UNIVERSITY OF CALCUTTA

Notification No. CSR/25/2025

It is notified for information of all concerned that in terms of the provisions of Section 54 of the Calcutta University Act, 1979, (as amended), and, in the exercise of her powers under 9(6) of the said Act, the Vice-Chancellor has, by an order dated 13.05.2025 approved the new revised Course structure and Syllabus (semester-1 to 6) of Physiology, after incorporating some amendments under CCF.

The above shall take effect from the Even semester examinations, 2025 and onwards.

21/5/2025

SENATE HOUSE
Kolkata-700073
21.05.2025

Prof.(Dr.) Debasis Das
Registrar

CURRICULUM FRAMEWORK FOR UNDERGRADUATE PROGRAMME

IN

PHYSIOLOGY

SYLLABUS

(SEMESTER-I TO SEMESTER-VI)

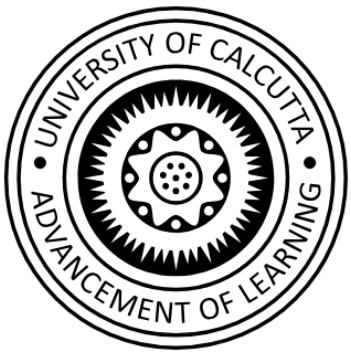
FOR STUDENTS OF FIRST BATCH (2023-24) & SECOND BATCH (2024-25)

OF 4 YEARS HONOURS/HONOURS WITH RESEARCH

AND

3 YEARS MDC COURSES IN PHYSIOLOGY

(Under Curriculum & Credit framework, NEP)



UNIVERSITY OF CALCUTTA

IMPORTANT CLARIFICATIONS

1. This Syllabus is applicable for all the batches of students studying 4 years Honours/Honours with Research course in Physiology i.e., **Batch I (Academic session: 2023-24)**&**Batch II (Academic session: 2024-25)** and similar batches of 3 years MDC courses in Physiology under CCF, 2022.

2. Syllabus for Major and Minor papers, including MDC, have been introduced separately in the syllabus.

3. Also the Supplementary candidates of these two batches will follow the Subsidiary Syllabus henceforth.

Programme Specific Objectives

The primary objective of the course is to know the 'Human Body' as the most resourceful creation of the nature. It basically focuses on the structural and functional inter-relationship of different systems, their molecular integration, actions and reactions under different internal and external factors and conditions, the remedies including the modern concepts and technologies to combat any biomedical threat on man and mankind.

Outcome of the Programme

1. Units of a Physiological system and its molecules, Contributions of Physiologists. Inter-communications within human system, Basic internal Modulators and Parametric control system.
2. Fluid tissues, Fluid Connectivity, Effects of fluid pumping system, and Basic operating systems of life and their functioning
3. Supply and Requirements of Essentials from outside and their effects.
4. Technology for recording, screening, and estimating the different aspects of the Physiological system.
5. Human genome and all molecular basics along with specific biomolecular contributions required for physiological system development.
6. Pathogens and environments as affecting human health and its manifestations: their trends and interference in deadly diseases and possible remedial measures.
7. The ergonomic aspects and issues related to human and its system.
8. Yoga for holistic upkeeping of both neuronal and physical health. Sports and exercise physiological aspects for future development of physical ability with in-depth scientific inputs inclusive for society.
9. Advanced technologies, instruments and methodologies for identification, stage differentiation, determination of different chronic, acute, and critical diseases.
10. A vision towards the modern approach of the subject for advancement of research and future orientation for the long-term benefit of the society.

BASIC STRUCTURAL FRAMEWORK OF THE SUBSIDIARY SYLLABUS

4-Year B. Sc. (Honours and Honours with Research) Courses of Studies

PHYSIOLOGY MAJOR

(1 CREDIT=25 MARKS)

SEM	COURSE CODE	COURSE NAME	CREDITS		
			THEORY	PRACTICAL	TOTAL
I	PHYM DSCC-1 TH/P	History of Physiology, Cellular Physiology & Biochemistry	03	01	04
	PHYM SEC-I TH/P	Clinical Importance of Biomolecules, Microscopy, Analytical Techniques, Work & Exercise Physiology	02	02	04
II	PHYM DSCC-2 TH/P	Cell Signalling, Biophysics, Enzymes, Basic Genetics, & Haematology-I.	03	01	04
	PHYM SEC-II TH/P	Clinical Haematology, Ergonomics and Histology	02	02	04
III	PHYM DSCC 3 TH/P	Cardio-Respiratory Physiology, Alimentation, Haematology-II and Biostatistics-I.	03	01	04
	PHYM DSCC 4 TH/P	Nerve-Muscle Physiology-I, Nervous system-I and Special Sense.	03	01	04
	PHYM SEC-III TH/P	Community Health, Clinical Biochemistry, and Computer application.	02	02	04
IV	PHYM DSCC 5 TH/P	Metabolism and Nutrition	03	01	04
	PHYM DSCC 6 TH/P	Nerve-Muscle Physiology-II, Nervous System-II & Molecular Neurobiology.	03	01	04
	PHYM DSCC 7 TH/P	Physiology of Excretion, Altered Environment & Biostatistics-II	03	01	04
	PHYM DSCC 8 TH/P	Molecular Biology, Cancer Biology, Instrumentation and Methodology.	03	01	04
V	PHYM DSCC 9 TH/P	Endocrinology	03	01	04
	PHYM DSCC 10 TH/P	Reproductive Physiology, Developmental Biology, and Human evolution.	03	01	04
	PHYM DSCC 11 TH/P	Chronobiology, Stress Physiology & Occupational Health.	03	01	04
	PHYM DSCC 12 TH/P	Microbiology & Immunology	03	01	04
VI	PHYM DSCC 13 TH/P	Epidemiology, Dietetics and Therapeutic Nutrition	03	01	04
	PHYM DSCC 14 TH/P	Biotechnology & Bioinformatics	03	01	04
	PHYM DSCC 15 TH/P	Physiology of Yoga, Aging, Space Biology & Forensic Biology	03	01	04

MINOR COURSE PAPERS (for 4 yrs. Minors)

SEM	COURSE CODE	COURSE NAME
I OR III	MPHY MN1 TH/P	History of Physiology, Cellular Physiology & Biochemistry (Same as MDC CC1)
II OR IV	MPHY MN2 TH/P	Cell Signalling, Biophysics, Enzymes, Basic Genetics, & Haematology-I (Same as MDC CC2)
V	MPHY MN3 TH/P	Cardio-respiratory Physiology, Digestion, Haematology-II, and Biostatistics (Same as MDC CC3)
VI	MPHY MN4 TH/P	Metabolism and Nutrition (Same as MDC CC4)

MDC COURSE PAPERS (FOR 3 YRS. MDC COURSES)

SEM	Course Paper for MDC CC1	Course paper for MDC CC2	Course paper for MDC MINOR
I	MDC CC1 History of Physiology, Cellular Physiology & Biochemistry	MDC CC1 History of Physiology, Cellular Physiology & Biochemistry	NA
II	MDC CC2 Cell Signalling, Biophysics, Enzymes, Basic Genetics, & Haematology-I	MDC CC2 Cell Signalling, Biophysics, Enzymes, Basic Genetics, & Haematology-I	NA
III	MDC CC3 Cardio-Respiratory Physiology, Digestion, Hematology-II, and Biostatistics-I	MDC CC3 Cardio-Respiratory Physiology, Digestion, Hematology-II, and Biostatistics-I.	MDC MN-1 (Sameas MDC CC1) History of Physiology, Cellular Physiology & Biochemistry
IV	MDC CC4 Metabolism and Nutrition	MDC CC4 Metabolism and Nutrition	MDC MN-2 (Same as MDC CC2) Cell Signalling, Biophysics, Enzymes, Basic Genetics, & Haematology-I
	MDC CC5 Excretory Physiology, Skin & Body Temperature, Nerve-Muscle Physiology, Nervous System, and Special Senses	MDC CC5 Excretory Physiology, Skin & Body Temperature, Nerve-Muscle Physiology, Nervous System, and Special Senses	NA
V	MDC CC6 Endocrinology	MDC CC6 Endocrinology	MDC MN-3. (Sameas MDC CC3) Cardio-Respiratory Physiology, Digestion, Hematology-II, and Biostatistics-I.
	MDC CC7 Reproductive Physiology, Developmental Biology, and Environmental Biology	NA	MDC MN-4. (Sameas MDC CC4) Metabolism and Nutrition
VI	MDC CC8 Epidemiology, Microbiology, Immunology, Dietetics, and Food Additives & Adulterants	MDC CC7 Reproductive Physiology, Developmental Biology, and Environmental Biology	MDC MN- 5 (Same as MDC CC6) Endocrinology
	NA	MDC CC8 Epidemiology, Microbiology, Immunology, Dietetics, and Food Additives & Adulterants	MDC MN 6 (Sameas MDC CC8) Epidemiology, Microbiology, Immunology, Dietetics, and Food Additives & Adulterants

DETAILED SYLLABUS

PHYSIOLOGY HONOURS (MAJOR)

SEMESTER-I

PAPER: DSCC-1

(History of Physiology, Cellular Physiology & Biochemistry)

DSCC-1 THEORY (3 CREDITS; 75 MARKS)

Unit - I: History of Physiology:

Origin of Physiology as Biomedical Science from ancient times: Contributions of Hippocrates, Jean Francois Fernel, William Harvey, Claude Bernard, Ivan Petrovich Pavlov, Charles S. Sherrington, Subodh Chandra Mahalanabis, Narendra Mohan Basu, Sacchidananda Banerjee, and Autar Singh Paintal.

Unit – II: Structural organization of Human Body: Cell and Tissues:

Electron microscopic structure and functions of eukaryotic nucleus, endoplasmic reticulum, Golgi bodies, ribosome, mitochondria, lysosomes, peroxisomes, cytoskeletal elements, centrosomes, and plasma membrane. Cellular transport: simple diffusion, facilitated diffusion, active transport (primary and secondary), ion pumps, ion channels and ionophores, Tight junctions, gap junctions and anchoring junctions. Cell adhesion molecules. Basic concepts of mammalian tissue: epithelial connective, muscular and nervous tissue.

Unit – III: Chemistry of Biomolecules – I:

Carbohydrates: Definition and classification. Monosaccharides – Classification, structure, stereoisomerism, optical isomerism, pyranose and furanose, anomerism, mutarotation and its mechanism. Chemical reactions of monosaccharides (Glucose): reactions with concentrated mineral acids, alkali, phenyl hydrazine and their biochemical importance. Derivatives of monosaccharides -Amino sugars, deoxy sugars, sugar alcohols, sugar acids, sugar esters, their biochemical and physiological importance. Disaccharides – Maltose, Lactose and Sucrose: structure, occurrence, and physiological importance. Polysaccharides – starch, glycogen, dextrin, cellulose, glycosaminoglycans, glycoproteins, sialic acids.

Unit – IV: Chemistry of Biomolecules – II:

Lipids: Definition and classification. Fatty acids - classification, systemic nomenclature (IUPAC & OMEGA), and structure. Mono-, Di- and Triglycerides. Properties of Fat and Fatty acids: hydrolysis, saponification number, iodine number, acetyl number, acid number and Reichert-Meissl number. Cis-trans isomerism. Eicosanoids, Phospholipids, Glycolipids, Sphingolipids, Steroids and Cholesterol, its ester -their structure and physiological importance. Lipoproteins - Structure and classification. Concept of micelle, bilayer, and liposome.

Unit – V: Chemistry of Biomolecules - III

Amino acids: classification, structure, nomenclature, and optical properties. Protonic equilibria of amino acids – Zwitterions, Isoelectric point. Titration curve of amino acids. Reactions with ninhydrin and formaldehyde. Peptides and Proteins: Structure and properties of peptide bonds – Phi and Psi angles. Reactions with Sanger's and Edman's reagent. Biuret reaction. Different levels of protein structure: Primary, Secondary (α-helix and β-pleated sheet), Tertiary and Quaternary. Forces stabilizing the structures. Denaturation and Renaturation of protein.

Purine and Pyrimidine bases: Structure, nomenclature and tautomerism. Nucleic acids: Nucleosides and Nucleotides. DNA double helix, Primary, Secondary: A-DNA, B-DNA and Z-DNA. RNA - Structure, types, features. Denaturation and annealing of DNA. Hyperchromicity, melting temperature and half Cot value.

DSCC 1 PRACTICAL (1 CREDIT; 25 MARKS)

1. Examination and staining of fresh tissues: Squamous, Ciliated and Columnar Epithelium by Methylene Blue stain.
2. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, Lactic Acid, Uric Acid, Albumin, Gelatin, Peptone, Starch, Dextrin, Glucose, Fructose, Lactose, Sucrose, Urea, Acetone, Glycerol and Bile salts.

Distribution of Questions:

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER- SEC-I

(Clinical Importance of Biomolecules, Microscopy, Analytical Techniques, Work & Exercise Physiology)

SEC -I THEORY (2 CREDITS: 50 MARKS)

Unit – I: Clinical importance of Biomolecules

Carbohydrates: Estimation of blood glucose. Glycosuria, Oral glucose tolerance test, Hyper & Hypoglycaemia, Lipids: estimation of blood lipid profile, hypercholesterolemia, hyperlipoproteinemia, atherosclerosis. Proteins: estimation of serum albumin, hypoalbuminemia, hypo-proteinemia. Bence Jones proteins.

Unit – II: Methods of Cell study: Microscopy

Principles of construction and uses of compound microscope, phase contrast microscope, polarizing microscope, fluorescence microscope, transmission & scanning electron microscope. Concept of numerical aperture and resolution.

Unit – III: Common Analytical techniques

Chromatography and centrifugation: Principles and uses of paper chromatography, thin layer chromatography, size exclusion chromatography, affinity chromatography, ion exchange chromatography. Electrophoresis: principle, method and uses of agarose gel electrophoresis, SDS-PAGE, Principles of centrifugation, ultracentrifugation: and density-gradient ultracentrifugation.

Unit IV: Work and Exercise Physiology-I

Fundamental concepts of work- different categories of work. Physical work, its definition and nature—isotonic, isometric, isokinetic, positive, and negative work. Concept of physiological work. Power and capacity relation. Work load – light, moderate (submaximal) and heavy (maximal) depending on intensity and duration of work. Study of changes in heart rate, oxygen consumption and blood pressure to assess person's ability to withstand work load.

