & blood group incompatibility- erythroblastosis fetalis.

Spleen- structure, function, lymph & tissue fluid: Anatomical organization of lymphatic system, structure, functions of lymph nodes. Formation, composition, circulation, functions & fate of lymph & tissue fluid. Obstruction of lymphatics as in filaria.

Cardiac Physiology :

[20]

Anatomical organization of cardiovascular system. Microscopic structure of cardiac muscle. Basic

properties of cardiac muscle – rhythmicity, refractory period, all or none law, stair-case phenomenon. Transmembrane potential & electrophysiology of cardiac tissue. Specialized junctional tissue of heart. Origin & propagation of cardiac impulse.

Stannius ligature. Pacemaker potential . Heart block & basic idea about artificial pacemaker. Electrocardiography, normal ECG. Leads, Einthoven triangle, vectorial analysis, vector cardiogram, mean electrical axis of the heart. Basic ideas of abnormalities in Q- wave, T- wave & ST segment. Cardiac valves location & function. Heart rate, law of heart & its regulation, cardiac reflexes. Frank Starling law of heart. Cardiac cycle, pressure changes in cardiac chamber in different phases. Heart sounds & their causes. Cardiac output : definition, normal values & factors regulating it , determination by Fick`s, dye dilution & isotopic method. Heart- lung preparation. Cardiac metabolism. Nerve supply of the heart & its role in the regulation of the function of heart. Cardiac reflexes & the roles of cardiac receptors, vagal afferents & sympathetic afferents.

Circulatory System:

[20]

Histological structure of arteries, arterioles, capillaries & veins . General pattern of circulation. Open and close systems. Hemodynamics, its biophysics and its significances. Blood pressure- systolic, diastolic, mean arterial & pulse pressure.

Determination of blood pressure, Sphygmomanometry. Factors controlling blood pressure. Central pulse & peripheral pulse & their patterns. Innervation of blood vessels and vasomotor control, role of baroreceptors and chemoreceptors, neural and humoral control of circulation. Coronary Circulation- phasic flow in the cardiac cycle, peculiarities of coronary circulation- anastomosis, factors controlling coronary circulation, coronary thrombosis, significance of streptokinase in thrombolysis. Angiography and angioplasty.

Pulmonary circulation- Peculiarities, pressure flow relation, regulation of pulmonary circulation.

Cerebral circulation- anatomical organization, control under different physiological conditions.

Cutaneous circulation- anatomy, peculiarity, and regulation.

Respiration:

[20]

Studies of anatomy and histology of respiratory system. Mechanism of respiration. The role of different respiratory muscles and accessory muscles in respiration. Compliance, elasticity and elastic recoil of the lung. Role of lung surfactants, intrathoracic and intrapleural pressures. Tidal volume, inspiratory and expiratory reserve volumes, residual volume, vital capacity, functional residual capacity, maximum breathing capacity. Ventilation-perfusion ratio. Partial pressure and percentage of respiratory gases inspired, expired and alveolar air and in blood. Respiratory gases and their exchange between the lung alveoli and blood and between the blood and the tissues. Transport of O₂ and CO₂ in blood, O₂ dissociation curve, CO₂ dissociation curve. Modern concept of regulation of respiration. Role of respiratory centres and central peripheral chemoreceptors. Respiration of man at high altitude. Respiratory failure and artificial respiration and its different techniques. Oxygen therapy and its importance. Hypoxia, asphyxia, dyspnoea, asthma, cardiac and bronchial emphysema, cyanosis, dysbarism, acclimatization, Lung function test.

PAPER II: PRACTICAL : 100 Marks

Histology-55marks ; Biochemistry: (a) Qualitative Analysis – 10 Marks and (b) Quantitative Estimate – 15 Marks, Laboratory Note Book – 10 Marks, Viva-voce – 10Marks

1. Histology:

(a) Hematology:

20 Marks

Preparation and staining of human blood cell (Leishman, hematoxylin-eosin), Identification and measurement of WBC. Differential count of WBC, Total count of RBC and WBC.

Estimation of hemoglobin (Sahli's Method)

Determination of ESR and packed cell volume. Preparation of haemin crystal. Determination of coagulation time by capillary method. Bleeding time. Prothrombin time. Vital staining of reticulocytes. Demonstration of reticulocyte count. Blood grouping. Rh typing. Measurement of megakaryocyte diameter.

b) Staining and examination of fresh tissues:

15 Marks

Squamous, ciliated columnar epithelium (methylene blue), corneal cell space (silver nitrate), urinary bladder (silver nitrate), node of Ranvier (silver nitrate), Adipose tissue (Sudan III or IV), Voluntary muscle (methylene blue).

ii) Study and identification of stained sections of different mammalian tissues and organs: 20 Marks

Bone, different types of cartilage, trachea, lung, spleen, lymph gland, esophagus, stomach, duodenum, ileum, jejunum, large intestine, liver, kidney, ureter, different types of salivary glands, pancreas, adrenal gland, thyroid gland, testis, ovary, spinal cord, cerebral cortex, cerebellum, skin, cardiac muscle, skeletal muscle, artery, vein, tongue, uterus.

B. Biochemistry: 25 Marks

1. Qualitative analysis of biochemical molecules :

10 Marks

A. Carbohydrates- Glucose, fructose, galactose, lactose, sucrose, starch, dextrin, maltose.

Protein: Albumin, gelatin, peptone, Glycerol, cholesterol, bile salt and pigment, acetone, lactic acid, urea, uric acid, HCl.

B. Identification of normal and abnormal constituents of urine.

2. Quantitative estimation by titrametric method:

15 Marks

a) Estimation of glucose and sucrose in aqueous solution, lactose in milk by Benedict's method. Silver nitrate titration of chloride in aqueous solution. Amino nitrogen in aqueous solution by formol titration method.

b) Estimation of free and total acidity of stimulated gastric juice.

3. Laboratory notebook : 10 marks

4. Viva-voce: 10 marks.

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

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

1. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K. Brobeck. The William and Wilkins Co.
2. Review of Medical Physiology. By W.F. Ganong, Lange Medical Book. Prentice-Hall International.
3. Harper's Illustrated Biochemistry, by R.K. Murray & others. Lange Medical Book, International Edition, Mc Graw Hill.
4. Text Book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
5. Lehninger's Principles of Biochemistry. By D.L. Nelson and M.M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West ; W.R. Todd.; H.S. Mason; J.T. Van Bruggen. The Macmillan Company.
7. Biochemistry. by D. Das. Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D. Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A. Keele. E. Neil & N. Toels.

