

UNIVERSITY OF KALYANI

REVISED SYLLABUS

FOR THREE YEARS B.Sc. DEGREE COURSE

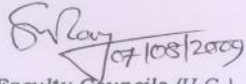
(HONOURS AND GENERAL)

IN

PHYSIOLOGY

**According to the New Examination Pattern
Part – I, Part- II & Part- III**

**WITH EFFECT FROM THE SESSION
2009 – 2010**


Secretary, Faculty Councils (U.G.)
University of Kalyani
Kalyani, Nadia

UNIVERSITY OF KALYANI
KALYANI NADIA
COUNCIL FOR UNDER GRADUATE STUDIES
PROCEEDINGS OF THE 21ST MEETING OF THE (PREVIOUS) COUNCIL FOR UG
STUDIES HELD ON 13/09/2005

Revised Structure and Distribution of Marks for Practical Based Subjects at UG Level
w.e.f. Academic Session 2005-2006

BACHELOR OF SCIENCE (GENERAL)	PART-I	PART-II	PART-III
Compulsory English : One half paper : 50 Marks Modern Indian Language : One half paper : 50 Marks	50 Marks 50 Marks	- - -	- - -
Environmental Studies : One full paper* : 100 Marks*	100 Marks*		
Elective Subjects : Three : Four full papers : 3x4x100 each =1200 Marks	3x1x100 =300 Marks	3x2x100 =600 Marks } Th: 3x1x100 = 300 Marks Pr: 3x1x100 = 300 Marks	3x1x100 =300 Marks } Th : 3x1x 60 = 180 Marks Pr : 3x1x40 = 120 Marks
AGGREGATE MARKS : 1400	500 Marks	600 Marks	300 Marks

BACHELOR OF SCIENCE (HONOURS)	PART-I	PART-II	PART-III
Compulsory English : One half paper : 50 Marks Modern Indian Language : One half paper : 50 Marks	50 Marks 50 Marks	- -	- -
Environmental Studies : One full paper* : 100 Marks*	100 Marks*	-	-
Elective subjects : Two : Three full papers : 2x3x100 each = 600 Marks	2x1x100 Marks =200 Marks	2x2x100 =400 Marks } Th: 2x1x100 =200 Marks Pr: 2x1x100 =200 Marks	- -
One Honours Subject = 800 Marks			
Theory: Seven Papers = 540 Marks Practical: Four Papers = 260 Marks	200 Marks (Th: 2 x 75 Marks) (Pr : 1 x 50 Marks)	200 Marks (Th: 2 x 75 Marks) (Pr : 1 x 50 Marks)	400 Marks (Th: 3 x 80 Marks) (Pr : 2 x 80 Marks)
<u>For Computer Science Honours</u>		<u>For Computer Science Honours</u>	
Theory : Seven Papers = 440 Marks Practical : Four Papers = 280 Marks Project : One Paper = 80 Marks	200 Marks (Th: 2 x 50 Marks) (Pr: 1 x 100 Marks)	200 Marks (Th: 2 x 50 Marks) (Pr: 1 x 100 Marks)	400 Marks (Th: 3 x 80 Marks) (Pr : 1 x 80 Marks) (Project : 1 x 80 Marks)
AGGREGATE MARKS : 1600	600 Marks	600 Marks	400 Marks

* With effect from the session 2009-2010.

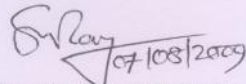
S. Nayak
10/08/2009
Secretary, Faculty Councils (U.G.)
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University of Kalyani

**Revised Syllabus for B.Sc.(Honours) Course in
PHYSIOLOGY**

(w.e.f. the session 2009-2010)

**According to the New Examination Pattern
Part – I, Part – II & Part – III**


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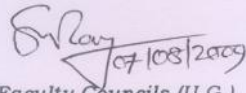
University of Kalyani

Revised Syllabus of Physiology Honours Course

(w.e.f. the session 2009-2010)

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PHYSIOLOGY (HONOURS)**Distribution of Marks****PART - I****PAPER - I****75 Marks**

i) Internal Assessment	11 Marks
ii) Theoretical	64 Marks
Group - A	34 Marks
Group - B	30 Marks

Total no. of Lectures required -70L

Group A :	34 Marks
1. Functional organization of Human body:	(25L)
2. Biophysical and physiochemical Principles:	(15L)

Group B :	30 Marks
1. Blood and body Fluids :	(20L)
2. Enzymology :	(10L)

PAPER - II**75 Marks**

i) Internal Assessment	11 Marks
ii) Theoretical	64 Marks
Group - A	34 Marks
Group - B	30 Marks

Total no. of Lectures required- 65L

Group A :	34 Marks
1. The Respiratory system :	(20L)
2. The Digestive System :	(15L)

Group B:	30 Marks
1. The cardiovascular system:	(30L)

PAPER - III (Practical) **50 Marks**

- | | |
|--|----------------|
| (i) Histology | 15Marks |
| Identification of Permanent Sections:
Hematological experiments | |
| (ii) Physiological chemistry: | 5 Marks |
| Qualitative experiments | |
| (iii) Experimental Physiology : | 10Marks |
| Amphibian skeletal muscle experiments | |
| (iv) Viva Voce | 10Marks |
| (v) Laboratory Note Book | 10Marks |

PART - II**PAPER - IV** **75 Marks**

- | | |
|-------------------------------|-----------------|
| i) Internal Assessment | 11 Marks |
| ii) Theoretical | 64 Marks |
| Group - A | 34 Marks |
| Group - B | 30 Marks |

Total no. of Lectures required –64L

Group A : **34 Marks**
1. Physiological Chemistry: (34L)

Group B : **30 Marks**
1. Nutrition and Dietetics: (20L)
2. Microbiology: (10L)

PAPER - V **75 Marks**

- | | |
|-------------------------------|-----------------|
| i) Internal Assessment | 11 Marks |
| ii) Theoretical | 64 Marks |
| Group - A | 34 Marks |
| Group - B | 30 Marks |

Total no. of Lectures required –64L

Group A : **34 Marks**
Renal Physiology : (20L)
2. Immunology: (14L)

Group B : **30 Marks**
1. Genetics and Molecular Physiology: (30L)

<u>PAPER - VI (Practical)</u>	<u>50 Marks</u>
i) Histology	10 Marks
Identification of Permanent Sections: Haematological experiments	
(ii) Physiological chemistry:	10 Marks
Qualitative experiments	
(iii) Experimental Physiology:	10 Marks
Amphibian skeletal muscle experiments	
iv) Review Work	5 Marks
v) Viva Voce	10 Marks
vi) Laboratory note book -	5 Marks

PART-III

Paper -VII **80 Marks**

- | | |
|-------------------------------|-----------------|
| i) Internal Assessment | 12 Marks |
| ii) Theoretical | 68 Marks |

Total no. of Lectures required –70L**Group –A: 40 marks**

- | | | |
|----------------------------|---|-------|
| 1. Nerve Muscle Physiology | : | (20L) |
| 2. Sensory Physiology | : | (18L) |

Group B : 40 marks

- | | | |
|-------------------|---|-------|
| 1. Nervous system | : | (32L) |
|-------------------|---|-------|

Paper -VIII **80 Marks**

- | | |
|-------------------------------|-----------------|
| i) Internal Assessment | 12 Marks |
| ii) Theoretical | 68 Marks |

Lectures required Total–70L**Group –A: 40 marks**

- | | | |
|---------------------|---|-------|
| 1. Endocrine system | : | (30L) |
| 2. Chronobiology | : | (5L) |