Unit-V: Work and Exercise Physiology-II

Concept of energetics: work, power, and energy. Sources of energy and energy demand for different activities. Determination of energy cost at rest, work, and fatigue by direct and indirect methods. Aerobic and anaerobic capacity. Athletic performance based on aerobic and anaerobic capacity. EPOC, lactate threshold and lactate tolerance. Brief idea about nutritional aspects of sports.

SEC-I PRACTICAL (2 CREDIT, 50 MARKS)

1. Concept of molecular weight, equivalent weight, molarity normality, primary and secondary standard.
2. Determination of strength of the supplied NaOH solution by titrating against N/10 oxalic acid.
3. Determination of BMI, BSA, PI, and waist hip ratio.
4. Determination of physical fitness by modified Harvard Step Test.

Distribution of Questions*:*

1. SEC Theory: One question of 10 marks from each unit with one alternative to be set. The 10 marks question may be subdivided (Maximum marks not to exceed 5).
2. SEC Practical: Experiments: 30 (Minimum 2 experiments to be set), Viva-voce-10, Laboratory Note Book:10.

SEMESTER-II

PAPER: DSCC-2

(Cell Signalling, Biophysics, Enzymes, Basic Genetics, & Haematology-I)

DSCC-2: THEORY (3 CREDITS; 75 MARKS)

Unit I:Cell Signaling

Definition, Types (Autocrine, Endocrine, Paracrine, and Juxtacrine), Stages of signaling (Reception, Transduction & Response): Cell surface receptor: Ion-channel, G-protein, and Enzyme-coupled receptors. Intracellular messengers—cAMP, cGMP, IP3, DAG, Protein kinases, Calcium, Carbon monoxide, Nitric oxide. Signal transduction pathways: Phosphatidyl-inositide, MAP Kinase, JAK-STAT, Raf-Ras & SMAD.

Unit II: Biophysics and Biophysical Principles

Diffusion: Fick's law & physiological applications. Osmosis: Osmotic pressure, laws, physiological applications. Basic concepts of Osmolarity and Tonicity. Surface tension, Viscosity, and Adsorption: physiological applications. Proteolysis of water: Hydrogen ion concentration & pH, their physiological significance. Determination of pH. Buffers: Henderson-Hasselbalch equation (simple quantitative problems). Physiological buffers. Colloids: classification and properties: optical, electrical & electrokinetic, physiological application. Gibbs-Donnan membrane equilibrium: physiological significance. Thermodynamics: type of surroundings and systems. First law- Internal energy, Enthalpy. Second law- Entropy, Free energy change. Endergonic and Exergonic reactions. Reversible and Irreversible processes, Equilibrium constant, Physiological steady-state. Living body as a thermodynamic system.

Unit III: Enzyme:

Definition, Chemical nature of enzymes. Ribozymes and Abzyme. EC classification. Concept of Apoenzyme, Holoenzyme, Coenzyme, Cofactors, and Prosthetic group. Metals in enzyme activity. Enzyme-substrate complex—Transition state theory, Active site, Binding site, Fischer's Lock and Key model & Koshland

Induced Fit model of ES interaction. Specificity of enzyme. Single-substrate Michaelis-Menten Kinetics of Enzymes—Initial velocity (V_0), Maximum velocity (V_{max}). Steady-state kinetics and their significance. Derivation of Michaelis-Menten Equation and its linear transformation: Lineweaver-Burk Plot, Eadie-Hofstee plot and Wolf-Hanes plot and their merits & demerits. Characteristics of Michaelis Constant (K_m). Factors influencing enzyme-catalyzed reactions: Substrate concentration, Enzyme concentration, pH,and Temperature & Q_{10} value. Enzyme inhibitions: basic concepts-reversible, irreversible, competitive, noncompetitive and mixed. Regulation of enzyme activities: covalent modifications. Allosteric modification- Sigmoid kinetics and Hill equation. K & M series of enzymes. Feedback inhibition. Rate limiting enzymes and its features. Isozymes.

Unit IV: Basic Genetics & Molecular Biology:

Basic concepts of Mendelian Genetics. Laws of inheritance. Chromosome: structure and classification, Crossing over, linkage and recombination, Chromosomal Mutations. Chromosomal DNA packaging-nucleosomes and higher levels of organization of chromatin. Euchromatin and heterochromatin. Human genome and its characteristics (basic concept). Nuclear & Mitochondrial DNA. Epistasis, Penetrance, Expressivity, Pleiotropism. Karyotyping. Molecular Biology: Central dogma. DNA Replication, transcription, and translation in prokaryotes: concept of operon (lac operon).

Unit V: Hematology-I

Bone marrow: types.Formed elements of blood: origin, functions, and fate. Haematopoiesis: Erythropoiesis & its regulation: role of Erythropoietin, vitamins, and other factors. Leucopoiesis, Thrombopoiesis. Plasma proteins: composition, normal values, origin, and functions. Plasmapheresis. Haemoglobin-structure, biosynthesis, compounds, derived products, and catabolism. Foetal haemoglobin. Abnormal haemoglobins. Blood volume and haematocrit. Blood groups: ABO & Rh system. Immunological basis of identification.

DSCC-2 PRACTICAL (1 CREDIT, 25 MARKS)

1. Blood film: Preparation of blood smear, staining and identification of blood cells.
2. Estimation of Haemoglobin by Drabkin's method.
3. Preparation of phosphate buffer using Henderson-Hasselbalch equation.
4. Pedigree analysis for blood group & colour blindness.
5. Histological Slides- (Hyaline Cartilage, Lung, Artery, Vein, Lymph Gland, Spleen, Thyroid, Testis, Ovary, Uterus).

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: SEC-II

(Clinical Haematology, Ergonomics and Histology)

SEC-II THEORY (2 CREDITS, 50 MARKS)

Unit I: Clinical Hematology:

Blood transfusion- Procedure, precaution, and hazards. Concept of blood bank. Definition and pathophysiological significance of TC, DC, Arneth count, PCV, MCV, MCH, MCHC, ESR, Bleeding time, Clotting time, and Prothrombin time. Concept of complete haematogram. Anaemia & Its classification. Pathophysiological significance of Erythrocytosis, Leucocytosis, Leukaemia, Leukopenia and Purpura. Automated hematoanalyzer. Coulter principle and application.

Unit II: Basic Ergonomics

Introduction to Ergonomics& brief history. Multidisciplinary approach to Ergonomics Definition and scope of Ergonomics. Classification of Ergonomics. Introduction to man machine -environment interaction. Ergonomic assessment of workplace: Light, temperature and Noise. Brief concept of manual material handling.

Unit III: Anthropometry & Designing:

Definition of anthropometry. Static, Dynamic and Newtonian. Common terminologies used in anthropometry. Different body dimensions measured in anthropometry and their applications. Basic concepts of reach, clearance, posture, range of motion. Concept of percentile and its calculation and use of percentile values in anthropometry. Application of anthropometric datain designing**:** Chair and Helmet designing.

Unit IV: Histological Techniques:

Tissue fixation: objectives, methods. Fixatives: types, composition, and chemistry of fixation. Physical methods: freezing and microwave fixation. Choice of fixatives, Fixation artifacts, Different methods of decalcification and their effects on staining, Microtomy: working principle and use of various types of microtomes, preparation of thin section, step section, and serial section.

Unit V: Theory of Staining:

Theory and practice of staining. Dyes and stains in Histology: types,principle, procedure, and importance of different staining techniques: Progressive, Regressive, Vital, and Supravital. Staining methods: Haematoxylin-Eosin, Romanowski stain e.g., Leishman, PAS, Sudan III & IV, Methylene Blue, Silver nitrate. Recognition of artifacts in section.

SEC-II Practical (2 CREDIT, 50 MARKS)

1. Haematological Experiments: TC, DC, Clotting time, and Bleeding time.
2. Determination of WBGT index.
3. Assessment of illumination.
4. Measurement of some common anthropometric parameters: stature, eye height, shoulder height, elbow height-standing and sitting, sitting height, knee height, shoulder elbow length, arm reach from the wall, Head circumference, neck circumference, and mid upper arm circumference.
5. Haematoxylin-Eosin staining of supplied tissue sections: Liver, testis, and thyroid gland.

Distribution of Questions*:*

1. SEC Theory: One question of 10 marks from each unit with one alternative to be set. The 10 marks question may be subdivided (Maximum marks not to exceed 5).
2. SEC Practical: Experiments: 30 (Minimum 2 experiments to be set), Viva-voce-10, Laboratory Note Book:10.

SEMESTER-III

PAPER: DSCC 3

(Cardio-Respiratory Physiology, Alimentation, Haematology-II, and Biostatistics-I)

DSCC 3 THEORY: (3 CREDIT; 75 MARKS)

Unit-I: Cardiovascular System

Anatomy of the heart and blood vessels. Properties of cardiac muscle. Origin and propagation of cardiac impulse. Stannius ligature. Heart sounds, Pulse: arterial and venous. Cardiac cycle: events, pressure and volume changes, Cardiac Output: measurement by application of Fick's principle and dye dilution method, factors affecting cardiac output. Starling's law of heart. Electrocardiography: concept of normal ECG, electrocardiographic leads, mean electrical axis of heart. Blood pressure: measurement and factors affecting. Concept of hypertension and hypotension. Hemodynamics of blood flow, Poiseuille's Law, Reynolds Number. Coronary Circulation: anatomy and peculiarities. Basic concept of Micro-circulation.

Unit-II: Respiratory System

Anatomy and histology of the lung and airways, Mechanics of breathing: role of respiratory muscles. Mechanism of pulmonary ventilation, alveolar ventilation. Lung compliance. Pressure-volume relationship, Alveolar surface tension and surfactant, Work of breathing. Transport of gases in body: Oxygen dissociation curve of adult & foetal hemoglobin, and myoglobin – factors affecting. Carbon dioxide dissociation curve. Pulmonary Circulation: anatomy & peculiarities, Ventilation- perfusion ratio. Lung function tests. Spirometry: Definition, uses in the measurement of lung volumes and lung capacities. Dead space. Non-respiratory functions of lung.

Unit-III: Alimentary System

Gross anatomy and histology of GI tract. Digestive glands: Salivary glands, Pancreas, Liver- histological structures. Composition, functions, and regulation of salivary, gastric, pancreatic, hepato-biliary, and intestinal secretion. Deglutition and movements of the alimentary canal and its mechanism. BER. Enteric brain. Defecation. Concept of Gut Microbiome, Eubiosis and Dysbiosis, Probiotics and Prebiotics. GALT. Digestion and absorption of carbohydrates, proteins, lipids. Postprandial alkaline tide. Enterohepatic circulation. Basic concepts of Peptic Ulcer, Jaundice, Gallstones and Pancreatitis.

Unit-IV: Haematology -II

Introduction to Body Fluids. Composition and function of: blood, lymph, cerebrospinal fluid, synovial fluid. Formation and Function of: pleural, peritoneal, and pericardial fluids. Plasma and Serum: differences and clinical Importance Hemostasis: definition, stages & purpose. Coagulation- mechanism,coagulation factors and pathways.Pro and anticoagulants. Coagulopathy: hypercoagulation, hypocoagulation, acquired and inherited bleeding and clotting disorders (DIC, Vitamin K deficiency bleeding, haemophilia, Von Willebrand disease). Fibrinolysis: Fibrinogen degradation product and D-Dimer. Thrombolytic agents.

Unit-V: Biostatistics-I:

Definition, Scope, and Applications of Biostatistics. Scales of Measurement: Nominal, Ordinal, Interval, and Ratio. Types of Variables: Qualitative and Quantitative. Sample and population. Sampling techniques. Organisation of data: class, class intervals, class limits. Presentation of Data: tabulation, graphsand Diagrams (pie diagram, bar/column plot, frequency polygon, histogram, scatterplot). *Measures of central tendency & distribution:*mean, median, mode. Measures of Dispersion: range, variance, standard deviation, coefficient of variation, percentile. Skewness and kurtosis. Standard error and standard score, (z score

and t score). Degree of freedom. Basic Concepts of probability. Probability Distributions: Normal and t-Distributions.

DSCC 3 PRACTICAL (1 CREDIT, 25 MARKS)

1. Determination of BP and calculation of mean arterial pressure and pulse pressure.
2. Determination of Peak Expiratory Flow Rate using Peak flow meter.
3. Pneumographic recording of normal chestmovements and effects of hyperventilation and breath holding.
4. Determination of acidity of supplied gastric juice.
5. Identification of permanent histological slides (tongue, oesophagus, stomach, duodenum, jejunum, ileum, large intestine, parotid, submandibular, sublingual salivary glands, liver, and pancreas).
6. Biostatistics practical- Data tabulation, Calculation of mean, median, mode, standard deviation, and standard error from ungrouped data. Construction of Frequency polygon & Histogram from given dataset.

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: DSCC-4

(Nerve-Muscle Physiology, Nervous System and Special Senses)

DSCC 4 THEORY: (3 CREDITS; 75 MARKS)

Unit-I: Nerve Physiology I

Neurons, Neuroglial cells, and Nerves: Classification, structures, and functions, Myelinogenesis, Axoplasmic transport: anterograde and retrograde-roles of microfilaments, intermediate filaments, and microtubules), Basic concepts of voltage gated ion channels: sodium channels, potassium channels, Calcium channels, chloride channels.Properties of nerve fibre:Excitability, conductivity, refractory period, summation, adaptation, indefatigability and all or none law.Resting Membrane Potential: origin. Ionic conductance, Nernst equation, Hodgkin-Huxley-Goldman- Katz constant field equation. The Action Potential: origin and propagation in myelinated and non-myelinated nerve fibre. Compound Action Potentials, Electrotonic potential, Cable conductance, Current of injury, Chronaxie, Rheobase and Utilization time.

Unit II: Muscle Physiology I

Microscopic and electron microscopic structure of skeletal, cardiac, and smooth muscles: With special emphasis on contractile and regulatory proteins (major and minor proteins). Elastic components, sarcotubular system. Red and white striated muscle fibres.Single and multi- unit smooth muscles. Muscle groups: Agonist and antagonists. Properties of skeletal muscle: excitability, conductivity, contractility, all or none law, summation of stimuli, summation of contractions, effects of repeated stimuli, genesis of tetanus, onset of fatigue, refractory period, tonicity, extensibility, and elasticity.