Oxford University Press.

10. Physiology, by R.M.Berne & M.N.Levy, C.V.Mosby Co.
11. Basic Histology, by D.C.Jungquire, J Carneiro & J.A. Long: Appleton & Lange.
12. Histology- A Text and Atlas, by M.H.Ross & E.J.Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M.Copenhaver; The Williams and Wilkins Company.
14. Human Physiology, by R.F.Schmidt & G. Thews, Springer-Verlag.
15. Core Text Book Of Neuro-Anatomy, by M.B.Carpenter: the Williams and Wilkins Company.
16. The Human Nervous System, by Charles nobach, Mc Graw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J.Weibell & E.A.Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System, by M.L. Barr & J.A.Keirman,Harper & Row.
19. Human Physiology, by Rhoades & Pflanger, Saunder College Publishing.
20. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wallngton. Oxford University Press.
21. Neurobiology, by G.M. Shepherd. Oxford University Press
22. Biochemistry, by L. Stryer, W.H. Freeman and Co.
23. Text Book of Physiology by G.H.Bell: J.N.Davidson and H.Scarborougl. ELBS.
24. Physiology of Respiration by J.H.Comroe. Year Book Medical Publishers.
25. Text Book of Physiology. Vols. I & II by H.D.Patton; A.F.Fuchs; B.Hille; A.M.Scher and R. Sleiner. W.B.Saunders of Co .
26. Sports Physiology by E.L.Fox, Saunders College Publishing Holt-Saunders.
27. The Principles and Practice of Human Physiology by O.G.Edholm and Others, Academic Press.
28. Concise Medical Physiology by S.K.Chaudhury; New Central Book Agency.
29. Medical Physiology by A.B. Mahapatra, Current Books International.
30. Theory and Practice of Histological Techniques by J.D. Bancroft and A. Stevens, Churchill Livingstone.
31. Practical Biochemistry in Medicine by Srinivas Rao., Academic Publishers.
32. Practical Physiology, by M.K.Manna, Sritara Prakashani, Kolkata.
33. 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 in Physiology comprising syllabi of different Universities including Burdwan 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 recommended the aforesaid Note Books (Experimental, Biochemistry and Histology) for use by the students in undergraduate degree course (Honours Practical) in Physiology.

PART II SYLLABUS

PAPER III : THEORETICAL : 100 marks

UNIT 03 : 50 marks

Digestive system, Metabolism, Nutrition and Dietetics

The Digestive system :

[30]

Anatomy and histology of alimentary canal, tongue, pharynx, oesophagus, stomach, small intestine, large intestine, pancreas, liver, and gall bladder, salivary glands and their functions. Nerve supply to the alimentary system. Mastication, deglutition, movement of the alimentary canal and their control, composition, collection, functions and mechanism of secretion of saliva, gastric juice, pancreatic juice, bile and intestinal juice. Mechanism of gastric HCl secretion. Functions of gall bladder. Thirty-Vella Fistula and Pavlov's pouch. Digestion and absorption of carbohydrates, lipids and proteins. Functions of large intestine. Enterohepatic circulation of bile. Modern concept of bile secretion. Gall stones, achlorhydria, hyperchlorhydria, peptic ulcer, functional test meal and liver function test.

Metabolism :

[40]

Metabolism of carbohydrate: Glycogenolysis, Glycogenesis, Gluconeogenesis, Glycolysis. Pentose phosphate pathway. TCA cycle, amino sugar acid, uronic acid cycles. Regulation of glycogenesis and TCA cycle. Anabolic role of TCA cycle, Anaplerosis. Blood glucose and its regulation. Uncouplers, redox potential, mitochondrial electron transport and its components, redox loop mechanism, substrate-level phosphorylation and oxidative phosphorylation.

Metabolism of lipids : Fat storage and adipose tissue, lipolysis, oxidation of saturated and unsaturated fatty acids. Formation and fate of ketone bodies. Synthesis of fatty acids.

A gross outline of synthesis and metabolism of cholesterol, bile acids and fat. Lipoprotein – classification.

Metabolism of proteins : transamination, oxidative and non-oxidative deaminations. Formation of urea, ammonotelic, ureotelic and uricotelic organisms. Nonprotein nitrogen, formation of specialized products from amino acids (viz. catecholamines, creatine phosphate, nicotinamide, histamine, serotonin and melatonin, melanin, gamma amino butyrate, taurine, glutathione. Metabolism of phenylalanine, tyrosine, tryptophan and sulphur containing amino acids. Glycogenic and ketogenic amino acids, amino acid pool, labile methyl group and transmethylation, biosynthesis of nutritionally non-essential amino acids. Integration of carbohydrate, lipids and protein metabolism. TCA cycle as the final common path. Metabolism of purines and pyrimidines. Synthesis and catabolism of purines and pyrimidines. Salvage pathways of purine and pyrimidine synthesis. Water and mineral metabolism.

Sodium, potassium, chloride, calcium, magnesium and phosphorus metabolism. Trace elements (iron, zinc, selenium)- their role and deficiencies.

Nutrition and Dietetics:

[30]

An introduction to Nutrition : Mouse candle experiment (Lavoisier) Nutritional status of the body; normal, malnutrition and undernutrition; RDA-its significance;

Factors altering nutritional requirement- physical factors, nutrient-nutrient interaction, drug – nutrient interactions; Nutritional assessment; physical examination, anthropometry; nutritional support in patient management- a) TPN (total parental nutrition) and b) PN (parental nutrition).

Vitamins: Water soluble and fat soluble vitamins, sources, dietary requirements, deficiencies, coenzyme functions, Hypervitaminosis, Basal Metabolic Rate, Definition of BMR, factors affecting BMR, Principle of measurement of body surface area. Direct and indirect calorimetry. Determination

of BMR by Benedict-Roth apparatus and Douglas Bag, Respiratory quotient, its variation and significance.

Water metabolism, dehydration, ORS and edema.

Nutritional evaluation of proteins : Essential and nonessential amino acids, nitrogen balance, biological value of proteins, digestibility coefficient, net protein utilization, protein efficiency ratio. Supplementary action of protein, specific dynamic action (SDA), protein spacers. WHO and ICMR formulation for minimum protein requirement of individuals.

Dietary calories : Calorie value and physiological fuel value. Calorie requirements formulated by ICMR for different ages and activity level. Adult consumption Unit (ACU).