Group --B : 40 marks

- | | | |
|------------------------------|---|-------|
| 1. Reproductive biology | : | (15L) |
| 2. Social Physiology | : | (5L) |
| 3. Skin and Body temperature | : | (8L) |
| 4. Embryology | : | (7L) |

Paper –IX80 Marks**i) Internal Assessment****12 Marks****ii) Theoretical****68 Marks****Lectures required Total–70L****Group –A:****40 Marks**

1. Ergonomics and Exercise Physiology
2. Application of Computer in Physiology
3. Physiological instrumentation

(22L)

:

(6L)

:

(6L)

Group B :**40 Marks**

1. Man and Environment
2. Pharmacology
3. Application of Statistics in Physiology

(20L)

:

(4L)

:

(12L)

:

Paper –X (Practical)80 Marks

- (i) Physiological chemistry
- (ii) Experimental Physiology
- (iii) Computer Applications
- (iv) Microbiology
- (v) Viva Voce
- (vi) Laboratory Note Books

:

20 Marks

:

20 Marks

:

10 Marks

:

10 Marks

:

10 Marks

:

10 Marks

:

Paper –XI (Practical)80 Marks

- (i) Histology
- (ii) Experimental Physiology
- (iii) Experiments on Human and
Work Physiology
- (iv) Biostatistics
- (v) Social Physiology – Field Study Record
- (vi) Viva Voce
- (vii) Laboratory Note Books

:

15 Marks

:

15 Marks

:

10 Marks

:

10 Marks

:

10 Marks

:

10 Marks

:

10 Marks

:

10 Marks

:

PART - IPaper I

75 Marks

- i) Internal Assessment
ii) Theoretical

11 Marks
64 Marks

Total no. of Lectures required –70L

Group A :

34 Marks (40L)

1. Functional organization of Human body:

(i) **Cellular Physiology** : Basic structural differences between prokaryotic and eukaryotic cells. Electron microscopic structures and functions of the organelles of eukaryotic cell with special emphasis on Plasma membrane, mitochondria and cytoskeleton. Properties of membrane: transport across cell membranes, cell junctions— tight junction and gap junction.

(ii) **Homeostasis** positive and negative feed back.

(iii) **Biochemistry of Biomolecules**: Classification, chemistry and properties of carbohydrates, lipids and proteins. Primary, secondary, tertiary and quaternary structures of proteins and bonds involved in stabilizing them. Ramachandran's plot. Phospholipid – classification & function

Nucleic acids – intricate structural components, DNA double helix. Structure of mRNA, tRNA, rRNA.

(iii) **Neurobiology**: Myelinated and unmyelinated nerve fibers. The resting membrane potential. The action potential. Electrotonic potentials. Propagation of nerve impulse in different nerve fibres. Conduction velocity of nerve impulse 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. (25L)

2. Biophysical and physiochemical Principles: Diffusion, surface tension and viscosity– their characteristics, factors influencing and biological applications. Osmosis — laws of osmosis and biological applications. Acid, base, pH and buffers. Colloids — Classification, properties — Optical and electrokinetic, biological importance of colloids. Dialysis and ultracentrifugation. Chromatography, electrophoresis. Gibb's Donnan equilibrium. Thermodynamics — laws, the living body as a thermodynamic system, thermodynamic equilibrium and physiological steady state. Autoradiography, Cell fractionation and tracer techniques (principle and use of P_{32} , C_{14} , O_{18} , H_3). Nano particles and its application in physiology. (15L)

Group – B :

30 Marks (30L)

1. Blood and body Fluids: Composition and functions of blood. Plasma proteins – normal values, origins and functions. Plasmapheresis. Stem cells. Formed elements of blood — origin, formation, functions and fate. Hemoglobin — Chemistry, biosynthesis, functions, compounds and derivatives, T&R state of hemoglobin. Fetal hemoglobin. Abnormal hemoglobin. Thalasaemia, sickle cell anemia. Different types of anemia and their causes. Erythrocyte sedimentation rate (ESR) and its significances. Haematocrit. PCV, MCV, MCH, MCHC. Blood haemostasis - vasoconstriction, platelet aggregation & clot formation, anticoagulants and their mechanism of action, Coagulation hastening factors. Prothrombin time, disorders of coagulation. Fibrinolysin. Haemolysis. , Blood volume – normal values, regulation determination by dye and radioisotopic methods. Blood groups — ABO system and Rh factors. Blood transfusion. & hazards Lymph and tissue fluids — formation and function. (20L)

2 Enzymology — Mechanism of action, active sites, kinetic properties, K_m value, effect of temperature and pH, competitive, uncompetitive and non-competitive inhibitions, covalent modifications, allosteric regulation, cooperativity, isozymes, rate-limiting enzymes, ribozymes, abzymes. (10L)

Paper II

75 Marks

i) Internal Assessment

11 Marks

ii) Theoretical

64 Marks

Total no. of Lectures required –65L

Group A :

34 Marks (35 L)

1. The Respiratory system : Anatomy and histology of the respiratory tract and organs. Mechanism of breathing — role of respiratory muscles. Mechanics of breathing – role of surfactant. Lung compliance, Artificial respiration Significance of physiological and anatomical dead space. Tidal volume, inspiratory and expiratory reserve volumes, residual volume, vital capacity, functional residual capacity and maximum retaining capacity. . Work of breathing. Transport of gases in the body. Partial pressure and composition of inspired, expired and alveolar airs and the blood. Oxygen dissociation curve of hemoglobin and myoglobin — factors affecting. Carbon dioxide dissociation curve. Regulation of respiration — Neural and chemical, respiratory centers, chemoreceptors, baroreceptors, pulmonary receptors, Hypoxia — types, effects, Asphyxia. Voluntary hyperpnoea. Apnea. Ventilation–perfusion ratio, Lung function tests — FVC, MVV and their significance. Common respiratory diseases and their causes — asthma, lung carcinoma, emphysema. (20L)

2. The Digestive System: Anatomy and histology of alimentary canal and digestive glands. Movements of alimentary canal and their regulations. Compositions, functions and their regulation of the secretions of salivary, gastric, pancreatic and intestinal juices and bile. Enterohepatic circulation. Digestion and absorption of carbohydrates, lipids, proteins and nucleic acids. Clinical conditions of GI system — Gastric ulcers & its relation to helicobacter pylori. (15L)

Group – B :

30 Marks (30 L)

1. The cardiovascular system: Anatomy of the heart. Histological structures and properties of cardiac muscle. Origin and propagation of the cardiac impulse. Pacemaker, reserve pacemaker, artificial pace maker. Stannius ligature. The cardiac cycle — Pressure and volume changes. Heart sounds. Electrocardiography — the normal electrocardiogram, electrocardiographic leads, vectorial analysis, the vectocardiogram, the mean electrical axis of the heart. Principles of echocardiography. Cardiac output — measurement by application of Fick's principle and dye dilution method, factors affecting. Starling's law of heart.

Blood pressure — its measurement, factors affecting. Cardiovascular homeostasis — neural and chemical control of cardiac functions and blood vessels, cardiac and vasomotor centers, baroreceptors and chemoreceptors, innervation of the heart and blood vessels, cardiac and vasomotor reflexes. Causes of common cardiovascular diseases — dietary factors, smoking, diabetes mellitus, alcoholism, cyanosis.