Unit III: Nervous system I

Brain and spinal cord: Structural organization of different parts, *Receptors:* Definition, classification, properties-Specificity of response, adaptation, Response to increase in the strength of stimuli, Receptor

potential.Ascending and descending tracts:Origin, courses, termination and functions of ascending (fasciculus gracilis, fasciculus cuneatus, dorsal and ventral spinocerebellar tracts, anterior and lateral spinothalamic tracts, spino-tectal tract) and descending (corticospinal,medial longitudinal fasciculus, anterior vestibulospinal tract, lateral vestibulospinal tract, reticulospinal tract, tectospinal tract, rubrospinal tract, olivospinal tract).*Reflex action:* Definition, reflex arc, classification, properties (One way conduction, summation, occlusion, subliminal fringe, recruitment, after discharge, rebound phenomenon, reciprocal innervations and reciprocal inhibition, fatigue), *CSF:*formation, circulation and functions, Blood-Brain Barrier and Blood-CSF Barrier**,** lumber puncture, hydrocephalus. Circumventricular organs.

Unit IV: Special Senses I

Fundamentals of Special senses: Characteristics of special senses, Sensory coding. Weber-Fechner law, Steven's power law.

Vision: Outline structure of eyeball, Retina-histology, fovea and blind spot, crystalline lens. Aqueous humor -formation, composition, route of circulation, drainage, and functions. Vitreous humor- functions. Visual pathway -Origin, course, termination with special emphasis on centers. Effects of lesion in visual pathway. Light reflex. Mechanism of accommodation. Chemical and electrical changes in retina on exposure to light. Electroretinogram. Photopic and scotopic vision. Visual processing in retina; positive and negative after images.Contrast phenomenon. Light and dark adaptation, Colour vision (trichromatic, single and double opponent mechanisms including merits and demerits); Visual field and perimetry. Visual acuity-measurement, mechanism and factors affecting. Critical fusion frequency-Ferry-Porter Law.

Unit V: Special Senses I;

Audition: Structure and function of outer, middle, and inner ear. Tympanic membrane. Middle ear ossicles. Organ of Corti (structure and its role in hearing). Endolymph and perilymph. Auditory pathway- origin, course and termination with special reference to auditory centers. Mechanism of Hearing- transduction of sound stimuli, mechanism of discrimination of sound frequencies and intensities, localization of sound sources. Impedance matching.Attenuation reflex.

Gustation & Olfaction: Basic taste modalities-olfactory and gustatory pathways (receptor organs, neural pathways, centers). Signal transduction of olfactory and gustatory stimuli. Olfactory and gustatory coding.Olfactory masking, After taste.

Abnormalities of Specialsenses: Glaucoma, Errors of refraction and their corrections, Cataract, Colour blindness, retinal detachment, Deafness, anosmia, ageusia, dysgeusia.

DSCC-4 Practical (1 CREDIT, 25 MARKS)

1. Staining of Nodes of Ranvier and Cells space of Cornea with silver nitrate
2. Determination of Colour Blindness by Ishihara Chart
3. Determination of Visual Acuity by Snellen's Chart
4. Determination of Deafness by Tuning Fork Test
5. Identification of permanent histological slides: Spinal cord, Cerebrum, Cerebellum, Skeletal muscle, Smooth muscle, Cardiac muscle, Adrenal, Ureter, Skin, kidney, and Bone.

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: SEC-III

(Community Health, Clinical Biochemistry, and Computer application)

SEC-III THEORY (2 CREDITS: 50 MARKS)

Unit-I: Community Health

Basic idea about community, John Snow Water pump and Typhoid Mary- Early concept of community health. Public health issues Malnutrition in a community, over nutrition and possible remedial measures. Diet management of obese, diabetic, hypertensive individuals and athletes. Iron and iodine deficiency. Population problem- principles and methods of family planning. Problem of infertility and Assisted Reproductive Technologies (ART). PCM- Marasmus, Kwashiorkor, Marasmic Kwashiorkor, endemic goiter, nutritional anaemias, rickets, osteomalacia, xeropthalmia, beriberi and their social implications. Principles and social importance of immunization against diseases. Etiology, epidemiology, and prevention – Communicable diseases: Malaria, Swine flu, and AIDS. Non-communicable diseases – Hypertension and Obesity.

Unit-II: Clinical Biochemistry-II

Pathophysiological significance of the following serum enzymes and proteins: Lactate dehydrogenase, Creatine kinase, Amylase, Acid and Alkaline phosphatases, β-glucuronidase, Alanine and Aspartate Transaminases, Lipase, γ-glutamyl transferase, Regan Isoenzyme, Cardiac Troponins. Thyroid profile. PTT, APTT, and INR. Complement assay.Acute phase proteins- Positive APP (CRP) and negative APP (Albumin).

Unit-III: Laboratory Management & Safety

Introduction to Laboratory Management: definition, scope, and objectives. Sample management and documentation.Quality Management in Laboratories: Good Laboratory Practices (GLP).Quality assurance (QA) and quality control (QC). Accreditation and certification (ISO, NABL, CLIA). Equipment Management: Calibration, maintenance, and validation of equipment. Waste management and disposal.Introduction to Laboratory Safety: Importance of safety in laboratories. Common hazards and risk factors. Chemical and Biological Safety. Handling and storage of chemicals. Biological hazard management. Material Safety Data Sheets (MSDS). Physical and Fire Safety. Personal Protective Equipment (PPE) and Emergency Protocolsin laboratory.

Unit-IV: Cardio-Respiratory Disorders

Basic concepts of cardiac arrhythmias, heart blocks, myocardial Infarctions, atherosclerosis, angina, cardiac failure, hypotension, and hypertension. Haemorrhage: physiological consequences and compensatory mechanism. Disorders of Breathing: basic concepts of Hypoxia: Types & effects, Restrictive and obstructive lung diseases: asthma, chronic obstructive pulmonary disease (COPD), chronic bronchitis, emphysema, fibrosis, and interstitial lung diseases. Cyanosis, Periodic breathing, Asphyxia, Voluntary hyperpnoea, Apnoea, Artificial respiration: indications and methods including CPR.

Unit-V: Computer Application

Basic architecture of computer. Server- Types and application. Cloud computing. Operating system: Window and Linux. Search engines- Types, biological search engine- Google scholar and pub-med. Advance search option- AND, and OR logic. Referencing- Footnote and endnote. Referencing tools. Software and Programming Language: Machine Language and Assembly Language- Advantages,

disadvantages, and examples. Programming for Biological Data Analysis. Basic idea about software console. Basics of Python and R for biological applications. R studio.

SEC-III PRACTICAL (2 CREDIT, 50 MARKS)

1. Clinical biochemistry: Total protein (Biuret method), serum albumin (BCG method), serum bilirubin (Diazo method) (*all assay using biochemical kits*)
2. Field survey on community health: (at least 3 physiological/anthropometric parameters need to be assessed)- A hand written report to be submitted.
3. Computer application: data entry in ms-excel, pie diagram, bar diagram, mean, median, SD, SE.
4. Analysis of normal 12 lead ECG.
5. Analysis of spirogram data (digital/manualspirometer):Static- volumes and capacities, Dynamic- FEV1, FVC and their ratio.

Distribution of Questions*:*

1. SEC Theory: One question of 10 marks from each unit with one alternative to be set. The 10 marks question may be subdivided (Maximum marks not to exceed 5).
2. SEC Practical: Filed survey: 10, Experiments: 20 (Minimum 2 experiments to be set), Viva-voce-10, Laboratory Note Book:10.

SEMESTER-IV

PAPER: DSCC 5

(Metabolism and Nutrition)

DSCC 5 THEORY (3 CREDITS: 75 MARKS)

Unit-I: Metabolism I

Carbohydrate Metabolism*:* Glycolysis and TCA Cycle (metabolic pathways with special references to the regulatory steps, inhibitors,energetics, metabolic significances). Pyruvate Dehydrogenase complex, Gluconeogenesis (metabolic pathways and significances including the amphibolic nature of TCA cycle). Pentose Phosphate Pathways (metabolic pathways, Biochemical and clinical significances), Glycogen metabolism (metabolic pathways). R-L cycle (metabolic pathway and biochemical significance). Cori cycle (metabolic pathway and biochemical significance).

Unit-II: Metabolism II

Lipid Metabolism: β-Oxidation (pathway and energetics), Biosynthesis of Fatty acids (saturated and monounsaturated: pathways with special reference to Fatty acid synthase complex). Cholesterol Biosynthesis (with special reference to the regulatory step). Phospholipids (Biosynthetic pathways). Ketone bodies (Metabolism and clinical significances).

Unit-III: Metabolism III

Amino acid metabolism*:*concepts of glucogenic and ketogenic amino acids, amino acid pool, deamination (Oxidative and non-oxidative), trans deamination, decarboxylation, transamination (mentioning the role of PLP). Urea cycle (metabolic pathway and energetics).1-C compounds and transmethylation (Only metabolic outlines and significance).Individual amino acid metabolism- Glycine, methionine, tryptophan, and phenylalanine (metabolic outlines and significances of the end-products). Basic concepts of the integration of carbohydrate, protein. and lipid metabolism.

***Purine and Pyrimidines**:* Biosynthesis (De novo and salvage pathways) and catabolism, gout.

***Biological Oxidation**:* Redox potential. Mitochondrial Electron Transport Chain (Organization and functions of different components). Oxidative phosphorylation (Chemiosmotic hypothesis). High-energy compounds, inhibitors and uncouplers of ETC.

Unit-IV: Nutrition I

Vitamins—Water-soluble vitamins: Thiamine, Riboflavin, Niacin, Pyridoxine, Pantothenic acid, Biotin, Cyanocobalamin, Folic acid, Ascorbic acid, Inositol. Fat-soluble vitamins: A, D, E & K.*Minerals*—Sources, physiological functions of sodium, potassium, calcium, selenium, phosphorus, iron, zinc, iodine and fluoride.*Energy metabolism*—Direct calorimetry *and* Indirect calorimetry. Respiratory quotient. Basal Metabolic Rate:Determination and Factors affecting. Specific Dynamic Action of Food.

Unit V: Nutrition II

Constituents of food and their significance. Calorific value of food. Body calorie requirements-adult consumption unit. Dietary requirements of carbohydrate, protein, lipid and other nutrients. Balanced diet and principles of formulation of balanced diet for sedentary adult male and female. Nitrogen balance, essential amino acids biological value of proteins. Protein sparers. Protein efficiency ratio and net protein utilization. Dietary fibres. Principles of diet survey. Composition and nutritional value of common foodstuffs. Physiology of starvation and obesity.

DSCC 5PRACTICAL (1 CREDIT, 25 MARKS)

1. Quantitative estimation of glycine amino nitrogen by Sorensen's formol titration method (percentage and total).
2. Estimation of blood glucose by Folin-Wu method.
3. Estimation of ascorbic acid (from citrus vegetables/fruits)by DCPIP titrimetric method.
4. Qualitative identification of starch and protein in rice and pulse.
5. Diet survey in family by recall/weighment method.

***Distribution of Questions**:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Diet survey: 5, Experiments: 12 (Minimum 2 exp. to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: DSCC-6

(Nerve-Muscle Physiology-II, Nervous System-II & Molecular Neurobiology)

DSCC 6 THEORY (3 CREDITS. 75 MARKS)

Unit I: Nerve Muscle Physiology II

Synapse: types, EM structure of chemical synapse. molecular basis of synaptic transmission, docking, fusion & exocytosis. Properties of synapse: synaptic delay, summation, occlusion, subliminal fringe convergence and divergence, one way conduction, fatigue. Neurotransmitters, co-transmitters, and neuromodulators-basic ideas with examples. Neuro-muscular junction: EM Structure, transmission, EPP, MEPP, post-tetanic potential. Degeneration and regeneration of nerve fibers, Wallerian degeneration, Trans-neural degeneration, Denervation hypersensitivity. Skeletal and smooth muscle contraction and relaxation- Molecular basis, Electrical, chemical, and thermal changes. Isometric and isotonic contraction.

Muscle length-tension and Force-velocity relationship, Preload and afterload, Electromyography and Myasthenia gravis.

Unit II: Nervous System II

Autonomic Nervous system: Organization, outflow, functions, and chemical transmission. Thalamus-nuclei, connections, functions, and thalamic syndrome. Hypothalamus- nuclei, connections, functions. Brain stem: components and functions. Cerebellum-anatomy, histology, connections, functions. Intentional tremor. Reticular formation- structure and functions, Basal ganglia- components, connections, and functions, Parkinsonism, Vestibular apparatus: Structure and functions. Cerebral cortex: Histology, Functional localization, Muscle spindle and Golgi-tendon organ: Structure, innervations, and functions.

Unit III: Nervous System III

Emotion: Limbic system-structure, connections, and functions with special reference to Papez Circuit, Physiology of emotion, higher control of Limbic system. Pain: Receptor, Production, neural pathway, neurotransmitters involved, mechanism of perception, regulation, referred pain-Gate control theory, analgesia-basic concept. Speech: Organs of speech, sensory and motor speech centers, speech pathway and mechanism of expression of speech, aphasia. Learning: Conditioned reflex, Synaptic plasticity, neurochemical basis of Long-term Potentiation. Memory: Classification, physiology, and consolidation, Alzheimer's disease, and Senile dementia; Isolated cortex and Split brain, thalamic animals, decerebrate and decorticate rigidity. Sleep: REM and non-REM sleep. Basic concepts; Neural basis. EEG, ECoG, Evoked Cortical Potentials. Insomnia.

Unit IV: Molecular Neurobiology

Structure, Subtypes and functions of receptors: Ionotropic and metabotropic receptors, nicotinic and muscarinic acetylcholine receptors, adrenoceptors, cannabinoid receptors, glutamate receptors (NMDA and AMPA receptors), GABA, opiate, serotonin, dopamine, and histamine receptors

Unit V: Neural Regulation of Cardio-Respiratory System

Innervation of heart and blood vessels, baroreceptors and chemoreceptors, cardiac and vasomotor centre. Neural and chemical control of cardiac functions and blood vessels. Cardiac reflexes: Baroreceptor, Chemoreceptor, Bainbridge reflex, Bezold-Jarisch reflex, Regulation of respiration: Respiratory centres in brain, pre-Botzinger complex, Pulmonary J receptors, Central and peripheral chemoreceptors, baroreceptors, Neural and chemical control of respiration. Respiratory reflexes: Hering-Breuer Reflex, J-receptor reflex, chemoreceptor reflex.