Nutritional evaluation of Fat : Essential fatty acids. Nutritional significance of saturated and unsaturated fatty acids. Foods influencing blood cholesterol, dietary requirements of fats. Nutritional importance of dietary fibres.

Formulation of diet chart: Formulation of balanced vegetarian and nonvegetarian diets for growing child, pregnant and lactating mothers, college students, ICMR, formulation methods of dietary surveys.

Nutritional disorders: Starvation, dietary causes and dietary management of hypertension, diabetes mellitus and RDA

Unit 04: 50 marks

Environmental Physiology, Microbiology and Immunology, Work Physiology, Sports Physiology, and Ergonomics

Environmental Physiology :

[40]

Man and Environment : Environment – holistic definition. Types-Natural and fabricated; components of natural environment; Human environment; Atmospheric temperature fluctuations and human response. Acclimatisation to hot and cold environment; Heat disorders and their preventive measures. Effects of hypobaric and hyperbaric environment. Preventive measures for hypo and hyperbaric effects. Mountain sickness and acclimatization to high altitude. Caisson's disease.

Noise :An environment pollutant. Sound waves and characteristics. Sound level index. Measurement of sound intensity. Noise and its sources. Physical characteristics of noise. Effects of noise on human health. Noise pollution control. Legal, technological and personal measures.

Radiation Pollution : Radioactivity and radiation; radionuclides : What are they? Radionuclides sources: radiation units and dose, Ionizing radiation, Radioactive wastes; Radiation hazards: physiological basis, per capita human exposure by radiation from house hold items: control and preventive measures.

Ecology :Science of environment; relationship between ecology and physiology; ecosystem and its components, Anatomy and physiology of ecosystem; flow of matter and energy through Eco-system; food chain. Pyramid of biomass and energy.

Toxicology : Toxins; toxicology. Principles of toxicology, LD₅₀, Antagonism and synergism; reproductive toxins and neurotoxins; carcinogens, teratogens; mutagens.

Pesticides : Types and human health hazard. Biomagnification of pesticides.

Greenhouse effect : Greenhouse gases, Sources of green house gases, green house effect, Enhanced greenhouse effect; Global warming. Ecological consequences of global warming.

Ozone-Layer Depletion : Stratospheric ozone layer and its importance. Dobson unit; formation of

ozone layer, causes of ozone layer destruction; concept of ozone hole; global strategies for the protection of ozone layer.

Air and Water Pollution : Air and water pollutants; Causes of pollution; effects of air and water pollution- ocean pollution, oil spills, ground water pollution, concept of drinking water.

Microbiology and immunology : [30]

Bacterial prokaryotic cell. Classification of bacteria on the basis of morphology and staining characteristics – Gram staining, spore staining and acid-fast staining. Bacterial nutritional requirements, nutritional types, culture media, physical conditions for growth. Growth curve of bacteria. Bacterial metabolism- fermentation, glyoxylate cycle, Entner-Doudoroff pathway. Bacterial genetics, transformation, conjugation and transduction. Sterilization and pasteurization. Elementary idea of bacteriostatic and bactericidal agents viz. phenols, alcohol and antibiotics.

Elementary knowledge of virus:morphology, viral genome & classification.

Immunity: Definition, innate immunity,mechanical barrier against pathogenic organism. Antibacterial & antifungal substances in external body secretions, bacteriocidal actions of HCL, inflammatory responses & its role in body defences, chemotaxis & phagocytosis, lysozyme, role of phagocytes. Acquired immunity,active immunity & passive immunity. Humoral & cell mediated immunity, primary & secondary immune responses. Mechanisms of humoral immunity, antigens, haptens B-lymphocytes, plasma cells, Classification & molecular structure of immunoglobulins , antigen-antibody reactions & their effects. MAB – complements, classification of complements & their activation, function of complements,. Mechanisms of cell mediated immunity. T- lymphocytes, suppressor, helper & killer T cells. Cytotoxic & cytolytic effects of T cells. T- cell B- cell cooperation. Role of macrophages in cell mediated immunity. Cytokines & lymphokines. Antitoxins, interferons, hypersensitivity reaction, anaphylaxis, their effects & examples in the human system. Blood groups, antigens & serum agglutinins. Human leucocyte antigens, autoimmunization. Autoimmune diseases of thyroid & kidney & muscle, AIDS, tumor immunology. ELISA test.

Work Physiology, Sports Physiology, and Ergonomics : [30]

Physical work-definition and units of measurements. Concepts and classification of physiological work- static, dynamic, positive, negative and isokinetic work. Unit of work. Energetics of work. Source of work, capacity, power. Cardiovascular and respiratory responses during graded work. Aerobic and anaerobic capacity. Energy cost of work. Methods of measurement. Maximal aerobic power, Factors affecting and methods of measurements. Anaerobic power. Excess post exercise oxygen consumption. Short term and prolonged work. Work-rest cycle. Test for physical work capacity : measurements with bicycle ergometer, treadmill and Harvard step test. Physical Training. Principle of effects of training on cardio-respiratory system and muscle. Basic idea of ergogenic aids. Basic concepts of ergonomics and its application in industry to increase individual and group productivity. Industrial safety, occupational health hazards.

PAPER IV : PRACTICAL : 100 Marks

1. Experimental Physiology

(a) Experiments on mammals: 20 marks

Dale's bath experiment: Kymographic recording of normal movements of rat's intestine in Dale's apparatus. Effects of acetylcholine on frog / toad rectus abdominis muscle in Dale's bath.

(b) Experiments on Human : 15 Marks

Sphygmomanometric measurement of arterial blood pressure at rest and after exercise. Harvard step

test and determination of physical fitness. Pneumographic effects of talking, laughing, coughing, exercise, hyperventilation and breath-holding. Determination of muscular efficiency by Mosse's ergograph. Spirometric measurement of vital capacity . Measurement of some common anthropometric parameters - stature, eye height, shoulder height, elbow height, shoulder-elbow length, shoulder breadth, head breadth, head circumference, waist-hip ratio. Calculation of body surface area (using nomogram) and body mass index from anthropometric measurements

2.Environmental Physiology : 15 Marks

- i) Measurement of environmental temperature: dry bulb and wet bulb, relative humidity.
- ii) Determination of B.O.D. by Winker's method.
- iii) Measurement of noise by sound level meter.