Regional circulations — cerebral, coronary, hepatic and pulmonary. Cutaneous circulation

(30L)

Paper III (PRACTICAL)**50 Marks****(i) Histology :****15 Marks**

Study and identification of stained sections of different mammalian tissues and organs : Bone, cartilage, trachea, lung, spleen, lymph gland, esophagus, stomach, duodenum, ileum, jejunum, large intestine, liver, kidney, ureter, salivary glands, pancreas, adrenal gland, thyroid gland, testis, ovary, spinal cord, cerebral cortex, cerebellum, skin, cardiac muscle, skeletal muscle, smooth muscle, artery, vein, tongue, uterus.

Haematological experiments: Preparation and staining of blood film with Leishman's stain in hematoxylin-eosin. Identification of blood corpuscles. Differential count, Bleeding time and clotting time. Total count of RBC and WBC. Platelet count. Supravital staining of reticulocytes. Hemoglobin estimation. Preparation of haemin crystals. Preparation and staining of bone marrow smear. Measurement of the diameter of the megakaryocyte. Measurement of the diameter of the leucocytes.

(ii) Physiological chemistry :**5 Marks**

Qualitative experiments: Tests and identification of carbohydrates, glycerol, acetone, proteins, urea, uric acid, HCl, lactic acid, bile salts, bile pigments. Identification of normal and pathological constituents of urine.

(iii) Experimental Physiology :**10 Marks**

Study and use of kymograph, induction coils, key and tuning fork. Gastrocnemius – sciatic preparation and use in recording effects of make and break shocks of progressively rising intensity. Kymographic recording of isotonic muscle twitch using gastrocnemius – sciatic preparation. Determination of nerve conduction velocity by kymographic recording of simple twitches. Effect of excessive repeated stimulation on muscular contraction.

DEMONSTRATION : Genesis of clonus and tetanus by repeated successive stimuli in gastrocnemius muscle. Effect of neuromuscular blocking drugs on Gastrocnemius – sciatic preparation. Effect of Stannius ligature.

(iv) Viva–Voce :**10 Marks****(v) Laboratory Note Books :****10 Marks****PART-II****Paper IV****75 Marks**

- i) Internal Assessment 11 Marks**
ii) Theoretical 64 Marks

Total no. of Lectures required –64L**Group A :****34 Marks (34L)****Physiological Chemistry:**

Glycogenesis, glycogenolysis, glycolysis, gluconeogenesis, HMP s hunt pathway, Rapoport–Luebering Cycle. Regulation and energetics of Glycogenesis, Glycogenolysis, Glycolysis, and Gluconeogenesis TCA cycle & anabolic role of TCA cycle, synthesis & Regulatory role of cyclic AMP, TCA cycle as the final common pathway of metabolism.

Oxidation of fatty acids, its energetics, Formation and fates of ketone bodies. Cytosolic biosynthesis of saturated fatty acids. Metabolism of adipose tissue. Lipoproteins – Classification and brief idea of functions. Blood lipid profile

Amino acid pool. Deamination, transamination, and decarboxylation. Synthesis of urea. Basic idea of glucogenic and ketogenic amino acids. Metabolism of glycine, sulfur – containing amino acids and phenylalanine. Synthesis of physiological important biomolecules: melatonin, glutathione. serotonin & creatine phosphate), Histamine, GABA and creatinine.

Biological oxidations — Redox potential, mitochondrial electron transport chain, oxidative phosphorylation and high–energy compounds. (34L)

Group B :

30 Marks (30L)

1. Nutrition and Dietetics: Constituents of food and their significance. Basal metabolic rate – factors, determination by Benedict's– Roth apparatus, B M R - determination by Douglas bag, Respiratory quotient. Specific dynamic action.

Vitamins — dietary sources, biological functions, deficiency symptoms, hyper vitaminosis, antivitamins

Metabolism of calcium, phosphorus, iron, zinc, fluoride and selenium. Principles of formulation of balanced diets for growing child, adult man and woman, pregnant and lactating woman.

Nitrogen balance, essential amino acids, biological value of proteins – measurement and factors affecting. digestibility coefficient, net protein utilization, protein efficiency ratio, supplementary action of protein, protein spares, dietary fibre, Principles of diet survey. Composition and nutritional value of common food stuffs. Physiology of starvation and obesity. (20L)

2. Microbiology: Bacteria — Prokaryotic cell. Classification of bacteria on the basis of morphology and staining characteristics–gram staining, spores staining and acid fast staining. Bacterial nutritional requirements, physical factors affecting. Culture media, growth curve. Bacterial metabolism–fermentation, glyoxalate cycle, Entner – Doudoroff pathway. Bacterial genetics– transformation, conjugation and transduction, sterilization and pasteurization. Elementary idea of bacteriostatic and bacteriocidal agents–phenol, alcohol. Antibiotics–bacteriostatic and bacteriacidal effects. Virus– characteristics of animal virus (influenza virus), bacteriophage, viral replication. Lytic and lysogenic cycle. (10 L)

Paper V

75 Marks

i) Internal Assessment

11 Marks

ii) Theoretical

64 Marks

Total no. of Lectures required –64L

Group A :

34 Marks (34L)

1. Renal Physiology :

Anatomy of kidney, Histology of nephron. & its structural differences between cortical and juxta medullary nephrons, juxta glomerular apparatus, concept of renal threshold. Aquaporin .Formation of urine – glomerular function and tubular functions. Counter-current exchanger and multiplier. Renal regulation of osmolarity and volume of blood fluids. Diabetes insipidus. Formation of hypertonic urine. Renal regulation of acid-base balance, acidification of urine. Renal function tests

– inulin, urea and PAH clearance tests. Physiology of urinary bladder and micturition. Composition of urine. Abnormal constituents of urine, their detection and significance. Renal dialysis. Non-excretory functions of kidney. Renal circulation and its autoregulation (20L)

3. Immunology: Immune system–Innate and Acquired, Active and Passive. Antigen. Antibody. Haptens. Adjuvants. Immunoglobulin – classification, basic structure and function. **APC, Antigen** and antibody reactions – RIA, ELISA. Vaccine, toxins, toxoids, antiserum. Primary and secondary immune response. Antibody production–processing and presentation of antigen– diversity of antibody production. MHC. Cell mediated immunity. Formation, maturation and activation of B and T cells. Immune effectors system–cytokines complement system, K cells and NK cells, Cell mediated effectors response. Lymphocyte migration, Interferons. Immunopathology –basic principles of auto immune disease and transplantation immunology. (14L)

Group B :

30 Marks (30L)

1. Genetics and Molecular Physiology : Chromosome structure. Different levels of organization of chromatin. Chromosomal proteins. The organization and sequences of cellular genomes — Introns and Exons, repetitive DNA sequences, DNA duplications, and pseudogenes. Cell cycle — events. Elementary idea of apoptosis. Basic idea of multiple allelism, pleiotropism and epistasis in human. Chromosomal aberrations and mutations. Genes – biological and molecular definition. DNA polymorphism. DNA replication, Protein synthesis — genetic code, Wobble hypothesis, codon – anticodon interaction, transcription, translation in prokaryotes and eukaryotes. Regulation of gene expression — Operon concept — lac operon, trp operon. Inborn errors of metabolism of glycogen, tryptophan, phenylalanine, tyrosine. Basic idea of Recombinant DNA technology —vectors, Restriction enzymes, Plasmids. Applications of recombinant DNA technology — Cloning, Gene therapy, transgenic animals, hybridoma, monoclonal antibody. DNA fingerprinting and its application in forensic science. Polymerase chain reaction (PCR), gene mapping. Biotechnology and its benefits. (30L)

Paper VI (PRACTICAL)

50 Marks

1. Histology :

10 Marks

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

2. Experimental Physiology:

10 Marks

Kymographic recording of the effects of temperature and load (free and after load) on simple twitch of gastrocnemius muscle, Calculation of work done by the muscle in load experiments, Recording of summative muscle twitch from two single muscle twitches.