DSCC 6 PRACTICAL (1 CREDIT, 25 MARKS)

1. Staining of skeletal muscle and cardiac muscle with methylene blue.
2. Kymographic recording of Simple muscle curve, and effect of load (afterload).
3. Muscle strength and fatigue using hand grip dynamometer
4. Demonstration: Clinical examination of reflexes: Knee jerk, Plantar reflex.

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: DSCC -7

(Physiology of Excretion, Altered Environment & Biostatistics-II)

DSCC THEORY: (3 CREDITS: 75 MARKS)

Unit I: Renal Physiology

Anatomy and histological structures of different parts of nephron. Renal blood supply, peculiarities of renal circulation and autoregulation. Juxtaglomerular Apparatus (JGA). Glomerular and tubular function.Formation of urine. Counter-current multiplier and exchanger systems.GFR- Definition, determination, and factors affecting.Renal function tests - creatinine, inulin, urea, and PAH clearance tests. renal regulation of osmolarity and volume of blood fluids, acid-base balance.Normal and abnormal constituents of urine with pathophysiological significances. Physiology of urinary bladder and micturition. Pathophysiology of urinary system - Basic concept of Diabetes insipidus; Acute kidney injury &chronic kidney disease (CKD).Artificial kidney and Renal dialysis. End stage renal disease Kidney transplantation.

Unit II: Skin And Body Temperature Regulation

Structure (layers including sweat glands and sebaceous glands) and functions of skin; Cutaneous circulation (anatomy, peculiarities and regulation); Sweat (mechanism of formation, composition, regulation of secretion); Insensible perspiration; Regulation of body temperature in homeotherms (physiology and physical processes, neuro-humoral control); hyperthermia, hypothermia and pyrexia.

Unit III: Physiology Of Altered Environment

Physiological response to High Altitude: Acute and chronic responses to hypoxia, Mechanisms of acclimatization. Acute mountain sickness. Adaptation to Hyperoxia: Effects on lung function, oxidative stress, and potential toxicity. Factors Affecting Acclimatization Adaptation to Hyperbaric and Hypobaric Environments: Deep-sea diving. Heat Stress and Heat Acclimatization: Long-term adaptation mechanisms. Heat disorders. Prevention strategies of heat stroke. Cold Stress and Cold Acclimatization: Long-term adaptations mechanisms. Prevention strategies of frostbite. Metabolic changes during Heat and Cold Stress.

Unit IV: Physiological Responses to Environmental Pollutants and Stressors

Physiological Response to Environmental Pollutants: Air Pollution and Respiratory Health-Sources of air pollution, Effects of Particulate Matter (PM2.5, PM10), Impact on lung function, asthma, chronic obstructive pulmonary disease (COPD), Ozone and Nitrogen Dioxide exposure. long-term health effects. Noise Pollution-Pink and White noise, permissible noise levels, health impacts, remedial measures. Heavy metal pollution: Sources and health impacts of Pb, Hg, As, Cd, Al. Electromagnetic Radiation and its Physiological Effects- UV, X-ray, γ –Ray and Microwave radiation.

Unit V: Biostatistics-II

Hypothesis Testing and Statistical Error: Null and Alternative Hypothesis, types of Errors. Statistical Power and Sample Size determination. P-values. Parametric Tests: t-test (One-Sample, Two-Sample, paired and unpaired). Non-Parametric Tests: Chi-Square Test, Yates correction,Odds Ratio, Relative Risk. Analysis of Variance (ANOVA) – one-way ANOVA. Pearson's Correlation Coefficients. Applications of Regression in Biological Studies. Simple Linear Regression Analysis.

DSCC 7Practical (1 CREDIT, 25 MARKS)

1. Silver nitrate staining of urinary bladder
2. Qualitative identification of normal and abnormal constituents of urine (Chloride, Phosphate, Sulphate, Creatinine, Urea, Glucose, Protein, Acetone and Bile salts).
3. Qualitative tests for the detection of As, Pb, and Al in water sample.
4. Biostat: t- test (unpaired and paired), Chi square test (2×2 contingency table), Pearson's r.

***Distribution of Questions**:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: DSCC -8

(Molecular Biology, Cancer biology, Instrumentation and Methodology)

DSCC 8 THEORY (3 CREDITS, 75 MARKS)

Unit-I: Recombinant DNA Technology and its application

Cloning vectors- Plasmids, bacteriophages, cosmids, BACs, and YACs. Types of restriction enzymes (Type I, II, III), Sticky vs. blunt end digestion, DNA ligases and their role in cloning, Shuttle vectors and selectable markers. Gene Cloning Techniques-Transformation, transfection, and electroporation. Screening recombinant clones- Blue-white screening, antibiotic selection. Recombinant Insulin, CRISPR-Cas9 Gene Editing- Basic concept. Genetically Modified Organisms (GMOs) in Human Health- Nutritionally enhanced foods - Probiotic bacteria with therapeutic benefits, Gene-edited crops for allergy reduction. Recombinant vaccines: DNA vaccines-Hepatitis B, HPV; and RNA vaccines- COVID-19.

Unit-II: Stem Cell Biology

Types of stem cells- embryonic, adult, induced pluripotent. Molecular mechanisms regulating stem cell self-renewal - concept of Wnt/β-catenin Signaling Pathway, PI3K/AKT/mTOR Pathway, differentiation - concept of BMP Signaling, TGF-β Pathway. Regulation of Stem Cell Survival. Organoids- Basic concept. Applications of stem cells in regenerative medicine - Bone and Cartilage Regeneration, ESCs and iPSCs in neurodegenerative diseases.

Unit-III: Cancer Biology

Cell cycle regulation.Apoptosis- Basic concept and canonical and non-canonical pathway. Autophagy and necrosis. Basic concepts of- dysplasia, hyperplasia, neoplasia, metastasis.Characteristics of Cancer Cells. Classification of cancer- carcinomas, sarcomas, adenoma, leukemias, lymphomas retinoblastoma.Oncogenes and Tumor Suppressor Genes- roles of proto-oncogenes (RAS, MYC) and tumor suppressor genes (TP53, BRCA1/2) in cancer development. Oncogenic Signaling Pathways- PI3K/AKT/mTOR pathway. Cancer Genomics- Epigenetic regulation- concept of DNA Methylation, Histone Modifications, Non-Coding RNAs. Characteristics of Cancer Stem Cells (CSCs). Basic Concept of- Chemotherapy, Radiotherapy, and Immunotherapy. Minimum Residual Disease- Basic concept.

Unit-IV: Biomedical Instrumentation

Bio-electromagnetism: Electrocardiograph (ECG), Electroencephalography (EEG), Electromyograph (EMG), Magnetic Resonance Imaging (MRI), Magnetoencephalography (MEG). Ultrasound (Sonography), Echocardiography, X-ray and Computed Tomography (CT) Scan, Positron Emission Tomography (PET) Scan– Principle, application, merits and demerits.

Unit-V: Methodologies

Blotting Techniques- Southern blotting, Northern blotting, Western blotting. Enzyme-Linked Immunosorbent Assay (ELISA)- Types, principles, procedures and applications. Radioimmunoassay (RIA). Polymerase Chain Reaction (PCR) - Basic principles and steps, Reverse Transcriptase PCR (RT-PCR), Quantitative PCR (qPCR). Flow Cytometry and cell sorting. Induced Pluripotent Stem Cell (iPSC) Technology- Principle, procedures, and applications.

DSCC 8 PRACTICAL (1 CREDIT: 25 MARKS)

1. Estimation of RNA by Orcinol method and preparation of standard curve. (Colorimetric)
2. Isolation of DNA (from Banana/Onion/ Strawberry)
3. Barr Body Identification from Squamous Epithelium by Giemsa staining method.
4. Immunofluorescence Assay for "hs-CRP-CRP" (Qualitative Kit)

Demonstration:

1. Case study interpretation of Cancer (Breast /Prostate/Lung/Colon cancer – any one).
2. Purification of DNA and Agarose gel electrophoresis.

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

SEMESTER-V

PAPER: DSCC -9

(Endocrinology)

DSCC 9 THEORY (1 CREDIT; 75 MARKS)

Unit I: Endocrinology I

Hypothalamus as a neuroendocrine organ. Hypothalamic releasing and inhibitory hormones. Hypothalamic-hypophyseal portal system. Hypothalamo-hypophyseal tract. Feedback regulation- basic concept. Anterior and posterior pituitary- histology, chemical nature, mechanism of action and regulation of secretion, and functions of hormones secreted from these glands. Pineal gland- histology, chemical nature, biosynthesis, mechanism of action, functions, regulation of secretion of melatonin.

Disorders- Pan-hypopituitarism, dwarfism, gigantism, acromegaly, Cushing's disease, hyperprolactinemia, diabetes insipidus- neurogenic & nephrogenic, SIADH.

Unit II: Endocrinology II

Thyroid and Parathyroid Glands- Histological structures, chemical nature, biosynthesis, mechanisms of action, functions, regulation of secretion of the hormones. Deiodinase.

Disorders- Non-toxic goiter, myxedema, cretinism, Hashimoto's thyroiditis, Grave's disease, tetany.

Unit III: Endocrinology III

Adrenal cortex and medulla- Histology, chemical nature, mechanisms of action, functions, regulation of secretion of the hormones. Biosynthesis and catabolism of adrenal medullary hormones.

Disorders- Cushing's syndrome, congenital adrenal hyperplasia, Addison's disease, Pheochromocytoma.

Unit IV: Endocrinology IV

Pancreas- Histological structure of pancreatic islets, chemical nature, mechanisms of action, functions, and regulation of secretion of the hormones. Hormones secreted from adipose tissues: Types and Functions and their role in energy metabolism. Appetite control, obesity and hormones.
Disorders- Diabetes mellitus, hyperinsulinism, Zollinger-Ellison syndrome.

Unit V: Endocrinology V

Gastrointestinal hormones: chemical nature, mechanisms of action, functions, and regulation.Hormones secreted from heart, kidney, liver, thymus gland: chemical nature and functions, and regulation of secretion. CTGF, PDGF, NGF, Myokines, Adipokines- Basic concept.

DSCC 9Practical: (1 CREDIT; 25 MARKS)

1. Study of effects of adrenaline on intestinal movements—Dale's experiment.
2. H&E staining: Thyroid gland, adrenal gland, and pancreas.
3. PAS staining: Thyroid gland, and liver.
4. Determination of blood glucose by GOD-POD method.
5. Determination of serum cholesterol by kit method.

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: DSCC -10

(Reproductive Physiology, Developmental Biology, and Human evolution)

DSCC 10 THEORY (3 CREDITS; 75 MARKS)

Unit-1: Reproduction-I

General components and basic anatomy of Reproductive system. Sexual development- *in utero*, after birth, Puberty. Menopause, male climacteric. Primary and accessory sex organs and secondary sex characters. Male reproductive tract, histology of testis, spermatogenesis, testicular hormones: chemical nature, functions, mechanism of action and regulation of secretion—hypothalamic-pituitary-testicular axis.

Unit-II: Reproduction II

Female reproductive tract. Anatomy and histology of ovary. Growth, development and function of the ovarian follicle, ovulation, formation, function, and degeneration of corpus luteum. Ovarian hormones-mechanism of action, functions, and regulation of secretion- hypothalamic control. Human menstrual cycle and its regulation, oestrous cycle. Structure and functions of placenta., endocrine and other physiological changes during pregnancy. physiology of parturition, development of mammary glands, lactation, and its hormonal control.

Unit-III: Reproductive Health& Disorders:

Male infertility: mechanism and treatment.Diseases associated with male reproductive tract:low sperm count related disorders- oligoasthenoterratozoospermia (OAT), azoospermia, SCOS, Kallmann's

syndrome, Y chromosome micro deletion- AZF, cryptorchid or undescended testis, varicocele. Female infertility- mechanism and treatment. Abnormalities in menstrual cycle&Pathophysiology of ovary- AUB, DUB, menorrhagia, menometrorrhagia, oligomenorrhea, dysmenorrhea, endometriosis, endometrial polyp, PCOS, anovulation, tubal blockage.Ectopic pregnancy. Maintenance of pregnancy, pregnancy test, disorders of pregnancy. Conception and contraception.

Unit-IV: Developmental Biology

Fertilization- process. Totipotency, Pluripotency, and multipotency. Cleavage- Types of cleavage based on plane and pattern. Formation of morula Blastocyst formation and implantation, Gastrulation and germ layer differentiation, Placenta- Structure, types, functions, and hormonal role. Development of Heart, urinary system, and genital system. Foetal Circulation- anatomy and peculiarities. Changes after birth. Endochondral ossification.

Unit V: Human Evolution & Population Genetics

Definition and significance of evolution. Convergent and divergent evolution, Geological time scale, Brief Overview of evolutionary theories: Lamarckism, Darwinism, and Modern Synthesis. Origin of *Homo sapiens* from other hominins. Fossil evidence: Australopithecus, Homo habilis, Homo erectus, Neanderthals. Major transitions in hominin Evolution- Bipedalism, evolution of brain size and intelligence. Role of Mitochondrial DNA and Y-chromosome in tracing human evolution. Population genetics: Hardy-Weinberg Equilibrium- Concept and significance, Hardy-Weinberg equation and factors affecting genetic variation in populations.

DSCC-10 PRACTICAL (1 CREDIT; 25 MARKS)

1. H&E staining- Ovary, uterus, and testis
2. Pregnancy test by immunological method using kit using synthetic hCG solution.
3. Identification Of Stages of Oestrous Cycle from vaginal smear (From permanent slides)
4. Identification of stages of Embryogenesis (From permanent slides)
5. Survey Project- Menstrual history/PCOS/Endometriosis screening by Questionnaire method.
6. Identification of key hominin fossils (from Images)

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Survey report: 4, Experiments: 13 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: DSCC -11

(Chronobiology, Stress Physiology & Occupational Health)

DSCC 11 THEORY (3 CREDITS; 75 MARKS)

Unit-I: Chronobiology I

Physiological Rhythms: ultradian, circadian, infradian (Definition, examples). Differences between Circadian and Diurnal rhythms.Neuroendocrine basis of biological rhythm: Suprachiasmatic nucleus as Master clock- Structure, afferent and efferent connections, neurotransmitters in relation to circadian

rhythms, integration among retina, suprachiasmatic nuclei, paraventricular nuclei and pineal gland in relation to the regulation of circadian rhythms. Peripheral clocks- Basic ideasZeitgebers: Types and their role on circadian master clock. Entrainment and synchronization.Molecular regulation of physiological rhythm: Time keeping genes. Feedback loops and molecular oscillators.