3. Microbiology : 15 Marks

Sterilization, Gram staining for Gram-positive and Gram-negative bacteria, demonstration of bacterial spore staining, culture technique demonstration.

4. Diet survey report (as per ICMR specifications to be handwritten) : 15 Marks

5. Laboratory Note Book : 10 Marks

6. Viva-voce : 10 Marks

RECOMMENDED TEXTS AND REFERENCES FOR PHYSIOLOGY (HONOURS) Part - II COURSE

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

1. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K.Brobeck.The William and Wilkins Co.
2. Review of Medical Physiology. By W.F.Ganong, Lange Medical Book. Prentice-Hall International.
3. Harper's Illustrated Biochemistry, by R.K.Murray & others.Lange Medical Book, International Edition, Mc Graw Hill.
4. Text Book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
5. Lehninger's Principles of Biochemistry. By D.L.Nelson and M.M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West ; W.R.Todd.; H.S.Mason; J.T.Van Bruggen. The Macmillan Company.
7. Biochemistry. by D.Das. Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D.Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A.Keele. E. Neil & N.Toels. Oxford University Press.
10. Physiology, by R.M.Berne & M.N.Levy, C.V.Mosby Co.
11. Basic Histology, by D.C.Jungquire, J Carneiro & J.A. Long: Appleton & Lange.
12. Histology- A Text and Atlas, by M.H.Ross & E.J.Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M.Copenhaver; The Williams and Wilkins Company.
14. Human Physiology, by R.F.Schmidt & G. Thews, Springer-Verlag.
15. Core Text Book Of Neuro-Anatomy, by M.B.Carpenter: the Williams and Wilkins Company.
16. The Human Nervous System, by Charles nobach, Mc Graw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J.Weibell & E.A.Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System, by M.L. Barr & J.A.Keirman,Harper & Row.
19. Essential Food and Nutrition, by M.Swaminathan. The Bangalore Printing & Publishing Co. Ltd.
20. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications

21. Microbiology, by M.J.Pelczer & Others; Tata McGraw Hill Publishing Co Ltd.
22. Cellular & Molecular Biology, by E.D.P.De Robertis & E.M.F. De Robertis; Lea & Febiger.
23. Molecular Biology of the Gene, by J.D.Watson; H.H.Nancy & others; Benjamin- Cummings.
24. Molecular Biology of the Cell, by B. Alberts and others, Garland.
25. Human Physiology, by Rhoades & Pflanger, Saunder College Publishing.
26. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wallington. Oxford University Press.
27. Handbook of Experimental Physiology and Biochemistry, by P.V.Chadha; Jaypee Brothers Medical Publishers.
28. Kuby Immunology, by R.A. Goldsby. T.J. Kindt and B.A. Osborne, W.H. Freeman and Co.
29. Neurobiology, by G.M. Shepherd. Oxford University Press
30. Biochemistry, by L. Stryer, W.H. Freeman and Co.
31. Text Book of Physiology by G.H.Bell: J.N.Davidson and H.Scarborougl. ELBS.
32. Text Book of Physiology. Vols. I & II by H.D.Patton; A.F.Fuchs; B.Hille; A.M.Scher and R. Sleiner. W.B.Saunders of Co .
33. The Physiological Basis of Physical Education and Athletics by E.L Fox and D.K. Mathews. Saunders College Publishing.
34. Pesticides by P.K.Gupta, Interprint.
35. Environmental Chemistry by P.V.De. Wiley Eastern Ltd.
36. Exercise Physiology – Energy, Nutrition and Human Performance by W.D.McArdle, F.Katch and V.L.Katch. Williams and Wilkins.
37. Essentials of Exercise Physiology by L.G.Shaver, Surjeet Publications.
38. Text Book of Environmental Physiology by C.Edger Folk Jr. Lea and Febiger.
39. Text Book of Work Physiology by P.O.Astrand and K.Rodhal. Mc Graw-Hill Book Co.
40. Human Factors in Engineering and Design by E.O.McCormick and M.Sanders. Tata Mc Graw Hill.
41. Energy, Work and Leisure by J.V.G.A.Durin and R.Passmore. Heinemann Educational Books.
42. Sports Physiology by E.L.Fox, Saunders College Publishing Holt-Saunders.
43. The Principles and Practice of Human Physiology by O.G.Edholm and Others, Academic Press.
44. Concise Medical Physiology by S.K.Chaudhury; New Central Book Agency.
45. Medical Physiology by A.B. Mahapatra, Current Books International.
46. Endocrinology. Vols- I II and III by L.O.DeGroot. W.B.Saunders Co.
47. The Physiology of Reproduction, Vols I, & II , by E.Knobel and J.D.Neil. Raven Press.
48. Park's Text Book of Preventive and Social Medicine by K.Park, M/s. Banarsidas Bhanot Publishers.
49. Practical Biochemistry in Medicine by Srinivas Rao., Academic Publishers.
50. Practical Physiology, by M.K.Manna, Sritara Prakashani, Kolkata.
51. 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 in Physiology comprising syllabi of different Universities including Burdwan 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 recommended the aforesaid Note Books (Experimental, Biochemistry and Histology) for use by the students in undergraduate degree course (Honours Practical) in Physiology.

PART III SYLLABUS

PAPER V (Theoretical)

Unit 05: 50 marks

Nerve Muscle Physiology, Sensory Physiology & Renal Physiology

Nerve muscle Physiology :

[50]

Microscopic and electron microscopic structure of striated, smooth and cardiac muscles. The sarco-tubular system, Red and white striated muscle fibres. Single unit and multiunit smooth muscle. Muscle groups; antagonist and agonists, motor point, myography. Properties of muscle, excitability and contractility, all or none law, summation of stimuli, summation of contractions; effects of repeated stimuli; genesis of tetanus, onset of fatigue; refractory period, tonicity, contractility, extensibility and elasticity. Optimal load, optimal length of fibres. Muscle proteins, mechanism of muscle contraction and relaxation. Excitation-Contraction coupling; dihydro-pyridine receptors, ryanodine receptors, isometric and isotonic contractions. Muscle length tension and velocity relationship, mechanical components of muscle. Chemical, thermal and electrical changes in striated muscle during contraction and relaxation. Electro-myography, Muscle autoimmune diseases, myasthenia gravis, Myelinated and unmyelinated nerve fibres. Myelinogenesis. The resting membrane potential, the action potential. Electronic potential. Propagation of nerve impulses in different types of nerve fibres. Cable concept of a nerve fibre and gating current. Compound action potentials. Conduction velocity of nerve impulses in relation to myelination and diameter of nerve fibres. Properties of nerve fibres: excitability, conductivity, all or none law, accommodation, adaptation, summation, refractory period, indefatigability. Concept of chronaxie and rheobase, Synapses; types, structure, synaptic transmission of the impulse, synthesis, storage and release of neurotransmitter, synaptic potentials, neurotransmitter, co-transmitters, neuromodulators. The neuromuscular junctions, structure, transmission, end plate potential, post-synaptic potential. Motor unit. Injury to peripheral nerve, degeneration and regeneration in nerve fibres. Changes in the nerve cell body, transneuronal degeneration, changes in receptors and motor end plates, denervation, hypersensitivity. Reaction of degeneration, Thermal changes in nerve during activity. Neurotrophins, Molecular basis of ciliary movements.