3. Physiological Chemistry :**10 Marks**

Quantitative experiments : Estimation of glucose and sucrose in aqueous solution and lactose in milk by Benedict's method. Estimation of ammonia and amino nitrogen (Sorensen's formol titration method).

Identification of amino acids by paper chromatography or TLC

Demonstration: Paper electrophoresis.

4. Review work on a topic of Physiological importance**5 Marks****5. Viva-Voce:****10 Marks****6. Laboratory Note Books:****5 Marks****PART III****Paper VII****80 Marks****Internal Assessment - 12 Marks****Theoretical - 68 Marks****Total no. of Lectures required –70L****Group A:****34 Marks (40L)****1. Nerve muscle physiology:**

Microscopic and electron microscopic structures of striated, smooth and cardiac muscles. The sarcotubular system. Red and white muscle, fast and slow muscle. Properties of muscle – excitability and contractibility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, conductivity, extensibility and elasticity, Rigor mortis. Mechanism of muscle contraction and relaxation. Excitation-contraction coupling. Isometric and isotonic contractions. Chemical, thermal and electrical changes in striated muscle during contraction and relaxation.

Synapses-types, structure and synaptic transmission of the impulse, synaptic potential, neurotransmitters, co transmitters, and neuromodulators. The skeletal neuromuscular junction – structure, transmission, end-plate potential-, Post tetanic potential. Motor unit. Injury to peripheral nerves – degeneration and regeneration in nerve fibres. Changes in nerve cell body, transneuronal degeneration, changes in receptors and motor end plates, denervation hypersensitivity. Reaction of degeneration. Thermal changes in nerve during activity. Neurotrophins.

Muscle spindle: structure, innervations and behaviors.

(20L)**2.Sensory Physiology:**

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

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- a. Olfaction and Gustation: Structure and function of receptor organs, nerve pathways, centers, physiology of taste and smell. After taste. Olfactometer. Electro-olfactogram.
- b. Audition— Sound waves, decibel. Structure and functional significance of auditory apparatus – external, middle and internal ears. Organ of corti. Auditory pathway and centers. Mechanism of hearing and its modern theories. Different electrical potentials of internal ears. Discrimination of sound frequency and loudness. Audiometry.
- c. Vision: Anatomy and structure of the eye ball. Principal characteristics of ocular system compared to a camera. The structure of lens. Formation, circulation and functions of aqueous humour. Mechanism of accommodation. Pupillary reflexes — light reflex, near response. Argyll–Robertson pupil. Errors of refraction and their corrections. Histological details of retina, peripheral retina, fovea and blind spot. Visual pathway and centers. Effects of lesion in visual pathway. Photopic and scotopic vision. Chemical and electrical changes in retina on exposure to light. Electroretinogram. Positive and negative after-images. Light and dark adaptations. Colour vision and its modern concept. Colour blindness. Visual field. Perimetry. Visual acuity— measurement, mechanism, factors affecting. Binocular vision and depth perception. Lux. Measurement of illumination. Critical fusion frequency. (18L)

Group B

34 Marks (40L)

1. Nervous system

Organization – A brief outline of the organization and basic functions : (sensory, motor and association) of the nervous system (central and peripheral). Structural organization of the different parts of brain and spinal cord. Ascending and descending tracts: origin, courses, termination and functions. Lower motor neurons and upper motor neurons. Reflex action – definition, reflex arc, classification, properties. Functions of the spinal cord with special reference to functional changes following hemisection and complete section of spinal cord.

Reticular formation: structure connection and functions of reticular formation. Decerebrate rigidity, decorticate rigidity. Vestibular organ and posture regulation: structure and function of vestibular apparatus. Postural reflexes. Structure, connections and functions of cerebellum. Nuclei, connections and functions of thalamus and hypothalamus. Basal ganglia: structure, connections and functions. Cerebral cortex: histological structure, location and functions. Limbic system – structure, connections and functions. Emotions.

Higher Functions of Brain: Spontaneous electrical activity of brain, EEG and ECoG (electrocorticogram), evoked potential, D.C. potential. Isolated cortex. Sleep -wakefulness. Physiological basis and types of sleep. Physiology of learning and memory. Speech. Aphasias. Asymmetrical organization of certain cognitive functions - split brain. Physiology of pain and pitch. CSF formation, circulation and functions.

Autonomic nervous system: organization, outflow, ganglia, centers and functions. Chemical transmission in autonomic ganglia; cholinergic and adrenergic receptors, agonists and antagonists. Central control of autonomic nervous system.

Molecular Neurophysiology: General concept of ionotropic and metabotropic receptors. Structure and functions of nicotinic and muscarinic acetylcholine receptors, α, β adrenoceptors and their agonists and antagonists, Glutamate receptors — NMDA receptors and AMPA receptors, GABA receptors, Opiate receptors, CAM proteins. (32 L)

Paper VIII

80 Marks

Internal Assessment - 12 Marks
Theoretical - 68 Marks

Total no. of Lectures required –70L

Group A:

34 Marks (35L)

1. The Endocrine System :

Definition of endocrine glands and hormones. Experimental and clinical methods of study of functions of endocrine glands. Classification of hormones.

Anatomy, histological structure, hormones (including chemistry) and functions (including hypo and hyper active states) and control of anterior and posterior pituitary, thyroid, parathyroid, pancreatic islet tissue, adrenal cortex and medulla. Biosynthesis and transport of thyroxine. Biosynthesis and catabolism of catecholamines (adrenomedullary hormones). Role of parathormone and calcitonin in calcium and phosphorus metabolism. Regulation of insulin. Hormonal control and blood sugar level – diabetes mellitus and hyper insulinism. Histological structure, hormone (including chemistry) and functions of pineal. Neuroendocrinology – concept of neurosecretion. Hypothalamic control of anterior and posterior pituitary – releasing hormones. Role of pituitary in the regulation of endocrine functions. Positive and negative feedback mechanisms. Chemistry, secretion and functions of the gastrointestinal hormones. Kidney as an endocrine organ. Thymus gland. Atrial natriuretic factors. Growth factors – EGF, PDGF, IGF and FGF. Prostaglandins. Kininogens and kinins. APUD cells. Biosignalling system : hormone signalling mechanism – steroid, peptide and amine hormones. Hormone receptors, G proteins, cAMP, IP₃, DAG, tyrosine kinase. Growth factor signaling mechanism: tyrosine kinase, MAP kinase, Janus tyrosine kinase (JAK) – STAT (Signal transducer and activator of transcription) pathways. (30L)

2. Chronobiology:

Different types of physiological rhythms – ultradian, circadian, infradian. Different zeitgebers and their relation with circadian clock. Physiological basis of sleep wakefulness cycle. Neural basis of biological clock and role of suprachiasmatic nuclei. Brief idea of jet -lag and shift work. (5L)

Group B:

34 Marks (35L)

1. Reproductive Physiology:

Primary and secondary sex organs and secondary sex characters. Histology of testis. Endocrine functions of testis. Spermatogenesis. Hypothalamic control of testicular functions. Histology of ovary. Ovarian hormones and their functions. Oogenesis and ovulation. Formation and functions of corpus luteum. Hypothalamic control of ovarian functions. Estrous cycle. Menstrual cycle and its regulation. Structure, formation and functions of placenta. Maintenance of pregnancy and the bodily changes during pregnancy. Parturition. Pregnancy tests. Elementary knowledge of fertilization and implantation. Development of mammary glands, lactation and their hormonal control. Physiology of puberty. (15L)

2. Social Physiology :

Population problem – principles and methods of family planning . Problems of infertility and brief idea about in vitro fertilization and intrauterine embryo transplantation. Malnutrition – PCM, marasmus, kwashiorkor, marasmic kwashiorkor, endemic goiter, nutritional anemias, rickets, osteomalacia, xerophthalmia, beriberi and their social implications. Principles and social importance of immunization against infectious diseases. Epidemiology and prevention of AIDS and hepatitis.