Unit-II: Chronobiology II

Endocrine Biorhythms: cortisol biorhythm, melatonin biorhythm, prolactin biorhythm.Diurnal variations: Potassium excretion, body temperature, Sleep-wakefulness cycle.Chronotype: Genetic and lifestyle influences. Chrono nutrition: Basic concepts. Impact of meal timing on metabolism and weight regulation. Chrono therapeutics: Basic concepts. Human Biorhythm Disorders: Jet-lag, shift work, Sleep disorders, Seasonal Affective disorders.

Unit-III: Stress Physiology

Stressors: Physical and emotional. Eustress and Distress.General Adaptation syndrome: occurrence, stages, possible therapeutic managementsHypothalamic-Pituitary-Adrenal axis and Sympathoadrenal Medullary axis: Role in coping stress. Effects of chronic stress: immunological, cardiovascular, emotional.Management of Stress: Biomarkers of stress- Heart rate variability, ACTH, cortisol, adrenal medullary hormones,salivary amylase IL-6, IL-10, Acute phase protein- CRP.

Unit-IV: Redox Biology

Reactive oxygen species, Antioxidants and Redox imbalance. Fenton equation and Haber Weiss Reaction. Biological sources of ROS- NOX, COX, MPO. Physiological role of ROS and related compounds (nitrosative and chlorosative stress). Oxidative modification of proteins and lipids and their implications. Antioxidant defence system- Primary and Secondary defence against ROS. Roles of superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase, glutathione synthetase. Roles of cytochrome P_{450}. Role of low molecular weight antioxidants: Vitamins, Minerals and Phytochemicals (Polyphenols and flavonoids).

Unit-V: Occupational Health

Introduction to Occupational Health: Definition, scope, and importance. Occupational health awareness.Occupational Hazards and Risk Factors- Types of occupational hazards (physical, chemical, biological, ergonomic, and psychosocial). Risk assessment and hazard control. Occupational Safety and Health (OSH) standards. Workplace safety programs and policies.Occupational Diseases and Disorders- respiratory diseases, skin disorders, and occupational cancers. Hearing loss and vision-related problems. Industrial and Environmental Toxins: Health impacts of solvents, polychlorinated biphenyls (PCBs), and volatile organic compounds VOCs.Workplace Stress and Mental Health. Occupational Health Surveillance and Epidemiology. Monitoring and controlling occupational diseases.

DSCC 11 PRACTICAL (1 CREDIT, 25 MARKS)

1. Project work on assessment of individual differences in human circadian rhythms (chronotype in human population) by questionnaire method
2. Determination of Circadian/ diurnal variation of body temperature.
3. Assessment of Musculo-Skeletal Disorder by Modified Nordic Questionnaire.
4. Single point Noise mapping of a premise- at least at 5 different sites.
5. Determination of polyphenol in 2% aqueous extract of CTC tea (black tea) using gallic acid standard curve

***Distribution of Questions**:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER DSCC -12

(Microbiology and Immunology)

DSCC 12 THEORY (3 CREDITS; 75 MARKS)

Unit I: Microbiology I

Classification of microorganisms: Techniques employed for the identification of microorganisms-microscopic, biochemical, and molecular methods (16s rRNA sequencing). Man-microbe interactions: Route of entry, habitat organs, positive (mutualism, commensalism, syntropism, proto-cooperation) and negative interactions (predation, parasitism, competition and ammensalism). Basic concepts of food borne infections- mode of transmission and methods of prevention, *Control of microbial growth:* Physical and chemical methods used in sterilization, disinfection and Pasteurization, *Bacteriology*: Bacterial classification based on morphology, Bacterial structure-cell envelop, pili, flagella, chromosome, plasmid, spore and cysts, staining techniques-Gram staining, and Acid-Fast Staining.

Unit II: Microbiology II

Bacterial culture: Nutritional requirements -complex and synthetic media, physical factors of bacterial growth-pH, temperature, volume of media, size of inoculum, incubation time. Bacterial auxotrophy, Bacterial growth curve-different phases, *Bacterial metabolism:* Fermentation, Glyoxylate cycle and Entner-Doudoroff pathway, *Bacterial genetics:* Transformation, conjugation and transduction, Bacterial infection and treatment-chemotherapeutic agents, antibiotics-definition, mode of action of bactericidal, and bacteriostatic antibiotics

Unit III: Virology

The origin and evolution of virus. Viral structure-virion, prion and bacteriophages, Classification of viruses based on nucleic acid composition and host system, *Replication of bacteriophages*-lytic and lysogenic cycles, Interferon. Structure, mode of transmission and control of infection: *Rhinoviruses, flu and Hepatitis viruses. HIV-AIDS.*

Unit IV: Immunology I

Overview of innate and acquired immunity: Elements of acquired immunity-characteristics of immune responses, cells and organs involved in immune response. *Immunogens, and antigens:* Requirements of immunogenicity, epitopes recognized by B and T-cells, haptens, adjuvants, cross-reactivity. Antibody-classification, structure, and functions. *Kinetics of antibody responses:* Primary and secondary. Antigen-Antibody interactions- association constant, affinity, avidity, precipitation, and agglutination. *Complement*-types, components, activation, and functions.

Unit V: Immunology II

Antigen processing and presentation. MHC molecules-Classification, structure, brief idea of peptide binding, cellular distribution. B-cell: receptor, activation, and differentiation. T-cell: receptor, maturation, and differentiation-thymic selection. *Thymus dependent and independent antibody*-basic concept, *T-B*

cooperativity. *Cytokines*-Production by T_H1 and T_H2 cells and their role in immunity. Inflammation. *Cell mediate effector responses*-CTLS, NK cells, K cells. *Autoimmunity*-basic concepts, *Hypersensitivity*-brief ideas about different sub-types, Vaccination-Passive and active immunization. Types and uses of vaccines. Toxins and toxoids.

DSCC 12 PRACTICAL (1 CREDIT, 25 MARKS)

1. Media preparation and aseptic transfer
2. Inoculation (plate & slant culture)
3. Gram staining
4. Lactophenol cotton blue staining of yeast.
5. Blood grouping
6. *Demonstration:* Ouchterlony double diffusion method

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

SEMESTER-VI

PAPER DSCC -13

(Epidemiology, Dietetics and Therapeutic Nutrition)

DSCC 6.1 THEORY (3 CREDITS; 75 MARKS)

Unit-I: Epidemiology

Definition, methods and surveys, study designs- case control and cohort studies (prospective and retrospective), Techniques of sampling, sources of bias, Data: Primary and Secondary Sources. Epidemiological concept of rate, ratios and proportions, Definition, of infant, child & maternal mortality rates, Under five mortality rate, Birth Rate and Crude death rate with sources of relevant statistics. Growth charts: plotting and monitoring, Assessment of nutritional status by anthropometry; stunting, wasting, and undernutrition. Epidemiological questionnaire: Basic concepts.

Unit-II: Parasitology

Definition, classification of parasites: (Ecto, and endoparasites, Protozoa, Helminths, and Arthropods), classification of hosts: (definitive, intermediate, reservoir, paratenic), host-parasite interaction (commensalism, symbiosis, and parasitism), Lifecycle of *Entamoeba histolytica, Plasmodium falciparum, Leishmania donovani, Wuchereria bancrofti and Ascaris lumbricoides*: pathogenesis, clinical symptoms, and prevention of associated disease.

Unit-III: Common Metabolic Disorders

Cause, symptoms, and pathophysiology of Glycogen storage diseases, Phenylketonuria, Maple syrup urine disease, Hemochromatosis, central obesity and metabolic disorders.Fatty liver, MAFLD, NASH, Dyslipidaemia, Lysosomal storage disorder (Krabbe disease, Gaucher Disease), Wilson disease. Endemic goitre.

Unit-IV: Dietetics And Therapeutic Nutrition

Principles of formulation of balanced diet.Nutritional requirement and dietary management of pregnancy, lactation, and old age. Basic concepts of diet therapy. Classification of therapeutic diets based on texture and nutrient restriction/modification. Nutritional concern and management of obesity, Nutritional anaemia, Diabetes, Hypertension (DASH), and Renaldisease, Gluten free diet in celiac disease, Autoimmune diet. Keto diet.

Unit-V: Food Additives & Adulterants

Food additives: Definition and classification (preservatives, colouring agents, flavour enhancers, sugar substitutes and emulsifiers). Food adulterants: Definition, classification (intentional, & non intentional). Common adulterants in Food samples: Milk, honey, ghee, butter, coffee, turmeric powder, chili powder, mustard seed/oil, besan and black pepper. DART. Pathophysiological effects: Metanil yellow, Rhodamin B, Saccharin, Monosodium glutamate, Chicory, feed grade urea, Malachite green and Margarine.

DSCC 13 PRACTICAL (1 CREDIT: 25 MARKS)

1. Food Adulteration Tests: As per DARTguidelines(Turmeric powder, chili powder, green vegetables, milk, honey, coffee)
2. Identification Of Parasites (From permanent Slides)
3. Diet chart formulation in Pregnancy/ Lactation and Diabetes/Hypertension/Renal disease.

Distribution of Questions:

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: DSCC -14

(Biotechnology & Bioinformatics)

DSCC 14 THEORY (3 CREDITS; 75 MARKS)

Unit I: Basic Biotechnology

Cellular totipotency, somatic embryogenesis, preparation steps for animal cell culture, primary cell culture, differentiation of cells, growth kinetics, animal cell lines-origin, characterization with examples, cloning, somatic cell fusion, HAT selection, medium suspension fusion, selection of hybrid clone.

Unit II: Industrial Microbiology

Microorganisms in amino acids, vitamins, enzymes, alcohol, antibiotics production, microorganisms in bioleaching of ore, biogas and bio diesel production, microorganisms in monoclonal antibody and biosurfactant production. Microorganisms and probiotics: Basic concepts. Bioreactor/fermenter: Types and operation, physico-chemical standards used in bioreactors and their limitations, types of fermentation processes, media design for fermentation processes, steps to maintain microbial culture and aseptic inoculation process. Down-stream processing; extraction, separation, concentration, recovery, and purification.

Unit III: Environmental Microbiology

Physiological ecology of microorganisms: adaptation to the environment, abiotic growth limiting factors-Leibig's law of minimum, Shelford law of tolerance, microbial community succession: biofilm

communities, Microbial waste water treatment. Bioremediation of heavy metals, Plastic biodegradation using microorganisms, *Water borne pathogens:* Modes of transmission and preventive measures for: *Shigella, E. coli, Salmonella, Vibrio, Entamoeba,* and *Rotavirus.*

Unit IV: Immuno-Biotechnology

Cloning, Gene therapy, Hybridoma technology, Monoclonal antibody, Transgenic animals. Vaccines: types, vaccine vectors and application. Immune enhancement: Vitamins and Nano vaccines. Cancer screening, liquid biopsy, and cancer immunotherapy. Basic concepts of xenotransplantation.

Unit V: Bioinformatics & Computational Biology

Bioinformatics- History, definition and scope. Biological Databases- Types (Primary, Secondary and specialized), examples – NCBI, GenBank, EMBL, DDBJ, UniProt, PDB, KEGG, BRENDA, PubMed. Bioinformatic tools: Types and examples- BLAST and PDB. Bioinformatics File format- FASTA, SAM, VCF. Analysis and interpretation of sequence data- DNA, RNA, and protein sequence formats. Sequence alignment and pattern searching- Pairwise (global and local), and Multiple sequence alignment (Clustal Omega), Conserved domain search. Phylogenetic analysis Methods- Neighbor-Joining, Maximum Likelihood. Homology searches- Alpha fold. Analysis and interpretation of genome data- gene prediction, full gene comparison. Introduction to computational biology - prediction of 3-D protein structure, identification of unknown protein, NGS Platforms (Illumina, Ion Torrent Sequencing), Concept of Library Preparation for NGS, Whole Genome Sequencing (WGS) and Whole Exome Sequencing (WES). Bioinformatics in medicine and drug discovery- Drug likeliness (Lipinski Rule) and ADMET analysis.

DSCC 14 PRACTICAL (1 CREDIT; 25 MARKS)

1. Estimation of amino acids from fermentation broth by paper chromatography.
2. Colorimetric detection of the presence of Lead(II) and Chromium(VI) in water by kit methods.
3. BLAST Sequence Search - Perform a BLAST search with a DNA sequence (eg. the first 20 bases of the human BRCA1 gene or any other gene of interest.)
4. NCBI CD search and interpretation of Human LDHA (Uniprot Entry: P00338) and LDHB (Uniprot Entry: P07195)
5. ADMET and Drug likeliness analysis of –paracetamol (Pubchem. CID- 1983) using ADMET Lab (https://admetmesh.scbdd.com/ or any standard online software)
6. Industry/Institute visit. (report to be submitted)

Demonstration:

1. Fermenter
2. BOD method
3. Introduction to NCBI websites- Accessing NCBI Website by any internet browser (e.g., Chrome, Firefox) and exploring NCBI Databases (Gene in Gene Database, Using PubMed to find research articles)

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Report submission: 5, Experiments: 12 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER DSCC -15

(Physiology of Yoga, Aging, Space Biology & Forensic Biology)

DSCC 15 THEORY (3 CREDITS, 75 MARKS)

Unit I: Physiology Of Yoga and Pranayama

History, and classification of yoga. Concept of Pancha Kosha (Five Sheaths) and its physiological relevance. Effect of pranayama on lung function and oxygen consumption. Effects of asanas on muscle flexibility, joint mobility and proprioception, Role of yoga in stress and anxiety modulation, postural care, digestive function, and immune modulation (impact on inflammatory markers). Neurocognitive benefits of meditation. Therapeutic yoga: Role in treatment of arthritis, postural correction, neuro-degenerative disorders, hypertension, chronic pain, and respiratory disorders.

Unit II: Space & Aviation Physiology

Historical perspectives and milestones. Cabin Atmosphere in Space flights. Physiological effects of high G-forces (Acceleration and Deceleration), Weightlessness, Thermal extremes, and Cosmic radiation on space flights. Effects of microgravity: Cardio respiratory, musculoskeletal, Sensory-neuro, and cognitive systems. Physiological basis and counter measures. Energy Metabolism and Digestion in Microgravity. Dietary adaptations for astronauts. Post-flight rehabilitation of astronauts. Physiology of aviation: Physiological changes in high altitude and hypoxia. Health issues of flight crew and attendants.