Sensory Physiology :

[30]

Classification of general & special senses & their receptors. Muller's law of specific nerve energies. Weber – Fechner law, mechanism of transduction of stimuli from sensory receptors. Adaptation of receptors- phasic & tonic adaptations.

a) Olfaction & gustation : structure of the receptor organs, nerve pathway centers, physiology of taste & smell. After taste, olfactometer, electro- olfactogram.

b) Audition: sound waves, decibel, structure & functional significance of auditory apparatus- external, middle, internal ears. Organ of Corti, Auditory pathway & centers. Mechanisms of hearing & its modern theories . Different electrical potentials of internal ear. Discrimination of sound frequency & loudness, Audiometry.

c) Vision: Anatomy & structure of eyeball, principal characteristics of ocular system compared to a camera. The structures of lens. Formation, circulation of aqueous & vitreous humor. Pupillary reflexes, light reflex, near response. Argyll- Robertson pupil. Errors of refraction & their corrections. Histological details of retina, peripheral retina, fovea, blind spot. Visual pathway, photopic & scotopic vision. Chemical & electrical changes in retina on exposure to light. Electroretinogram, positive & negative after image. Light & dark adaptation. Colour visions & its modern concept.

Colour blindness. Visual field, perimetry, visual acuity- measurement, mechanism, factors controlling visual acuity. Binocular vision & depth perception . Lux, measurement of illumination, critical fusion frequency

Renal Physiology:

[20]

Anatomical organization of urinary system. Gross structure of kidney. Renal circulation-anatomy, peculiarities, regulation of renin-angiotensin system. Microanatomy (including electron microscopy) of a nephron and structure differences between cortical and juxtamedullary nephrons. Juxtaglomerular apparatus. Mechanism of formation of urine. Concept of ultrafiltration, glomerular filtration rate. Passive and active tubular transport. Counter-current exchanger and counter multiplier mechanism. Role of kidney in acid base balance and osmoregulation.

Non-excretory functions of kidney; normal and abnormal constituents of urine and their significance. Concept of renal threshold. Functions of kidney and renal function tests (inulin, urea clearance tests). Kidney failure. Renal stone formation. Dialysis and artificial kidney. Innervation of urinary bladder and micturition. Micturition reflexes and its regulation by higher centers. Diuresis.

Unit 06 : 50 marks-

Genetics and Molecular Biology, Central nervous system, Peripheral nervous system.

Genetics and Molecular Biology:

[30]

Double helical structure of DNA , clover-leaf and L-shaped structure of t-RNA, 3-dimensional structure of m-RNA and t-RNA molecules. Chromosome structure, molecular organization, chromosomal proteins, and different levels of chromatin organization; linkage and crossing over. Cell cycle, cell differentiation, Replication, transcription and translation, Genes, protein synthesis, genetic-code. One cistron- one subunit concept; Regulation of gene expression – operon concept, lac operon; inborn errors of metabolism of glycogen, galactose, tryptophan, phenylalanine and tyrosine. Elementary idea of genetic engineering, recombinant DNA technology.

Central Nervous System

[60]

Spinal Cord: Position & relations, external features, segments & roots, meninges, enlargements, fissures & funiculi. Internal structure: cross section & regional variations, grey matter, nuclei, white matter.

Tracts: long ascending tracts- spinothalamic, Goll and Burdach ; spinocerebellar, long descending tracts- corticospinal (pyramidal), reticulospinal, vestibulospinal, rubrospinal

(origin, course and termination). Lesions of the spinal cord: complete transection, Hemisection of the spinal cord (Brown-Sequard syndrome), dorsal column lesions. Syringomyelia.

Reflexes : Reflex action; definition and type. Reflex arc: monosynaptic and polysynaptic, Monosynaptic and polysynaptic reflexes with examples.

Muscle spindles: structure, innervation and function. Muscle tone. General properties of reflexes.

Ventricular System and Cerebrospinal fluid: Ventricular system; lateral ventricle and aqueduct of midbrain, fourth ventricle. Choroid plexus; position and relations, microscopic features, functions. Cerebrospinal fluid (CSF): formation of CSF, Circulation of CSF. Sub-arachnoid cisterns, functions of CSF, hydrocephalus.

Cerebral cortex : Definition and basic concepts. Internal structure: cortical layers. Cytoarchitectonic areas; sensory and motor areas. Higher cortical functions; learning and memory. Hemispheric dominance. Language function:- Broca's area, physiology of speech and speech disorders. Prefrontal functions.

Cerebellum : Definition, position and relations. External feature. Phylogeny and dysfunction. Internal structure; nuclei, cortical layers, fibres. Connection of the cerebellum; afferents and efferents. Function and cerebellar disorders.

Thalamus : Definition, Gross features, position and relations. Structure and nuclear groups, Functions of the thalamus. Lesions of thalamus.

Hypothalamus : Definition, positions and relations; Internal structure: groups, connections: afferent and efferents, Functions: endocrine, automatic, temperature regulations, feeding and drinking behaviour and other behavioural functions.

Reticular formation : Definition and position, basic structure: reticular nuclei and fibres, connection; functions of ascending and descending reticular formations. Decerebrate and decorticate rigidity.

Basal Ganglia : Definition and terminology. Gross anatomy: caudate nucleus; lentiform nucleus, claustrum, amygdaloid body, substantia nigra, subthalamic nucleus, connections of basal ganglia: neostriatum, globus pallidus, amygdaloid body, substantia nigra; Subthalamic nucleus. Functions of basal ganglia, Disorders of basal ganglia: Parkinsonism, chorea, athetosis, hemiballismus.