(5L)

3. The Skin and Body Temperature Regulation :

Structure and functions of skin. Sweat gland – structure, composition of sweat. Physiology of sweat secretion and its regulation. Insensible perspiration. Regulation of body temperature in homeotherms – its physical and physiological processes, roles of neural and hormonal processes. Physiology of hyperthermia, hypothermia and hibernation. Temperature regulation in non-sweating animals.

(8L)

4. Embryology: Formation of trilaminar germ disc., development of heart, kidney, and lung. Fetal circulation and the changes after birth, Teragenicity.

(7L)

Paper IX**80 Marks**

Internal Assessment - 12 Marks
Theoretical - 68 Marks

Total no. of Lectures required –70L**Group A :****34 Marks (34L)****1. Ergonomics and Exercise Physiology :**

Basic concept of ergonomics and its application in daily life. Anthropometry and its application in design. Methods of evaluation of Occupational work load. Classification of work Load. Working conditions and environment – Heat stress, illumination level, noise level, vibration, ventilation, Radiation.

Method for assessing of Body composition, BMI. Cardiorespiratory respiratory response during graded exercise. Aerobic and anerobic pathways during rest and exercise. Measurement of energy cost of exercise. Aerobic work capacity. (VO_2 max). EPOC. Nutrition and Physical fitness. Effect of training on Physical performance.

(22L)

2. Application of Computer in Physiology :

Computer – Characteristics, evolution, type of computer, anatomy of computer, brain versus computer, binary operations, logic GATES, elementary idea about computer languages.

Application – application of computer in elucidating homeostasis, power -point Presentation of physiological variables, presentation of electrocardiogram, lung volumes, nerve discharge etc by computer.

(6L)

3. **Physiological instrumentation**

Principle of construction and use of compound microscope, phase – contrast microscope, fluorescence microscope, electron microscope (Transmission and scanning), photoelectric colorimeter, sound level meter and audiometer.

Elementary idea about clinical importance of ECG, EEG, USG, MRI and PET. (6L)

Group B:

34 Marks (36L)

1. **Man and Environment**

Human environment – definition , composition , interaction between human and environment, homeostasis and homeorhesis., Ecology – ecosystem , food chain , food pyramid , biogeochemical cycle ; N₂ and carbon cycle., Xenobiotics – toxins : teratogens , carcinogens , reproductive toxins , food adulterants , synthetic chemicals , pesticides , dioxin . , poisoning of food , LD₅₀ / LOD₅₀ , dose response curves and Ames test ., High pressure and low pressure environments, extreme environments, human adaptation ., pollution – causes, effects and mitigation of air , water , noise and radioactive pollution , arsenic pollution and human health ., outline concept of “ozone hole” and “greenhouse effect” and Biochemical oxygen demand (BOD). (20L)

2. **Pharmacology**

Drug – host response: synergism, antagonism. Pharmacokinetics: definition of drug, drug absorption, metabolism and cellular action. Cholinergic and adrenergic agonists and antagonists., NM – blockers., Nerve gases and actions. (4L)

3. **Application of Statistics in Physiology**

Definitions of Statistics ., Statistical terms : data , variables , samples , observations , parameters , observation unit., presentation of data : frequency distribution , diagrams – histogram , bar diagram , line – chart , pie – diagrams. , mean , mode , median ., Standard deviation , standard error of mean ., test for significance : Student “ t ” test , chi – square test . (16L)

Paper X (PRACTICAL)

80 Marks

1 . **Physiological Chemistry**

25 Marks

Estimation of blood chloride (silver nitrate method). Colorimetric estimation of blood constituents : Inorganic phosphate ((Fiske-Subbarow as given in Hawk’s Physiological Chemistry, 14th Edition) and Sugar (Folin –Wu method). Estimation of serum protein (Biuret method, by plotting standard curve). SGPT and SGOT.

2. Experimental Physiology : 15 Marks

Preparation of amphibian Ringer solution. Kymographic recording or perfused heart beat of toad – study of the effects of changes in perfusion fluid pressure, excess calcium and potassium ion concentration, acetylcholine, adrenaline and vagal stimulation.

3. Computer Application: 10 Marks

Operating system and command . File management in , MS –word ,Excel, power point, representation of physiological result in graph, stati stical calculation in Excel

4. . Microbiology : 10 Marks

Gram staining of bacteria and identification of gram positive and gram negative bacteria. Staining and identification of bacterial spores.

Demonstration :. Isolation of spring and non -spring bacteria from soil and milk. Preparation of slant, stab and plate.

5. Viva Voce 10 Marks**6. Laboratory Note Books 10 Marks****Paper XI (PRACTICAL) 80 Marks****1. Histology: 15 Marks**

Preparation of permanent slides of mammalian tissues and organs – fixation, dehydration, paraffin embedding, block preparation, cutting and staining of sections by haematoxylin – eosin and iron-haematoxylin.

2. Experimental Physiology : 15Marks

Kymographic recording of normal movements of rat's intestine in Dale's apparatus. Effects of hypoxia, acetylcholine and adrenaline on normal intestinal movements. Effects of acetylcholine on frog rectus abdominis muscle in Dale's bath.

3. Experiments on Human and Work Physiology : 10 Marks.

Sphygmomanometric measurement of arterial blood pressure at rest and after exercise. Harvard step 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, 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. Calculation of body surface area (using nomogram), body mass index from anthropometric measurements.

Perimetry, reaction time by stick drop test, ECG, knee jerk reflex, planter reflex, visual acuity by Snellen's chart, colour blindness test, audiometry.

4. 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.

5. Social Physiology – Field Study Record :**10 Marks**

A report to be submitted on the day of examination containing the results of field study on a topic of social variable(s).

6. Viva Voce**10 Marks****7. Laboratory Note Books****10 Marks****RECOMMENDED TEXT AND REFERENCE BOOKS FOR HONOURS STUDENTS****General Physiology :**

1. Samson Wright's Applied Physiology
2. Ganong : Review of Medical Physiology
3. A.C. Guyton: Text book medical Physiology
4. Starling's and Evan's: Principles of Human Physiology
5. K.J. Franklin: A short history of Physiology
6. Gray's Anatomy.
7. Harris: Experimental Physiology
8. De Flore: Atlas of Human Physiology
9. Rogers: Comparative physiology
10. Best and Taylor's: Physiological basis of medical Practice
11. J.N.Mills: Biological aspects of circadian rhythm
12. J.F.Fulton: Selected readings in the history of Physiology.
13. Youref and others (eds): Adaptation to environment – desert and mountains.
14. Bell, Davidson and Scarborough: Textbook of Physiology and Biochemistry.
15. C.C. Chatterjee : Human Physiology.
16. Stuart Era Fox: Human Physiology
17. Tortora and Grabowski: Principles of Anatomy and Physiology.
18. SK. Choudhury: Concise Medical Physiology
19. P.Nayak: Practical Medical Physiology

Work Physiology:

1. Falls: Exercise Physiology
2. McArdle, Katch and Katch: Exercise Physiology
3. LG Shaver: Essential of exercise Physiology
4. DK Mattews and EL Fox: Physiological basis of Physical Education and athletics.
5. O.G.Edholm: Biology of Work.