Unit-III: Physiology of Aging

Definition of Aging. Difference between chronological and biological aging. Systemic Changes with Aging: Changes in brain: neurodegenerative diseases, and memory loss. Sensory decline: hearing loss, vision impairment, Cardiovascular changes: Arterial stiffness and hypertension, Respiratory changes: Decline in lung elasticity and COPD, Endocrine Changes: Loss of hormone function, menopause, and osteoporosis, Immuno-senescence, Changes in skin: Loss of collagen and elastin, Cellular and Molecular Mechanism of Aging: DNA damage accumulation, telomere shortening, loss of proteo-stasis, mitochondrial aging and dysfunction and epigenetic alterations.

Unit-IV: Inheritance Pattern of Genetic Disorders

Inheritance: X-linked (haemophilia, colour blindness). Chromosomal Abnormalities: Numerical-Aneuploidy (Down syndrome, Turner syndrome, Klinefelter syndrome) and Structural abnormalities (Deletions, duplications, and translocations). Autosomal dominant disorders (Hereditary Spherocytosis, Marfan syndrome), autosomal recessive (cystic fibrosis, Albinism-OCA), Diagnostic methods for chromosomal disorders- Karyotyping: Down syndrome (Trisomy 21), Turner syndrome (monosomy X), and Klinefelter syndrome(XXY).

Unit-V: Forensic Biology

Definition and scope. Collection and preservation of biological evidences. Forensic Serology: Examination of body fluids like blood, saliva, and semen to identify their presence. DNA Analysis: DNA fingerprinting and its use, Analysis of physical evidence: Examination of hair. Forensic Anthropology: Analysis of skeletal remains to determine age, sex, ancestry, and cause of death. Idea of Polygraph test and Narco-analysis.

PRACTICAL 15: (1CREDIT: 25 MARKS)

1. Introduction to yogic postures: Setu *Bandhasana* (Bridge Pose), *Bhujangasana* (Cobra pose), *Marjaryasana-Bitilasana* (Cat-Cow Pose), *Trikonasana* (Triangle Pose), *Brahmari Pranayama* (Bee Breath), *Nadi Shodhana* (Alternate Nostril Breathing)- Maintain this order for the benefit of Yoga.
2. Measurement of physiological parameters (heart rate, BP) before and after yoga.
3. Lung function assessment before and after pranayama-sPo2 orFEV1 & FVC and their ratio.
4. Karyotyping and identification of genetic disorders from human chromosome images - Down syndrome, Turner syndrome, Klinefelter syndrome.
5. Survey on Osteoporosis/ Dementia among senior citizen (above 60 yrs) by standard Questionnaire.

Distribution of Questions*:*

1. DSCC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. DSCC Practical: Survey report: 5, Experiments: 12 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

Suggestive Readings:

General Physiology

1. Textbook of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
2. Best & Taylor's Physiological Basis of Medical Practice, O.P. Tandon. Lippincott Williams & Wilkins
3. Ganong's Review of Medical Physiology. Barrett et.al, McGraw Hill Lange
4. Samson Wright's Applied Physiology, C.A. Keele. E Neal & N. Towels. Oxford University Press.
5. Physiology, R.M. Berne & M.N. Levy, C.V. Mosby Co.
6. Vander's Human Physiology, E.P. Widmaier et al., McGraw-Hill, Higher Education.
7. Human Physiology: An Integrated Approach by D.U. Silverthorn, Pearson.
8. TextBook of Physiology. Vols. I & II by H.D. Patton. A.F. Ruchs. B.Hille. W.B. Saunders of Co.
9. Principles of Anatomy and Physiology, XII Ed, Tortora, G.J. and Derrickson, B.H. Wiley and Sons, Inc.
10. Medical Physiology, Walter F. Boron & Emile L. Boulpaep, Elsevier
11. Lippincott's Illustrated Reviews: Physiology, R. Preston & Thad E Wilson, Ed. R A. Harvey, Wolters Kluwer India.
12. Textbook of Medical Physiology, Indu Khurana, Elsevier
13. Human Physiology Vol. 1 & 2, C. C. Chatterjee, Medical Allied Agency.
14. Principles of Physiology. D. Pramanik, Academic Publishers, Kolkata.
15. Essentials of Medical Physiology: K. Sembulingam and P. Sembulingam, Jaypee Brothers Medical Pub.
16. Textbook of Medical Physiology, D. Venkatesh & H.H. Sudhakar, Wolters Kluwer

Anatomy

1. Handbook Of General Anatomy. B D Chaurasia. CBS Publishers.
2. Principles of General Anatomy. A K Dutta. Current Books International.

Biochemistry

1. Harper's Illustrated Biochemistry, V.W. Rodwell and others, Lange
2. Leininger's Principles of Biochemistry. By D.L. Nelson and M. M. Cox, Worth Publishers Inc.
3. Devlin TM: TextBook of Biochemistry with Clinical Correlations. John Wiley and Sons.
4. TextBook of Biochemistry, by E.S. West. W.R. Todd. H.S. Mason. J.T. Van Bruggen. The Macmillan Company.
5. Biochemistry, J.M. Berg, J.L. Tymoczko & L. Stryer, W.H. Freeman Williams
6. Lippincott's Illustrated Reviews Biochemistry, Denise R. Ferrier, Wolters Kluwer India Pvt Ltd.
7. Biochemistry, D. Das, Academic Publishers.
8. Biochemistry. Satyanarayana Chakrapani. Elsevier Pub.
9. Textbook of Medical Biochemistry, R. Chawla et.al, Wolters-Kluwer

Clinical Biochemistry

1. Practical Clinical Biochemistry. Methods & interpretation. Ranjana Chawla. Jaypee Brothers Medical.
2. Practical Clinical Biochemistry. H Varley. CBS Pub.

Biophysics & Biophysical principles

1. Biophysics and Biophysical Chemistry, D.Das. Academic Publishers.
2. Introduction to Biophysics. Pranav Kumar. S Chand.
3. Biophysical Chemistry, Principles and Techniques. Upadhyay, Upadhyay, Nath. Himalayan Publishing House
4. Biophysics, An Introduction.RodneyM.J. Cotterill. Wiley
5. A Textbook of Biophysics. R.N. Roy. New Central Book Agency (P) Limited

Cell & Molecular biology

1. The Cell – A Molecular Approach, G.M. Cooper & R.E. Hausman, ASM Press Sinauer.
2. Cell Biology, G. Karp, John Wiley & Sons, Inc. Core
3. Cell & Molecular Biology, EDP De Robertis & EMF De Robertis; Lea &Fibiger
4. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin Cummings.
5. Molecular Biology of the Cell, Bruce. Alberts and others, Garland.
6. Molecular Cell Biology, Berk, Kaiser, Lodish et.al, WH Freeman.
7. Genetics and Molecular Biology with Fundamentals of Biostatistics. David R. Hye. Mc. Graw Hill Publication,
8. Lewin's Essential Genes. J E. Krebs. E S. Gottstein, and S T. Kilpatrick. Jones & Bartlett Learning 2nd Edition.
9. Introduction to Genomics. Arthur M. Lesk. Oxford University Press.
10. Molecular Biology and Biotechnology: Basic experimental protocols -M P Bansal, Publisher: The Energy and Resources Institute.
11. Principles And Methods of Molecular Biology:A Practical Approach-S. Ghosh., Panima Publishing Corporation,

Haematology

1. Practical Haematology. Dacie and Lewis, Churchill Livingstone, 10th edition.
2. William's Haematology By E. Beutler et. Al., Mc Graw Hil
3. Hoffbrand's Essential Haematology. A.V. Hoffbrand. Wiley Blackwell Scientific Publications

4. Wintrobe's- Clinical Haematology By J. P. Greer et.al., Wolters Kluwer.
5. Textbook of Haematology. Tejindar Singh. Arya Publications.
6. Essentials of Haematology. S M kawthalkar. Jaypee Brothers Medical.
7. Medical Laboratory Technology, Volume 3, Kanai L. Mukherjee & Anuradha Chakravarty, McGraw Hill Education.

Neurophysiology

1. Neurobiology. G.M. Shepherd, Oxford University Press
2. Neuroscience. Dales Purves. Sinauer associates. Inc.
3. Barr's The Human Nervous System. J.A. Kierman, N Rajakumar. Lippincott Williams.
4. The Human Nervous System, by Charles Nobach, McGraw Hill Book Co.
5. TextBook of Neuro-Anatomy, by M.B. Carpenter; the Williams and Wilkins Company.
6. Essentials of Neuroanatomy. A K Dutta. Current Books International.

Endocrinology:

1. Endocrinology, Mac E. Hadley, Pearson Education
2. TextBook of Endocrinology Larsen et. al An Imprint of Elsevier.
3. General Endocrinology. Turner.Affiliated East West Press
4. Endocrinology. Vol. I, II and III by L.O. DeGroot. W.B. Saunders Co. Langman's
5. William's Textbook of Endocrinology. Elsevier.
6. Introduction to Endocrinology. Chandra S Negi. Prentice Hall India.

Embryology

1. Medical Embryology by J.W. Sadler, Lippincott Williams, and Wilkins.
2. Essentials of Human Embryology by A.K. Datta. Current Books International.
3. Human Embryology by I. Singh & G.P. Pal, McMillan.
4. Human Embryology and Developmental Biology. 5th Ed.Carlson BM. 2014. Elsevier.

Community Health & Epidemiology

1. Park's Textbook of Preventive and Social Medicine, K. Park, M/s. Banarasidas Bhanot.
2. Communicable Disease Control Handbook, Jeremy Hawker et.al, Blackwell Publishing
3. Textbook of Preventive and Social Medicine Mahajan BK, Roy RN, Saha I, Gupta,Jaypee Brothers Medical Publishers.

Nutrition &Dietetics

1. Food and Nutrition, by M. Swaminathan. The Bangalore Printing & Publishing Co.
2. Nutritive Value of Indian Foods by C. Gopalan and others, NIN, Hyderabad.
3. SrilakshmiB: Nutrition Science, New Age International (P) Ltd.
4. Passmore R and Eastwood MA: Davidson and Passmore's Human Nutrition & Dietetics, Churchill Livingstone.
5. Clinical Dietetics and Nutrition, Anita FP and Abraham P: Oxford University Press, Delhi.
6. Handbook of therapeutic nutrition. Shreya Dutta, S Pradhan. S Sahu. A Chatterjee. Taurean Publication.
7. Principles of therapeutic nutrition and dietetics. Sharma A. CBS Publishers.
8. Fundamentals of Foods and Nutrition(2nded) Mudambi S.R, M.V Rajagopal. Wiley Eastern Ltd,
9. Nutrient Requirements and Recommended Dietary Allowance for Indians, ICMR: New Delhi.

Biostatistics

1. Statistics in Biology and Psychology by D. Das and A. Das. Academic Publishers.
2. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.
3. Medical Statistics by B.K. Mahajan. Jaypee Brothers, Medical Publishers Pvt. Ltd.
4. Biostatistics: Basic Concepts and Methodology for Health Science, Wayne W. Daniel & Chad L. Cross, Wiley
5. Biostatistics in Brief- Made Easy, K. Visweswara Rao, Jaypee Brothers Medical Publishers
6. Biostatistics- A Manual of Statistical Methods for Use in Health, Nutrition and Anthropology, K. Visweswara Rao, Jaypee Brothers Medical Publishers
7. Statistical Methods in Biology, Norman T.J. Bailey, Cambridge University Press.

Genetics

1. Genetics, Monroe W. StrickBerger, Pearson Education India
2. Genetics- A Molecular Approach, Petter J. Russell, Pearson Education India
3. Genetics: A Conceptual Approach, Benjamin A. Pierce, W H Freeman, and Company
4. Genetics: Analysis of Genes and Genomes, by DL Hartl and EW Jones & Bartlett Publishers
5. An Introduction to Genetic Analysis, 12th Edition, Griffith et al.
6. Problems on Genetics, Molecular Genetics and Evolutionary Genetics, 2nd edition, P.K. Banerjee
7. Fundamental of genetics. B D Singh. Medtech Science Press.
8. Introduction to Genetic Analysis, A J F Griffiths, J Doebley, C Peichel & D A Wassermann, W H Freeman and Company.

Human Evolution

1. Human Evolution. Bernard Campbell. Taylor and Francis Inc.
2. Morphology of primates and human evolution. R P Shrivastava. Prentice Hall India.
3. Fundamentals of human origin and evolution. Dr. Mrinal Sarma. Global Net publication.
4. The Study of Science: Human Evolution. Rusty Huddle (ed). Britanica.

Microbiology

1. Microbiology, Pelczar Tata McGraw-Hill.
2. General Microbiology. Stanier et.al, Prentice Hall.
3. Microbiology An Introduction, G.J Tortora, Pearson.
4. Prescott's Microbiology, J. Willey et.al., McGraw-Hill

Immunology

1. Kuby Immunology by T.J Kindt et.al, W.H Freeman.
2. Essential Immunology, by I.M. Roitt, Blackwell Scientific Publications.
3. Cellular and Molecular Immunology, A.K. Abbas et.al, Elsevier

Parasitology

1. Biology of Disease. Ahmed N, Dawson M, Smith C, Wood. Taylor and Francis Group.
2. Medical Parasitology. Arora D R, Arora B. II Edition. CBS Publications and Distributors
3. Textbook of Medical parasitology, 3rd edition, Chakraborty, P. New Central Book Agency.

Biotechnology, Bioinformatics and Computational Biology

1. A Textbook of Biotechnology, R.C. Dubey, S. Chand Company Limited.
2. Biotechnology, Bioinformatics, Biotechnology, B D Singh, MedTech science Press
3. Essential Bioinformatics, Jin Xiong, Cambridge University Press
4. Bioinformatics: Principles And Applications: Jhumur Ghosh, Bibekanand Mallick. OUP India; Illustrated Edition.
5. Bioinformatics-Databases, Tools and Algorithms. O. Bosu and S. K. Thukral., Oxford Higher Education
6. Introduction to Bioinformatics, Aurthur M. Lesk, Oxford University Press
7. An Introduction to Biotechnology: The Science, Technology and Medical Applications, Academic Press.
8. Basic Biotechnology, Bjorn Kristiansen, Colin Ratledge (Eds), Cambridge University Press.
9. Biotechnology for Beginners, Reinhard Renneberg et al., Academic Press.
10. Introduction to Bioinformatics. Attwood et. Al., Pearson.
11. Nanobiotechnology: Concepts, Applications and Perspectives, Niemeyer and Mirkin, Wiley India.