Limbic System and emotion: Electrophysiology of brain, spontaneous electrical activity of brain, EEG and ECOG, evoked potential, DC potential. Sleep : types of sleep and physiological basis of sleep, sleep wakefulness cycle.

Higher functions of brain: Learning and memory; The nature of learning and memory. Types of learning and memory, Simple learning habituation and sensitization, associative learning, classical conditioning in aplysia, classical conditioning in the cerebellum, classical and operant conditioning. Aversion learning, complex learning, imprinting, latent learning; observational learning. Memory-hippocampus; anatomy and synaptic organization. Long term potentiation, presynaptic or postsynaptic locus, the role of dendritic spines. Speech: zones, neurophysiological mechanism, speech disorders.

Physiology of pain: Definition, types, pain nreceptors. Pain transduction: pattern and specific theory; referred pain.

Autonomic Nervous System(ANS) : (10)

Basic structure of somatic and autonomic systems. Divisions of ANS. Differences between divisions: anatomical, physiological and pharmacological differences.

Sympathetic division: origin and organization, distribution of fibres. Adrenal medulla, sympathetic receptors, sympathetic functions. Sympathectomy, Parasympathetic division : cranial outflow, sacral outflow. Parasympathetic functions. Autonomic plexuses. Autonomic acti vities of special organs and systems: eye, heart and blood vessels. Respiratory organs, gastrointestinal tract, urinary bladder. Autonomic synapses and chemical transmission.

Unit-07 : 50 marks

Endocrine System, Chronobiology

Endocrine System :**[80]**

Definition of endocrine glands and hormones. Experimental and clinical methods of study of endocrine glands. General classification of hormones on chemical basis. Different modes of hormone action. Concepts of hormone receptor. G-protein, cyclic AMP, IP₃, IP₄.

Hypothalamo-pituitary axis: Hypothalamus as a neuroendocrine organ, Hypophysiotropic hormones of hypothalamus. Synthesis and transport of posterior lobe hormones from hypothalamus.

Vascular and neural connections between the hypothalamus and the pituitary. Role of median eminence. Histological structure and regulations of anterior, middle and posterior lobes of pituitary. Chemistry, modes of action and function of growth hormone, TSH, ACTH, FSH, LH, MSH, Prolactin, Vasopressin and oxytocin.

Cushing's disease, gigantism, acromegaly, dwarfism, Simmond's disease, Frolich's syndrome, diabetes insipidus.

Thyroid: Microscopic & electron microscopic structure of thyroid. Chemistry, biosynthesis, storage, transport & functions of thyroxine, and tri-iodothyronine, stimulatory action of thyroid hormone on synthesis of growth hormone. Antithyroid drugs & goitrogen. Cretinism. Myxedema. Grave's disease. Hashimoto's disease, iodine deficiency goitre, toxic goiter, long action thyroid stimulator(LATS), exophthalmos producing substances(EPS).

Calcitonin: Source, function & regulation of secretion, calcitonin gene related peptide(CGRP).

Parathyroid: Physiology of PTH, regulation of secretion & functions.

Adrenal Cortex: Histological structure, regulation of different types of hormones & functions of adrenal cortex. Steroid hormone, biosynthesis. Cushing's syndrome. Addison's disease. Hyperaldosteronism.

Adrenal Medulla: Histological structure, regulation & hormonal function of adrenal medulla. Synthesis & metabolism of catecholamines. Action of adrenaline & noradrenalin on different organs & their effect. Pheochromocytoma.

Pancreas: Histological structure of pancreatic islets. Sources, regulation, modes of action. Function of insulin & glucagon. Oral hypoglycemic drugs. Pancreatic somatostatin. Type I and type II diabetes mellitus, hyperinsulinism. Prostaglandin, kininogens and kinins. Atrial Natriuretic Factor (ANF), Growth factor : EGF, IGF, PDGF, FGF and NGF.

GI hormones : General idea – secretin, gastrin, VIP, GIP, CCK-PZ.

Thymus : Its endocrinal functions.

Chronobiology :**[20]**

Different types of physiological rhythms- ultradian, circadian, infradian. Different zeitgebers and their relation with circadian clock. Biorhythms in physiological systems. Reproduction biorhythms; estrous and menstrual cycles. Seasonal pattern of breeding, physiological basis of sleep- wakefulness cycle. Hormonal biorhythms – adrenocortical and pineal, prolactin, body temperature. Neural basis of biological clock and the role of suprachiasmatic nuclei. Brief idea of jet-lag.

Unit-08 : 50 marks

Social Physiology & Community health, Comparative Physiology,. Instrumentation

Social Physiology and Community Health : [60]

Methods of nutritional survey of the population. Methods and principles of population control. Problems of sterility, infertility, impotence. In vitro fertilization. Intrauterine embryo transplantation, Malnutrition, under nutrition, Kwashiorkor, Marasmus, Marasmic Kwashiorkor, Rickets, Osteomalacia, Xerophthalmia, Beriberi, Pellagra, Nutritional anaemias, dental caries, endemic goiter and their remedial measures. Genetic and other factors affecting community health of tribal and non-tribal populations. Pregnancy tests. Nutritional deficiencies in pregnancy and their remedial measures

Comparative Physiology : [20]

Nitrogen metabolism, osmoregulation, electric organs, and bioluminescence.

Instrumentation: [20]

Basic principles of light, compound and electron microscopy (scanning and transmission) Cathode ray oscilloscopes, NMR, HPLC, Spectrophotometer.

PAPER VII

THEORETICAL : 100 Marks

UNIT 09 : 50 Marks

Reproductive Physiology, Developmental Biology

Reproductive Physiology : [80]

Primary and secondary sex organs, secondary sex characters. Puberty and its control, gonadal steroid hormones- synthesis and catabolism, general idea of sex differentiation.

Ovary : Histological structure of ovary, Graafian Follicle and corpus luteum. Hormonal control of ovarian functions. Hormonal functions of ovary. Estrous and menstrual cycles and their hormonal controls. Formation, function and fate of corpus luteum. Formation and maturation of ovum and ovulation, ovulation inducers.

Testis : Histological structure of testis, seminiferous tubules and interstitial tissue of Leydig. Hormonal control of testicular function. Spermatogenesis, spermiogenesis. Hormonal functions of testis. Erection, ejaculation, Eunuchoidism, Cryptorchidism. Prostate and seminal vesicle.