Physiological chemistry:

1. West and Todd: Text book of biochemistry
2. Lehninger: Biochemistry
3. Hawk's Physiological Chemistry
4. L.Stryer: Biochemistry
5. Harrow and Mazur: Text book of Biochemis try
6. D. Das: Biochemistry
7. harper's review of Physiological Chemistry

Environmental Physiology and Allied subjects:

1. Turk and Turk: Environmental Sciences
2. Jackson and Jackson: Environmental Science
3. EP Odom: Ecology
4. Collin Baird: Environmental Chemistry
5. Manahan: Environmental Chemistry
6. G. Paul: Paribas O Dushan (in Bengali)
7. G.Paul : Oceanography : Marine pollution .
8. FG Bell: Environmental Geography
9. S.Singh: Environmental Geography
10. M. Aurora: Biological control of Environme ntal pollution.
11. Brune (eds.): Global Environmental.

Histology:

1. A.W.Ham: Histology
2. Bloom and Fawcett: Text of Histology
3. Parse: Histochemistry
4. Carlton: Histological technique
5. De Fiore: Atlas of Human Histology
6. Keelson and Leeson: Text book of Histology
7. Sharpy Schaffer: Essentials of Histology

Immunology:

1. Ivan Roitt: Essential Immunology
2. Kubey: Immunology
3. Stites: Terr and Parslow: Basic and clinical Immunology

Endocrinology:

1. Turner: Endocrinology
2. Williams: Endocrinology
3. Griffith: Endocrinology
4. De Groot: Endocrinology

Reproductive Physiology:

1. Marshall: Physiological Reproduction
2. Knobil: Reproductive Physiology

Cell and Molecular Biology:

1. Albert, Watson and Others: Molecular Biology of the Cell
2. De Roberts: Molecular Biology and Genetics
3. Clang and Cummings: Concept of Genetics
4. Mason: Genetics on human perspective
5. Lodish Baltimore and others: Molecular cell Biology
6. De Robertis and De Robertis (Jr.): Cell and Molecular Biology

Microbiology:

1. Pelczar: Microbiology
2. R. Boyd: Microbiology
3. Panikar and others: Text book of Microbiology
4. Kumar, Cortran and Robbins: Basic Pathology
5. Mackie and McCortney: Practical Medical Microbiology

Biophysics and Statistics:

1. Lewis: Biostatistics
2. D. Das and A.Das: Biostatistics
3. D.Das: Biophysics and Biophysical Chemistry
4. Mahajan: Biological Statistics
5. Cambridge University Press: (student edition): Biological Statistics.

Nutrition and Dietetics:

1. M. Swaminathan: Principles of nutrition and dietetics.
2. M. Swaminathan: Advanced textbook of nutrition
3. Gillespie and Mc Neill: Health and Survival in India and developing countries.
4. Park and Park: Preventive and Social Medicine.
5. B. Srilakshmi : Food Science and Nutrition

Ergonomics

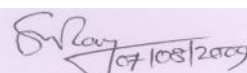
1. Varghese, Saha and Atreya: Ergonomic s
2. Murrel: Ergonomics
3. Grangean: Fitting task to the man

University of Kalyani

**Revised Syllabus for B.Sc.(General) Course in
PHYSIOLOGY**

(w.e.f. the session 2009-2010)

**According to the New Examination Pattern
Part – I, Part – II & Part – III**


Secretary, Faculty Councils (U.G.)
University of Kalyani
Kalyani, Nadia

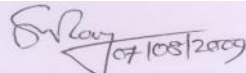
University of Kalyani

Revised Syllabus of Physiology General Course

(w.e.f. the session 2009-2010)

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Paper- IV	Theoretical	<i>(Page-G-6)</i>
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Secretary, Faculty Councils (U.G.)
University of Kalyani
Kalyani, Nadia

Distribution of Marks**PART – I**

PAPER – I

100 Marks**Total no. of Lectures required : 100L**

(1)	Importance of Physiology in Modern life		(2L)
(2)	Functional organization of human system		(3L)
(3)	Biophysical and Biochemical principles Involved in human systems.		(12L)
(4)	Conservation of matter and energy in human system		(28 L)
	a) Alimentation:	10L	
	b) Physiological Chemistry and metabolism	12L	
	c) Nutrition and Dietetics	6L	
(5)	The Blood and Body Fluids		(12L)
(6)	The Cardiovascular system		(18L)
	a) Heart	12L	
	b) Circulation	6L	
(7)	The Respiratory system		(13L)
(8)	Renal Physiology		(12L)

PART – II

PAPER - II

100 Marks**Total no. of Lectures required : 100L**

1.	Nerve muscle physiology	(18L)
2.	Nervous System	(20L)
3.	Sensory Physiology	(17L)
4.	The skin and body temperature	(5L)
5.	The Endocrine System	(25L)
6.	Reproductive Physiology	(15L)

PAPER –III (Practical)	<u>100 Marks</u>
a) Internal Assessment	30 Marks
(On the basis of student's performance in the practical classes)	
b) Practical	70 Marks
1. Histology	20 Marks
Haematological experiments and Fresh tissue experiments	
Study and identification of stained Section	
2. Physiological Chemistry	15Marks
Qualitative experiments	
Quantitative experiments	
3. Human Experiments	10 Marks
4. Experimental Physiology	10 Marks
5. Viva Voce	10 Marks
6. Laboratory Note book	5 Marks

PART – III

PAPER –IV 100 Marks

Paper –IV (A) Theoretical **60 Marks**
Total Lecture required: 64L

1. Application of Physiology	(2L)
2. Haematology	(10L)
3. Physiological Chemistry and Molecular biology	(10L)
4. Microbiological Immunology	(6L)
5. Social Physiology	(6L)
6. Exercise Physiology and Ergonomics	(8L)
7. Environmental Physiology	(10L)
8. Endocrinology	(6L)
9. The Nervous System and Special senses	(6L)

Paper –IV (B) Practical **40 Marks**

i) Internal Assessment	12 Marks
(On the basis of student's performance in the practical classes)	
ii) Practical	28 Marks
1. Haematology	8 Marks
2. Physiological Chemistry	8 Marks
3. Human Experiments	3 Marks
4. Field study report	3 Marks
5. Viva voce	3 Marks
6. Laboratory note book	3 Marks

PART - I**Paper I****100 Marks (Total – 100 L)**

1. Importance of Physiology in Modern life : Role of Physiology in modern life. Scope of physiology — improvement in health, nutrition, family planning and physical performance, and in the interaction between humans and environment. (2L)

2. Functional organization of human system : Homeostasis, feed back mechanism. Structure e function relationship of a cell and different tissues. (3L)

3. Biophysical and Biochemical principles Involved in human systems :

Physiological importance of the following processes: Diffusion, Osmosis, Dialysis, Ultracentrifugation, Surface tension, Adsorption and absorption.

A brief idea about Acids, Bases, pH, Indicators and buffers — definition, significance and maintenance of pH in the body.

Colloids — definition, classification and physiological importance.

Enzymes — definition, mechanism of action, factors affecting enzyme action. Concept of coenzymes and isozymes. (12L)

4. Conservation of matter and energy in human system : (Total Lecture–28L)

a) Alimentation: Structure in relation to functions of alimentary canal and digestive glands. Compositions, functions and regulation of secretion of digestive juices including bile. Digestion and absorption of food stuff. Movement of the stomach and small intestine. (10L)

b) Physiological chemistry and metabolism: Classification, chemistry and properties of carbohydrates, lipids, proteins and nucleic acids. Glycogenesis, glycogenolysis, glycolysis, gluconeogenesis, TCA cycle.