Industrial Microbiology

1. An Introduction to Industrial Microbiology. Dr. Shivkumar et al. S. Chand and Company Limited.
2. Industrial Microbiology, David B. Wilson, Hermann Sahm, Klaus-Peter Stahmann, MattheusKoffis (eds). Wiley.
3. The Art of Fermentation: An In-depth Exploration of Essential Concepts and Processes from Around the World, Sandor Ellix, Katz, Chelsea Green Pub.
4. Industrial Microbiology: An Introduction, Michael J. Waites, Neil L. Morgan, John S. Rockey, Wiley.

Environmental Microbiology.

1. Environmental Microbiology, Ji-Dong Gu, Ralph Mitchell (eds), Wiley.
2. Environmental Microbiology: From Genome to Biochemistry, Eugene L. Madsen, Wiley.

Work, Exercise, Sports Physiology

1. Exercise Physiology: Theory and Application to Fitness and Performance. S.K. Powers and E.T. Howley. 10th edition. McGraw Hill publishers.
2. Exercise Physiology: Nutrition, Energy, and Human Performance. W.D. McArdle, F.I. Katch and V.L. Katch. 7th edition. Lippincott, Williams & Wilkins publishers.
3. Physiology of Sport and Exercise. J. H. Wilmore, D. L. Costill, W. Larry Kenney. Human Kinetics
4. Textbook of Work Physiology: Physiological Bases of Exercise. Per- Olof Åstrand, Kaare Rodahl, Hans A. Dahl, Sigmund B. Strømme. Human Kinetics
5. Fox's Physiological Basis for Exercise and Sport by M. L. Foss. S. J. Keteyian, E. L. Fox , William C Brown Pub
6. The Physiology of Work, K. Rodahl, Taylor & Francis,
7. Essentials of Exercise Physiology, V.L. Katch, W.D. McArdle, F.I. Katch, Wolters Kluwer

Chronobiology & Stress Physiology

1. Chronobiology – The Biological Timekeeping, J.C. Dunlap, Sinauer Associates
2. The Rhythm of Life, M. Kelly, The New York Times Bestseller
1. Biological Rhythms, Vinod Kumar, Narosa Publishers
2. Physiology of Stress, Hans Selye, Jones, and Bartlett Publishers

Ergonomics

1. Fitting the task to the man: A textbook of Occupational Ergonomics. Kroemer and E Grandjean. Taylor and Francis.
2. Engineering Physiology: Bases of Human factors / Ergonomics, KHE Kroemer and HB Kroemer. Van Reinhold.

3. Body space: Anthropometry, Ergonomics and Design. S. Pheasant, Taylor and Francis
4. Human Factors in Engineering. EJ McCormick and H Saunders. 5th Edition. McGraw-Hill.
5. Ergonomics Man in His Working Environment. Murrell K. 3rd Ed. Springer.
6. Introduction to Ergonomics, R.S. Bridger, Routledge: Taylor & Francis group

Yoga:

1. Science of yoga. Understand the anatomy and physiology. ANN Swanson.DK publishers.
2. The Physiology of Yoga, Andrew McGonigle & Mathew Huy, Human kinetics.
3. Medical Understanding of Yoga, Prakash C Malshe, Notion Press.

SpaceBiology &, Aviation Physiology

1. Astrobiology and space medicine. Amartya Nandi and Bhaskar R. Puri. Notion Press.
2. Fundamentals of Space Biology.M Asashima and G M Malacinski. Japan Scientific Societies Press. Springer Verlag.
3. Physiology of Man in Space, J H U Brown, Academic Press
4. Human Physiology in Extreme Environment, Hanns Christian Gunga, Academic Press Inc
5. Space Physiology, Jay C Buckey, OUP USA
6. Space Physiology and Medicine, Arnauld E Nicogossian, Springer

Forensic Biology:

1. Forensic medicine & toxicology for medical students. Gautam Biswas. Jaypee Brothers Medical.
2. Essentials of forensic medicine & toxicology. KS Narayan Reddy. Jaypee Brothers Medical.

Environmental Physiology: Pollution

1. Pesticides by P.K. Gupta, Interprint. 4
2. Environmental Chemistry by P.K De. Wiley Eastern Ltd.
3. Environmental biology & toxicology. PD Sharma. Rastogi publications.

Cancer Biology &Stem cell Biology

1. Essentials of Stem Cell Biology. Robert Lanza and Anthony Atala (eds). Elsevier.
2. Concepts and Applications of Stem Cell Biology. Gabriela Rodrigues and Bernard Roelen. Springer.
3. Textbook of Cancer Biology. Dr. Pradeep Kumar. Prachi Digital Publication.
4. Molecular and Cell Biology of Cancer. Rita Fior and Rita Zilhao (eds). Springer

Instrumentation & Methodology

1. Biomedical Instrumentation & Measurements, by L. Cromwell, F.J. Weibel & E.A. Pfeiffer; Prentice-Hall..
2. Handbook of Biomedical Instrumentation. R S Khandpur.
3. Biophysics and Molecular Biology. Tools & Techniques. Pranav Kumar. Pearson.
4. Wilson and Walkers Principles and Techniques of Biochemistry and Molecular Biology, A Hofmann & S Cokie, Cambridge University Press.
5. Physical Biochemistry: Principles and Applications, David Sheehan, Wiley India

Practical Physiology

1. Textbook of Practical Physiology. G K pal, P Pal. University Press.
2. Ghai's Textbook of Practical Physiology. V.P. Varshney and Monal Bedi. Jaypee Brothers Medical Publishers.
3. Practical Physiology. Prasunpriya Nayak. Taurean Publications.
4. Practical Physiology. N Geetha. Jaypee Brothers Medical Publishers.

Histology

1. DiFiore's Atlas of Histology, V.P. Eroschenko, Wolters-Kluwer
2. Basic Histology, L.C. Junqueira & J Carneiro, McGraw- Hill.
3. Bailey's TextBook of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
4. Carleton's Histological Techniques, by R.A.B. Drury & E.A. Wellington, Oxford University Press.

Basic Computer Application

1. Computers in Biology. Anand Jain. Vision Publication.
2. Biostatistics and Computer Applications. Dr. Rajiv Goswami. Prints Publications Pvt Ltd.
3. Biostatistics, Computer applications and Bioinformatics. Er. A. Gopi et al. Saras Publication

PSI Lab Notebooks:

1. *Note Books on Practical Biochemistry (Published by the Physiological Society of India, Kolkata.)*
2. *Note Books on Experimental Physiology (Published by the Physiological Society of India, Kolkata.) and*
3. *Notebooks on Histology (Published by the Physiological Society of India, Kolkata.)*

Note: To maintain the uniformity of practical knowledge among the students of different Colleges, The Physiological Society of India has published Practical Note Books on Physiology comprising syllabi of different Universities, including Calcutta University with the help of experienced teachers of both Honours and General teaching degree colleges. Hence,

members of the Undergraduate Board of Studies in Physiology recommend the aforesaid Note Books for use by the students in undergraduate 4 yrHons, and 3 yr. MDC. course in Physiology.

DETAILED SYLLABUS

MINOR & MDC PAPERS IN PHYSIOLOGY

SEMESTER-I

MDC CC1

(History of Physiology, Cellular Physiology & Biochemistry)

MDC CC1THEORY (3 CREDITS; 75 MARKS)

Unit - I: History of Physiology

Origin of Physiology from ancient times: Contributions of Hippocrates, William Harvey, Claude Bernard, Ivan Petrovich Pavlov,Charles S. Sherrington, Subodh Chandra Mahalanabis, Narendra Mohan Basu.

Unit – II: Structural organization of human body: Cell and Tissues

Electron microscopic structure and functions of eukaryotic nucleus, endoplasmic reticulum, Golgi bodies, ribosome, mitochondria, lysosomes, peroxisomes, cytoskeletal elements, centrosomes, and plasma membrane. Cellular transport: simple diffusion, facilitated diffusion, active transport (primary and secondary), ion pumps, ion channels and ionophores, Tight junctions, gap junctions and anchoring junctions.Basic concepts of mammalian tissue: epithelial connective, muscular and nervous tissue.

Unit – III: Chemistry of Biomolecules – I

Carbohydrates: Definition and classification. Monosaccharides – Classification, structure. Chemical reactions of monosaccharides (Glucose):reactions with concentrated mineral acids, alkali, phenylhydrazine and their biochemical importance. Disaccharides – Maltose, Lactose and Sucrose: structure, occurrence, and physiological importance. Polysaccharides – starch, glycogen, dextrin, cellulose, glycosaminoglycans, glycoproteins, sialic acids.

Unit – IV: Chemistry of Biomolecules – II

Lipids: Definition and classification. Fatty acids - classification, systemic nomenclature (IUPAC & OMEGA), and structure. Mono-, Di- and Triglycerides. Properties of Fat and Fatty acids: hydrolysis, saponification number, iodine number, acetyl number, acid number and Reichert-Meissl number. Cis-trans isomerism. Phospholipids, Sphingolipids, Steroids and Cholesterol, its ester -their structure and physiological importance. Lipoproteins - Structure and classification.

Unit – V: Chemistry of Biomolecules - III

Amino acids: classification, structure, nomenclature, and optical properties. Protonic equilibria of amino acids – Zwitterions, Isoelectric point. Reactions with ninhydrin and formaldehyde. Peptides and Proteins: Structure and properties of peptide bonds. Reactions with Sanger's and Edman's reagent. Biuret reaction. Different levels of protein structure: Primary, Secondary (α-helix and β-pleated sheet), Tertiary and Quaternary. Forces stabilizing the structures. Denaturation and Renaturation of protein.

Purine and Pyrimidine bases: Structure, nomenclature. Nucleic acids: Nucleosides and Nucleotides. DNA double helix, Primary, Secondary: A-DNA, B-DNA and Z-DNA. RNA - Structure, types, features. Denaturation and annealing of DNA. Hyperchromicity, melting temperature and half Cot value.

MDC CC1 PRACTICAL (1 CREDIT; 25 MARKS)

1. Examination and staining of fresh tissues: Squamous, Ciliated and Columnar Epithelium by Methylene Blue stain.
2. Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, Lactic Acid, Uric Acid, Albumin, Gelatin, Peptone, Starch, Dextrin, Glucose, Fructose, Lactose, Sucrose, Urea, Acetone, Glycerol and Bile salts.

Distribution of questions:

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: MDC-SEC

(Clinical Importance of Biomolecules, Microscopy, Analytical Techniques, Work & Exercise Physiology)

MDC SEC THEORY (2 CREDIT: 50 MARKS)

Unit – I: Clinical importance of biomolecules

Carbohydrates: Estimation of blood glucose.Glycosuria, Oral glucose tolerance test, Hyper &Hypoglycaemia, Lipids: estimation of blood lipid profile, hypercholesterolemia, hyperlipoproteinemia, atherosclerosis. Proteins: estimation of serum albumin, hypoalbuminemia, hypo-proteinemia. Bence Jones proteins.

Unit – II: Methods of cell study: Microscopy

Principles of construction and uses of compound microscope, phase contrast microscope, polarizing microscope, fluorescence microscope, transmission &scanning electron microscope. Concept of numerical aperture and resolution.

Unit – III: Common analytical techniques

Chromatography and centrifugation: Principles and uses of paper chromatography, thin layer chromatography, size exclusion chromatography, Electrophoresis: principle, method and uses of agarose gel electrophoresis, SDS-PAGE, Principles of centrifugation, ultracentrifugation.

Unit IV: Work and Exercise Physiology-I

Fundamental concepts of work- different categories of work. Physical work, its definition and nature—isotonic, isometric, isokinetic, positive, and negative work. Concept of physiological work. Power and capacity relation. Workload – light, moderate (submaximal) and heavy (maximal) depending on intensity and duration of work. Study of changes in heart rate, oxygen consumption and blood pressure to assess person's ability to withstand work load.

Unit-V: Work and Exercise Physiology-II

Concept of energetics: work, power, and energy. Sources of energy and energy demand for different activities. Determination of energy cost at rest, work, and fatigue by direct and indirect methods.Aerobic and anaerobic capacity. Athletic performance based on aerobic and anaerobic capacity. EPOC, lactate threshold and lactate tolerance. Brief idea about nutritional aspects of sports.

MDC SEC PRACTICAL (1 CREDIT, 25 MARKS)

1. Concept of molecular weight, equivalent weight, molaritynormality, primary and secondary standard.
2. Determination of strength of the supplied NaOH solution by titrating against N/10 oxalic acid.

3. Determination of BMI, BSA, PI, and waist hip ratio.
4. Determination of physical fitness by modified Harvard Step Test.

***Distribution of Questions**:*

1. SEC Theory: One question of 10 marks from each unit with one alternative to be set. The 10 marks question may be subdivided (Maximum marks not to exceed 5).
2. SEC Practical: Experiments: 30 (Minimum 2 experiments to be set), Viva-voce-10, Laboratory Note Book:10.

INTERDISCIPLINARY COURSE (IDC)

IDC THEORY: (2 Credits; 50 marks)

Unit-I: Cells, Tissues, Systems, Organs of Human Body

Cells in relation to human physiological functions, Cell organelles and their functions. Physiological system as a cluster of cells and tissues. Location and basic functions of major body-organs: Heart, Lung, Brain, Spinal cord, Liver, Stomach, Pancreas, Kidney, Digestive tract, Intestines, Sense organs, Reproductive organs.

Unit-II: Biophysical and Biomolecular Phenomena

Importance of major biophysical parameters in Physiology: Diffusion, Surface Tension, Absorption, Adsorption, pH, Buffer. Macro and Micronutrients and biomolecules involved in maintenance of human health: Definition with primary classifications, examples and functions of Carbohydrate, Protein, Lipids, Vitamins, and enzymes.

Unit-III: Regulation and coordination of internal system

Composition and functions of blood; functions of different blood cells. Composition and functions of Plasma proteins,hemoglobin molecule and anaemia. Exchange of respiratory gasses between lung and blood, and blood and tissue and their functions. Definition of hormone. Major secreting hormones and their important functions: Pituitary, Adrenal, Thyroid and Pancreas. Primary concept on Nerve fibers, Synapses, reflex action. Functional difference between central nervous system and peripheral nervous system.