Pregnancy and Lactation : Transport of ovum and sperm in female reproductive tract. Fertilisation. Uterine implantation of fertilized ovum. Formation, structure, functions and fate of placenta. Placental hormones. Pregnancy changes and their hormonal control. Pregnancy tests. Parturition. Brief idea about histological structure of mammary gland. Phases of mammary gland development and their hormonal control. Hormonal control of lactation and milk ejection.

Developmental Biology : [20]

Fertilisation and formation of trilaminar germ disc from zygote; development of heart, GI tract and urinary system; foetal circulation and changes occurring at birth.

Unit 10 : 50 Marks

Biostatistics, Computer Application in Physiology, Skin and body temperature regulation, Pharmacological Physiology

Biostatistics :

[40]

1. Common statistical terms. Notations. Application and uses of biostatistics as a science and its scopes. Physiological statistics. Characteristics and application.
2. Data: sources and presentation. Qualitative and quantitative data, Methods of presentation-tabulation; frequency distribution, drawings, graphical representation of qualitative and quantitative data. Histogram, Frequency polygon and curve, scatter and dot diagrams. Bar diagram, Pie or sector diagram.
3. Measures of central tendency: Averages: Mean, Mode and Median. Measures of location, Percentiles; Application and uses of percentiles.
4. Biological Variability; Mean deviation, Standard deviation (SD), coefficient of variation (CV).
5. Sampling: Definition and types; Characteristics, Sampling techniques-random and non-random sampling, simple random sampling. Systematic sampling. Precision of sampling.
6. Standard error of mean (SEM): Calculation and application in physiological sciences, z-test (for large samples) and t-test (Student's t-test or Gosset's t-test) for small samples.
7. Simple correlation, correlation coefficient : Spearman's ρ and Pearson's product-moment correlation-coefficient (r); Linear regression.

Computer :

[20]

Basic concept, input and output devices, binary data systems, binary data systems, binary operations. Addition, subtraction, multiplication, Boolean algebra, elementary idea of computer language and programming. Application of computer knowledge in Physiology.

Skin and body temperature regulation :

[20]

Skin structure and function, skin circulation, peculiarities and control. Bradykinin and triple response: insensible perspiration; composition of sweat; physiology of sweat secretion and its regulation. Body temperature - factors involved in heat gain and heat loss. Regulation of body temperature by physical, physiological, neural and hormonal factors with reference to nonsweating animals. Physiology of hyperthermia, hypothermia and hibernation. Brown fat; non-shivering thermogenesis.

Pharmacological Physiology :

[20]

The importance of pharmacology in the study of physiological processes- drugs, agonist, antagonist. Pharmacokinetics- absorption, distribution, excretion and bioavailability of drug. Drug biotransformation. The dose effect relationship and the characteristics of dose response curve. Assessment of drug toxicity- LD_{50} and ED_{50} .

PAPER VIII : Practical : 100 Marks

Biochemistry : 15 marks; Biostatistics : 10 marks;

Histology & Histochemistry: 20 marks; Expts on Toad: 20 marks;

Field study report: 15marks ; Lab Note Book: 10 marks; Viva-voce: 10 marks

1. Biochemistry : 15 marks

a) Photocolorimetric estimation of blood constituents:

- i) Blood glucose by Folin-Wu method.
- ii) Blood inorganic phosphate by Fiske-Subbarow method.
- iii) Estimation of serum protein by biuret method

- iv) Estimation of serum amylase by iodometric method.
- b) Demonstration : i) Photocolorimetric estimation of serum cholesterol by Lieberman-Burchard method.
- ii) Estimation of food carbohydrate by Benedict's method.

2. Biostatistics : 10 Marks

Statistical analysis of data of body temperature, pulse rate, systolic blood pressure, respiration, height and weight of the students of the class by the following methods : Computation of frequency distribution, drawing of histogram and frequency polygon, mean, median, standard deviation, standard error. t-test (one tail) for significance of difference between sample means.

3. Histology and histochemistry : 20 Marks

- i) Staining and identification of supplied paraffin sections of mammalian tissues by H/E staining. Liver, kidney, oesophagus, duodenum, ileum, large intestine, lungs, spleen, lymph node, ovary, testis, salivary glands, thyroid, adrenal, pancreas, spinal cord, cerebellum, cerebrum.
- ii) Histochemistry : Staining and demonstration of mucopolysaccharides (PAS), demonstration of alkaline phosphatase and staining of nuclear elements by iron-haematoxylin and hepatic or splenic iron by Prussian blue method.

4. Experiments on toad : 20 Marks

- i) Study and use of kymograph, induction coils, key and tuning fork. Gastrocnemius-sciatic preparation and its use in recording effects of make and brake shocks of progressive rising intensity. Kymographic recording of isotonic muscle twitch. Effects of temperature, summation of two stimuli and load (after load and free load) on muscle in the load experiment. Determination of nerve conduction velocity by kymographic recording of simple twitches.
- ii) **Demonstration** : Genesis of clonus and tetanus by repeated successive stimuli in gastrocnemius muscle. Effect of neuromuscular blocking drugs on gastrocnemius-sciatic preparation.
- i) Perfused Heart: Preparation of amphibian Ringer solution; Kymographic recording of perfused heart beat of toad. Study of effects of changes in perfusion fluid pressure, excess calcium and potassium ion concentration, acetyl-choline, adrenaline and vagal stimulation.

5. Field Study Report : 15 Marks

A report (hand-written) on the basis of field survey from one of the followings :

1. Physiological parameters (at least three parameters to be measured) : Heart rate, blood pressure, respiratory rate, PFI, blood hemoglobin content, differential count of WBC and visual acuity.
2. Anthropometric Measurements (at least three parameters)
3. Epidemiological studies
4. Optional- Visits to institutes of National importance engaged in physiological, biomedical, biochemical and nutritional research.

6. Laboratory Note Book : 10 Marks

7. Viva-voce : 10 Marks

CORRIGENDUM OF ANNEXURE - IV

Guidelines for Educational Excursion and Field Report:

Students are to attend Compulsory Educational Tour to different Laboratories and National Institutes of biomedical importance for exposure to modern techniques or to undertake field studies on tour (e.g. Population Survey, Diet Survey, Anthropometrical Survey, Group Projects etc. only for Part -III).

A Field Report is to be submitted by each student during the Practical Examination as per syllabus.

General Instruction :

Questions to be set from each Chapter of each Unit with equal weightage as far as practicable.