Oxidation of fatty acids, Formation and significance of ketone bodies. Deamination, transamination, Amino acid pool – fate and function of amino acids in the body. Synthesis of urea and its importance. (12L)

C) Nutrition and Dietetics: Basic constituents of food and their significance. Vitamins — definition, classification, functions, deficiency symptoms, daily requirements. Hypervitaminosis. Metabolism of calcium, phosphorus, iron and zinc. Basal metabolic rate – factors affecting, determination by Benedict– Roth apparatus. Respiratory quotient – definition, factors affecting, and significance. Biological value of proteins, Essential and non essential amino acids, Nitrogen equilibrium, minimum protein requirement, positive and negative nitrogen balance. Specific dynamic action: definition and importance. (6L)

5. The Blood and Body Fluids: Composition and functions of blood. Plasma proteins – origin and functions. Plasmapheresis. Bone marrow. Formed elements of blood — their formation, and functions. Hemoglobin — Different types of compounds and derivatives. Haematocrit and its importance. Blood volume and its determination (Dye and radioisotopic methods), regulation. Blood coagulation — mechanism, factors affecting, anticoagulants, disorders of coagulation. Lymph and tissue fluids — Composition, formation and functions. (12L)

6. **The Cardiovascular System:** (Total Lecture –18L)
- (a) **Heart** : Anatomy and histology of the heart, properties of cardiac muscle. Origin and propagation of the cardiac impulse. The cardiac cycle — Pressure and volume changes. Heart sounds, Cardiac output — measurement by application of Fick's principle and dye dilution method, factors affecting regulation. Heart sound. (12L)
- (b) **Circulation:** Structure of arteries, arterioles, capillaries, venules and veins, Pulse – arterial and venous, Blood pressure and its regulation and factors controlling. Methods for measurement of blood pressure. (6L)
7. **The Respiratory System:** Anatomy and histology of the respiratory tract and organs. Mechanism of breathing — role of respiratory muscles. Artificial respiration, Significance of physiological and anatomical dead space. Lung volumes and capacity. Exchange of respiratory gases between lung, blood and tissues. Transport of oxygen and carbondioxide in blood. Regulation of respiration — Neural and chemical, Hypoxia. (13L)
- (8) **Renal Physiology:** Relationship between structure and functions of kidney. Aquaporine. Mechanism of formation of urine. Physiology of urine storage, micturition. Renal regulation of acid base balance. Non-excretory functions of kidney. (12L)

PART-II

Paper II

100 Marks (Total – 100 L)

1. **Nerve muscle physiology:**

Microscopic and electron microscopic structures of striated, smooth and cardiac muscles. Red and white muscle. Properties of muscle— all or none law, summation, effects of repeated stimuli, tetanus, fatigue, refractory period. Mechanism of muscle contraction and relaxation. Excitation–contraction coupling. Isometric and isotonic contractions. Structure and classification of nerves. Propagation of nerve impulse. Conduction velocity of nerve impulse in relation to myelination and diameter of nerve fibres. Synapses –types, structure, synaptic transmission, neuromuscular junction– structure, transmission. Motor unit. Degeneration and regeneration in nerve fibres. (18L)

2. **Nervous System :**

Organization – A brief outline of the organization and basic functions: Structural organization of the different parts of brain and spinal cord, central and peripheral nervous system.
 Ascending tracts: for touch, temperature and kinesthetic sensations.
 Descending tract: pyramidal tract.
 Reflex action – definition, reflex arc, classification, properties. Functions of the spinal cord
 Outline of functions of brain stem. Structure, connections and functions of cerebellum. Nuclei, and functions of thalamus and hypothalamus. Cerebral cortex: histological structure, location and functions. CSF: formation, circulation and functions.
 Autonomic nervous system: a brief idea of organization, functions of parasympathetic and sympathetic nervous system. (20L)

3. Sensory Physiology:

Classification of general and special senses and their receptors. Muller's Law of specific nerve energies. Weber–Fechner law. Mechanism of transduction of stimuli from sensory receptors. Adaptation of receptors.

a. **Olfaction and Gustation:** Structure and function of receptor organs, nerve pathways, centers, mechanism of taste and smell sensation. After taste.

b. **Audition**– Structure of auditory apparatus– external, middle and internal ears. Organ of corti. Auditory pathway and centers. Mechanism of hearing. Pitch perception, perception of loudness.

c. **Vision:** Anatomy and structure of the eye. Histological details of retina. Visual pathway and centers, light reflex. Chemical and electrical changes in retina on exposure to light. Mechanism of accommodation. Errors of refraction. Positive and negative after-images. Light and dark adaptations. Colour vision and Colour blindness. (17L)

4. The Skin and Body Temperature Regulation :

Structure and functions of skin. Physiology of sweat secretion and its regulation. Insensible perspiration. Regulation of body temperature in human – its physical and physiological processes. (5L)

5. The Endocrine System:

Anatomy of endocrine system. Hormones – classification. Basic concept of regulation of hormone actions, positive and negative feedback mechanism. Elementary idea of hormone action.

Pituitary: Histological structure, hormones, functions. Hypothalamic control of anterior and posterior pituitary. Hypo and hyperactive status of pituitary gland.

Thyroid: Histological structure and functions of thyroid hormones. Thyrocalcitonin. Hypo - and hyper active states of thyroid.

Parathyroid: Histological structure and functions of parathyroid hormone.

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.

Pancreas: Histology of the islets of Langerhans. Origin and functions of pancreatic hormones. Diabetes mellitus.

Brief idea of the origin and functions of renin -angiotensin, prostaglandins, erythropoietin and melatonin. Elementary idea of gastrointestinal hormones. (25L)

6. Reproductive Physiology :

Primary and secondary sex organs and secondary sex characters. Histology of testis. Spermatogenesis. Testicular hormones and their functions. Histology of ovary. Ovarian hormones and their functions. Oogenesis. Estrous cycle and Menstrual cycle and their hormonal regulation. Pregnancy: fertilization, structure and functions of placenta. Development of mammary gland and lactation. (15L)

Paper III (PRACTICAL)**100 Marks****Internal assessment - 30 marks****Practical examination - 70 marks****(1) Histology:****20 Marks**

Haematological experiments: Preparation and staining of blood film with Leishman's stain. Identification of blood corpuscles. Preparation of haemin crystals.

Fresh tissue experiment: Suitable staining and examination of fresh tissues – squamous, cornified, ciliated and columnar epithelium, skeletal and cardiac muscle tissues, areolar tissue by methylene blue. Silver nitrate preparation for nodes of Ranvier and mesentery for cell spaces. (10 M)

Study and identification of stained sections of different mammalian tissues and organs : Bone, trachea, lung, spleen, lymph gland, esophagus, stomach, small intestine, large intestine, liver, kidney, salivary glands, pancreas, adrenal gland, thyroid gland, testis, ovary, spinal cord, cerebral cortex, cerebellum, skin, tongue. (10 M)

(2) **Physiological chemistry :** **15 Marks**

Qualitative experiments: Tests and identification of carbohydrates, glycerol, acetone, proteins, urea, uric acid, HCl, lactic acid, bile salts, bile pigments, blood. (5M)

Quantitative experiments: Estimation of glucose and sucrose in aqueous solution by Benedict's method. Estimation of ammonia and amino nitrogen (Sorensen's formol titration method). (10 M)

(3) **Human Experiment:** **10 Marks**

Measurement of systolic and diastolic arterial pressure by sphygmomanometer and determination of pulse pressure and mean pressure during rest and exercise.

(4) **Experimental Physiology:** **10 Marks**

Normal tracing of unperfused heart beat of toad. Effect of temperature on unperfused toad's heart.

(5) **Viva voce :** **10 Marks**

(6) **Laboratory Note Books :** **5 Marks**

PART III

Paper IV : A (Theoretical)

60 Marks

Total Lecturer-64L

1. Application of Physiology: Brief idea of the application of physiology in different fields –Hematology, Biochemistry, Molecular biology, Microbiology, Immunology, Social physiology, Work physiology, Environmental physiology. (2 L)

2.Haematology: Blood groups — ABO system and Rh factors. Blood transfusion. Immunological basis of identification of ABO and Rh blood groups. Function of haemoglobin. Abnormal hemoglobin. Sickle cell anemia, Thalassaemia. Definition, determination and significances of TC, DC, Erythrocyte sedimentation rate (ESR), Arneht count, Haematocrit. PCV, MCV, MHC, MCHC, bleeding time, clotting time and prothrombin time. Anemia — types (definition and causes). Leucocytosis, Leucopenia and leukemia. Purpura. (10L)

3. Physiological Chemistry and Molecular Biology: Lipoproteins — types and functions. Structure of DNA and RNA, Brief idea of gene, genetic engineering and its applications in biol ogical sciences. Pathological significances of the following blood constituents: glucose, urea, creatinine, uric acid, cholesterol, bilirubin, SGPT and SGOT, alkaline and acid phosphatase and ketone bodies. (10 L)

4. Microbiology and Immunology: Bacteria — Prokaryotic cell. Classification of bacteria on the basis of morphology and staining characteristics — gram staining and acid fast staining. Pathogenic and non-pathogenic bacteria — definition with a few examples. Sterilization and pasteurization. Elementary idea about antibiotics.

Virus— DNA virus and RNA virus. Bacteriophage. Viral diseases — Elementary idea of Immune system—Innate and Acquired. Humoral and cell mediated immunity. Vaccination — basic principles and importance of immunization. (6L)

5. Social Physiology: Composition and nutritional value of common Indian foodstuffs — rice, wheat, pulses, egg, meat, fish and milk. Dietary fibers. Calorie requirement. Concept of ACU. Principles of formulation of balanced diets for growing child, adult man and woman, pregnant and lactating woman. Diet management of obese, diabetic, hypertensive person and athlete. Diet survey. Malnutrition and its causes — PCM, marasmus, kwashiorkor — their prevention. Iron and iodine deficiency. (6L)

6. Exercise Physiology and Ergonomics: Cardiovascular and respiratory response during exercise. Isometric and Isotonic muscle contraction, static and dynamic work, Aerobic power and Anaerobic power. Physical fitness Index. Role of Ergonomics in daily life. Evaluation of work Load and work environment. (8L)

7. Environmental Physiology: Concept of human environment: Definition, types, component, Physical environment — air, water, soil. Ecosystem: food chain and concept of biomagnification, Air, water and noise pollution: causes, effects and mitigation, concept of ozone hole and global warming, Health hazards of food adulterants and pesticides, Birth defects. (10L)

8. Endocrinology: Concept of neurosecretion. Hypothalamus as a neuroendocrine organ. Hypothalamic control of anterior and posterior pituitary — releasing hormones. Role of pituitary in the regulation of endocrine functions. Atrial natriuretic factors. Gastrointestinal hormones. (6L)

9. The Nervous system and special senses: The brief idea about learning, memory, speech, EEG, sleep and pain. Visual field — perimetry. Visual acuity and its determination by Snellen's Chart. (6L)

Paper IV : B (Practical)

40 Marks

i) Internal Assessment

12 Marks

(On the basis of student's performance in the practical classes)

ii) Practical

28 Marks

1. Haematology : Total count of RBC and WBC. Differential Count of WBC, estimation of hemoglobin, blood group determination, bleeding time and coagulation time. (8 Marks)

2. Physiological chemistry: Identification of normal constituents of urine — Chloride, sulphate, phosphate, creatinine, and urea. Identification of abnormal constituents of urine — glucose, acetone, protein, blood and bile salts. (8 Marks)

3. Human experiments: a) Determination of physical fitness index by Harvard step test and graphical plotting of the changes in pulse and respiratory rate till recovery.

b) Measurement of Blood pressure

c) Measurement of some anthropometric parameters — stature, Weight, BMI, eye height, shoulder height, eye height (sitting), elbow height, sitting height, elbow rest height (sitting), knee height (sitting). **(3Marks)**

4. Field study report ; Diet Survey and Field Study Record : (3 Marks)

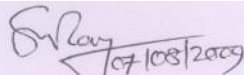
Diet survey of family as per ICMR specification. **Or** Population study of physiological parameters such as height, weight, BMI, heart rate, blood pressure, respiratory rate, PFI, TC of RBC, Estimation of Haemoglobin, DC of WBC as far as practicable.

5. Viva voce (3 Marks)

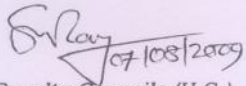
6. Laboratory notebook (3 Marks)

RECOMMENDED TEXT AND REFERENCE BOOKS FOR GENERAL STUDENT

1. Jogen Debnath : Physiology
2. A.C. Guyton and Hall: Pocket book medical Physiology
3. Harris: Experimental Physiology
4. De Flore: Atlas of Human Physiology
5. Rogers: Comparative physiology
6. Best and Taylor's: Physiological basis of medical Practice
7. J.N.Mills : Biological aspects of circadian rhythm
8. Bell, Davidson and Scarborough: Textbook of Physiology and Biochemistry.
9. C.C. Chatterjee: Human Physiology.
10. Stuart Era Fox: Human Physiology
11. Tortora and Grabowski: Principles of Anatomy and Physiology.
12. Falls: Exercise Physiology
13. McArdle, Katch and Katch : Exercise Physiology
14. LG Shaver: Essential of exercise Physiology
15. DK Matthews and EL Fox: Physiological basis of Physical Education and athletics.
16. West and Todd: Text book of biochemistry
17. Lehninger: Biochemistry
18. Hawk's Physiological Chemistry
19. L.Stryer: Biochemistry
20. D. Das: Biochemistry
21. Jackson and Jackson: Environmental Science
22. G. Paul: Paribesh O Dushan (in Bengali)
23. M. Aurora: Biological control of Environmental pollution.
24. Bloom and Fawcett: Text of Histology
25. Pearse: Histochemistry
26. De Fiore: Atlas of Human Histology
27. Keelson and Leeson: Text book of Histology
28. Ivan Roitt: Essential Immunology
29. Kubey: Immunology
30. Turner: Endocrinology
31. Williams: Endocrinology
32. Griffith: Endocrinology


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33. De Groot: Endocrinology
34. Knobil: Reproductive Physiology
35. Albert, Watson and Others: Molecular Biology of the Cell
36. De Robertis: Molecular Biology and Genetics
37. Clang and Cummings: Concept of Genetics
38. Mason: Genetics on human perspective
39. De Robertis and De Robertis (Jr.): Cell and Molecular Biology
40. Pelczar: Microbiology
41. R. Boyd: Microbiology
42. Panikar and others: Text book of Microbiology
43. Kumar , Cortran and Robbins : Basic Pathology
44. Das and A.Das : Biostatistics
45. D.Das : Biophysics and Biophysical Chemistry
46. Mahajan: Biological Statistics
47. M. Swaminathan: Principles of nutrition and dietetics.
48. Park and Park: Preventive and Social Medicine.
49. B. Srilakshmi: Food Science and Dietetics



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