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

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

1. Best & Taylor's Physiological Basis of Medical Practices, edited by B.K.Brobeck.The William and Wilkins Co.
2. Review of Medical Physiology. By W.F.Ganong, Lange Medical Book. Prentice-Hall International.
3. Harper's Illustrated Biochemistry, by R.K.Murray & others.Lange Medical Book, International Edition, Mc Graw Hill.
4. Text Book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
5. Lehninger's Principles of Biochemistry. By D.L.Nelson and M.M. Cox, Worth Publishers Inc.
6. Text Book of Biochemistry, by E.S. West ; W.R.Todd.; H.S.Mason; J.T.Van Bruggen. The Macmillan Company.
7. Biochemistry. by D.Das. Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D.Das. Academic Publishers.
9. Samson Wright's Applied Physiology. Edited by C.A.Keele. E. Neil & N.Toels. Oxford University Press
10. Physiology, by R.M.Berne & M.N.Levy, C.V.Mosby Co.
11. Basic Histology, by D.C.Jungquire, J Carneiro & J.A. Long: Appleton & Lange.
12. Histology- A Text and Atlas, by M.H.Ross & E.J.Reith. The Williams and Wilkins Company.
13. Bailey's Text Book of Histology, revised by W.M.Copenhaver; The Williams and Wilkins Company.
14. Human Physiology, by R.F.Schmidt & G. Thews, Springer-Verlag.
15. Core Text Book Of Neuro-Anatomy, by M.B.Carpenter: the Williams and Wilkins Company.
16. The Human Nervous System, by Charles nobach, Mc Graw Hill Book Co.
17. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J.Weibell & E.A.Pfeiffer; Prentice-Hall of India Pvt Ltd.
18. The Human Nervous System, by M.L. Barr & J.A.Keirman,Harper & Row.
19. Molecular Biology of the Gene, by J.D.Watson; H.H.Nancy & others; Benjamin- Cummings.
20. Molecular Biology of the Cell, by B. Alberts and others, Garland.
21. Human Physiology, by Rhoades & Pflanger, Saunder College Publishing.
22. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wallngton. Oxford University Press.
23. Handbook of Experimental Physiology and Biochemistry, by P.V.Chadha; Jaypee Brothers Medical Publishers.
24. Neurobiology, by G.M. Shepherd. Oxford University Press
25. Biochemistry, by L. Stryer, W.H. Freeman and Co.
26. Molecular Cell Biology, by H. Lodish; D. Baltimore & Others. Scientific American Book.
27. Genetics: Analysis of Genes and Genomes, by D.L. Harlt and E.W. Jones & Burtlett Publishers.
28. William's Text Book of Endocrinology by J.D.Wilson and D.W.Saunders of Co.
29. The Kidney : An outline of Normal and Abnormal Functions, by H.E. Dewardener, ELBS.
30. Text Book of Physiology by G.H.Bell: J.N.Davidson and H.Scarborougl. ELBS.
31. Physiology of Respiration by J.H.Comroe. Year Book Medical Publishers.

32. Text Book of Physiology. Vols. I & II by H.D.Patton; A.F.Fuchs; B.Hille; A.M.Scher and R. Sleiner. W.B.Saunders of Co .
33. The Physiological Basis of Physical Education and Athletics by E.L Fox and D.K. Mathews. Saunders College Publishing.
34. Statistics in Biology and Psychology by D.Das. Academic Publishers.
35. An Introduction to Biostatistics (2nd ed.) by N.Gurumani, M.J.P.Publishers, Chennai.
36. The Pharmacological Basis of Therapeutics by L.S. Goodman and A. Gilman, Macmillan Publishing. Co.
37. Quintessence of Medical Pharmacology, S.K.Chaudhuri, New Central Book Agency
38. Pharmacology in Medicine by S.N.Pradhan; R.P.Maickel and S.N.Dutta. S.P.Press International Inc.
39. The Principles and Practice of Human Physiology by O.G.Edholm and Others, Academic Press.
40. Concise Medical Physiology by S.K.Chaudhury; New Central Book Agency.
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44. Park's Text Book of Preventive and Social Medicine by K.Park, M/s. Banarsidas Bhanot Publishers.
45. Medical Embryology by J.Langman, Williams & Wilkins.
46. Essentials of Human Embryology by A.K. Datta. Current Books International.
47. Human Embryology by I.B.Singh, McMillan India Ltd.
48. General and Comparative Physiology by W.S.Hoar,Prentice-Hall of India Pvt.Ltd.
49. Comparative Animal Physiology by C.L.Posser and E.A.Brown. W.B.Saunders.Co.
50. The Circadian System of Man by R.A.Weaver, Spinger-Verlag.
51. The Clock That Time Us, by M.C.Moore-Ede and others, Harvard University Press.
52. Circadian Rhythms and the Human, by D.S.Minors and J.M.Waterhouse. Wright. PSG.
53. The Physiological Clock: Circadian Rhythms and Biological Chronometry by E.Bunning Springer-Verlag.
54. Pharmacology by M.Das. Books and Allied (Pvt. Ltd.)
55. Basic and Clinical Pharmacology by E.G.Katzung. Appleton and Lange.
56. An Introduction to Biological Rhythms, by D. Palmer, Academic Press.
57. Medical Statistics by B.K.Mahajan. Jaypee Brothers, Medical PublishersPvt. Ltd.
58. Statistical Methods by G.W.Snedecor and W.G.Cochran, Oxford & IBH Publishing Co. Pvt. Ltd.
59. Theory and Practice of Histological Techniques by J.D. Bancroft and A. Stevens, Churchill Livingstone.
60. Practical Biochemistry in Medicine by Srinivas Rao., Academic Publishers.
61. Practical Physiology, by M.K.Manna, Sritara Prakashani, Kolkata.
62. Note Books on Practical Biochemistry, Experimental Physiology and Histology. (Published by the Physiological Society of India, Kolkata.)

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GUIDELINES FOR THEORETICAL PAPERS FOR PART-I, PART-II & PART - III

I. DISTRIBUTION OF QUESTIONS AND MARKS IN THEORETICAL PAPERS.

In each paper of 100 marks the distribution of questions and marks will be as follows:

1. Out of fourteen questions of two mark each, eight questions are to be answered $2 \times 8 = 16$
2. Out of eight questions of twelve mark each, four questions are to be answered $12 \times 4 = 48$
3. Out of ten questions of six mark each, six questions are to be answered $6 \times 6 = 36$