Unit-IV: Applied Physiology

Haematology: Definition, ABO, and Rh Blood group system. Precautions of blood transfusion, Concept of Blood Bank. Microbiology and Immunology: Types of microbes, Beneficial and harmful bacteria with examples.Definitions of Antigen and Antibody and Antibiotic and Vaccine with examples. Biotechnology: Outline concept and its modern applications. Basic concepts of Ergonomics and its importance in occupational health. Sports and Exercise Physiology: Physical fitness. Classification of sports, Basic concept of anthropometry. Application of statistics in biological science, Basic concept of population biology and Sample.

Unit-V: Common Diseases and Patho-physiological significance

Prevailing global communicable and non-communicable diseases, their primary causes and suggested measures: Influenza, Tuberculosis, Hepatitis, COVID-19, Diabetes mellitus, Haemophilia, Thalassaemia, COPD, Heart failure, Stroke, Hypothyroidism, Obesity, Stress. Pathophysiological tests, their normal range in the system and indicative diseases: TC, DC, ESR, Arneth Count, Fasting and Post-prandial blood sugar tests, Glycosylated haemoglobin, Bilirubin, Urea, Uric acid, Creatinine, SGOT, SGPT, Alkaline Phosphatase, Acid Phosphatase.

IDC Practical: (1 credit: 25 marks)

1. Determination of Heart rate and Respiratory Rate.
2. Measurement of systolic and diastolic arterial blood pressure by sphygmomanometer and determination of pulse pressure and mean pressure.
3. Determination of Body Mass Index and Body Surface Area by using nomogram.

Distribution of marks:

1. IDC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
3. IDC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

SEMESTER-II

PAPER: MDC CC2

(Cell Signalling, Biophysics, Enzymes, Basic Genetics, & Haematology-I)

MDC CC2 THEORY (3 CREDITS; 75 MARKS)

Unit I:Cell Signaling

Definition, Types (Autocrine, Endocrine, Paracrine, and Juxtacrine), Stages of signaling (Reception, Transduction & Response): Cell surface receptor: Ion-channel, G-protein, and Enzyme-coupled receptors. Intracellular messengers—cAMP, cGMP, IP3, DAG, Protein kinases, Calcium. Signal transduction pathways: JAK-STAT.

Unit II: Biophysics and Biophysical Principles

Diffusion: Fick's law & physiological applications. Osmosis: Osmotic pressure, laws, Physiological applications. Basic concepts of Osmolarity and Tonicity. Surface tension, Viscosity, and Adsorption: Physiological applications. pH, their physiological significance. Buffers: Henderson-Hasselbalch equation. Physiological buffers. Colloids: Classification and properties: optical, electrical & electrokinetic, physiological application. Thermodynamics: Type of surroundings and systems. First law- Internal energy, Enthalpy. Second law- Entropy.

Unit III: Enzyme

Definition, Chemical nature of enzymes. Ribozymes and Abzyme. EC classification. Concept of Apoenzyme, Holoenzyme, Coenzyme, Cofactors, and Prosthetic group. Metals in enzyme activity. Enzyme-substrate complex— Active site, Binding site, Fischer's Lock and Key model & Koshland Induced Fit model of ES interaction. Specificity of enzyme. Single-substrate Michaelis-Menten Kinetics of Enzymes—Initial velocity (V_0), Maximum velocity (V_{max}) & Steady-state kinetics. Characteristics of Michaelis Constant (K_m). Factors influencing enzyme-catalyzed reactions: Substrate concentration, Enzyme concentration, pH & Temperature and Q_{10} value. Enzyme inhibitions: Basic concepts. Rate limiting enzymes and its features. Isozymes.

Unit IV: Basic Genetics & Molecular Biology

Basic concepts of Mendelian Genetics. Laws of inheritance. Chromosome: structure and classification, Crossing over, linkage and recombination. Euchromatin and heterochromatin. Human genome and its characteristics (basic concept). Nuclear & Mitochondrial DNA. Karyotyping. Molecular Biology: Central dogma.

Unit V: Hematology-I

Bone marrow: Types. Formed elements of blood: origin, functions, and fate. Haematopoiesis: Erythropoiesis & its regulation: Role of Erythropoietin and vitamins. Plasma proteins: composition, normal values, origin, and functions. Plasmapheresis. Haemoglobin-structure, biosynthesis, compounds & derived products, catabolism. Foetal haemoglobin. Abnormal haemoglobins. Blood volume and haematocrit. Blood groups: ABO & Rh system. Immunological basis of identification.

MDC CC2-2 PRACTICAL (1 CREDIT, 25 MARKS)

1. Blood film: Preparation of blood smear, staining and identification of blood cells.
2. Estimation of Haemoglobin by Drabkin's method.
3. Histological Slides- (Hyalin Cartilage, Lung, Artery, Vein, Lymph Gland, Spleen, Thyroid, Testis, Ovary, Uterus)
4. Haemin crystal.

Distribution of Questions:

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

SEMESTER-III

PAPER: MDC CC3

(Cardio-Respiratory Physiology, Digestion, Haematology and Biostatistics.)

MDC CC3 THEORY: (3 CREDIT; 75 MARKS)

Unit-I: Cardiovascular Physiology

Anatomy of the heart and blood vessels. Properties of cardiac muscle. Origin and propagation of cardiac impulse. Stannius ligature. Heart sounds, Pulse: arterial and venous. Cardiac cycle: Events, Cardiac Output: factors affecting CO. Starling's law of heart. Electrocardiography: Concept of normal ECG. Blood pressure: measurement and factors affecting. Concept of hypertension and hypotension.

Unit-II: Respiratory Physiology

Anatomy and histology of the lung and airways, Mechanics of breathing: role of respiratory muscles. Lung compliance. Alveolar surface tension and surfactant. Transport of gases in body: Oxygen dissociation curve of adult and myoglobin – factors affecting. Lung function tests. Spirometry: Definition, uses in the measurement of lung volumes and lung capacities. Dead space. Non-respiratory functions of lung.

Unit-III: Digestion

Gross anatomy and histology of GI tract. Digestive glands: Salivary glands, Pancreas, Liver- histological structures. Composition, functions, and regulation of gastric. Deglutition and movements of the alimentary canal and its mechanism. Enteric brain. Defecation. Digestion and absorption of

carbohydrates, proteins, lipids: Role of enzymes and bile salts. Postprandial alkaline tide. Enterohepatic circulation. Basic concepts of Peptic Ulcer, Jaundice.

Unit-IV: Haematology -II

Introduction to Body Fluids: Composition and function of: Blood, Lymph, Cerebrospinal Fluid, Synovial Fluid. Plasma and Serum: Differences and Clinical Importance Hemostasis: Definition, Stages & purpose. Coagulation: mechanism; Coagulation Factors and Pathways. Fibrinolysis. Pro and anticoagulants.

Unit-V: Biostatistics-I

Definition, Scope, and Applications of Biostatistics Types of Variables: Qualitative and Quantitative. Sample and population. Sampling techniques. Organisation of data: class, class intervals, class limits. Presentation of Data: Data Tabulation, Graphs (Bar/column plot, Frequency polygon, Histogram), and Diagrams (Pie diagram). *Measures of Central Tendency & distribution:* Mean, Median, Mode. Measures of Dispersion: Range, Variance, Standard Deviation, Standard error, and standard score (z score). Degree of freedom.

MDC CC3 PRACTICAL (1 CREDIT, 25 MARKS)

1. Determination of BP and calculation of mean arterial pressure and pulse pressure.
2. Determination of Peak Expiratory Flow Rate using Peak flow meter.
3. Identification of permanent histological slides (tongue, oesophagus, stomach, duodenum, jejunum, ileum, large intestine, parotid, submandibular, sublingual salivary glands, liver, and pancreas).
4. Pneumographic recording of normal chest movements and effects of hyperventilation and breath holding.

Distribution of questions:

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

SEMESTER-IV

PAPER: MDC CC4

(Metabolism and Nutrition)

MDC CC4THEORY (3 CREDITS: 75 MARKS)

Unit-I: Metabolism I

Carbohydrate Metabolism*:* Glycolysis and TCA Cycle (metabolic pathways, energetics, metabolic significances); Gluconeogenesis (metabolic pathways and significances); Pentose Phosphate Pathways (metabolic pathways, significances), Glycogen metabolism (metabolic pathways).

Unit-II: Metabolism II

Lipid Metabolism: β-Oxidation (pathway and energetics), Biosynthesis of Fatty acids (saturated: pathways with special reference to Fatty acid synthase complex. Phospholipids (Biosynthetic pathways); Ketone bodies (Metabolism and clinical significances). Rate limiting steps have to be discussed.

Unit-III: Metabolism III

Amino acids Metabolism: Concepts of glucogenic and ketogenic amino acids, amino acid pool, Deamination (Oxidative and non-oxidative), Trans deamination, amination, decarboxylation, transamination (mentioning the role of PLP); Urea cycle (metabolic pathway and energetic). Redox Biology*:* Redox potential: Basic concept; Mitochondrial Electron Transport Chain (Organization and functions of different components); Oxidative phosphorylation (Chemiosmotic hypothesis).

Unit-IV: Nutrition I

Vitamins—Water-soluble vitamins: Thiamine, Riboflavin, Niacin, Pyridoxine, Pantothenic acid, Biotin, Cyanocobalamin, Folic acid, Ascorbic acid, Inositol. Fat-soluble vitamins: A, D, E & K. *Minerals*—Sources, physiological functions of sodium, potassium, calcium, selenium, phosphorus, iron, zinc, iodine and fluoride. *Energy metabolism*— Respiratory quotient. Basal Metabolic Rate- Determination and Factors affecting. Specific Dynamic Action of Food.

Unit V: Nutrition II

Constituents of food and their significance. Calorific value of food. Body calorie requirements-adult consumption unit. Dietary requirements of carbohydrate, protein, lipid and other nutrients. Balanced diet and principles of formulation of balanced diet for sedentary adult male and female. Nitrogen balance, essential amino acids biological value of proteins. Protein sparers. Protein efficiency ratio and net protein utilization. Dietary fibres. Principles of diet survey. Composition and nutritional value of common foodstuffs. Physiology of starvation and obesity.

MDC CC4 PRACTICAL (1 CREDIT, 25 MARKS)

1. Quantitative estimation of glycine amino nitrogen by Sorensen's formol titration method (percentage and total).
2. Qualitative identification of starch and protein in rice and pulse.
3. Diet survey in family by recall / weighmentmethod.

Distribution of questions:

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Diet Survey Report; 5, Experiments: 12 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER-MDC CC5

(Excretory Physiology, Skin & Body Temperature, Nerve-Muscle Physiology, Nervous System, and Special Senses)

MDC CC5 THEORY (3 CREDITS: 75 MARKS)

Unit – I: Renal Physiology and Regulation of Body Fluids

Kidney – structure and function. Formation of urine- Ultrafiltration, tubular functions. Renal clearance test, Peculiarities of renal blood flow, Renal circulation, Juxtaglomerular Apparatus in blood pressure regulation and Acid-base balance – concept. Normal and abnormal constituents of urine. Chronic Kidney Disease (CKD) – basic concept.

Unit–II:Skin & Body Temperature Regulation

Ultrastructure of skin, physical processes of heat loss and heat conservation, composition of sweat and sebum, mechanism of sweat secretion- Factors affecting sweat secretion. Hyperthermia and Hypothermia.

Unit–III:Nerve-muscle Physiology

Anatomy of neurons - dendrites, axon, synaptic terminals; Resting membrane potential and action potential generation;Structure of the neuromuscular junction (NMJ). Mechanism of neurotransmitter release (acetylcholine) and its role in muscle contraction.Muscle Twitch- Isometric and Isotonic Contractions, Muscle Fatigue.

Unit–IV:Outline of Nervous System

Neurons, nerve and Glial Cells- Types and function. Central Nervous System (CNS): Brain (cerebrum, thalamus, hypothalamus, cerebellum, brainstem) and spinal cord- major functions. Limbic System and Basal Ganglia (only function). Peripheral Nervous System (PNS): Nerves and ganglia, sensory and motor components. Autonomic Nervous System (ANS): Sympathetic and parasympathetic – functions. Reflex Arcs: Components of a monosynaptic reflex, the role of spinal cord in reflex actions, and examples (e.g., patellar reflex).Sensory pathways (kinesthetic sensation) and Motor pathway (Pyramidal tract)- functions only.

Unit-V:Special Senses

Vision and the Visual System- Basic structures of the eye- cornea, lens, retina, and optic nerve. Rod and Cone cells. Phototransduction and visual processing. Concept of colour vision and colour blindness. Hearing and the Auditory System- outer ear, middle ear, and inner ear (cochlea and auditory nerve). Mechanisms of sound transmission, from vibration to neural signals. Taste and the Gustatory System-Structure and function of taste buds and the tongue. Mechanisms of taste perception.Smell and the Olfactory System-Anatomy of the olfactory receptors and the olfactory bulb. Mechanisms of odor detection.

MDC CC5 PRACTICAL (1 CREDIT, 25 MARKS)

1. Qualitative identification of normal and abnormal constituents of urine (Chloride, Phosphate, Sulphate, Creatinine, Urea, Glucose, Protein, Acetone, Bile salts).
2. Silver nitrate preparation of Nodes of Ranvier
3. Identification of permanent slide- Kidney, Ureter, Skin, Skeletal muscle, Cardiac muscle, Spinal Cord, Cerebrum, Cerebellum.

Distribution of questions:

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

SEMESTER-V

PAPER MDC CC6

(Endocrine Physiology)

MDC CC6 THEORY (1 CREDIT; 75 MARKS)

Unit 1: Endocrinology I

Hypothalamus as a neuroendocrine organ. Hypothalamo-hypophyseal portal system. Feedback regulation- basic concept. Anterior and posterior pituitary- histology, chemical nature, mechanism of action and regulation of secretion, and functions of hormones secreted from these glands. Pineal gland- histology, chemical nature, functions, regulation of secretion of melatonin. Disorders- Dwarfism, Gigantism, Acromegaly, Cushing's disease, Diabetes insipidus.

Unit II: Endocrinology II

Thyroid and Parathyroid Glands- Histological structures, chemical nature, biosynthesis, mechanisms of action, functions, regulation of secretion of the hormones.Disorders- Non-toxic goiter, myxedema, cretinism, Hashimoto's thyroiditis, Grave's disease, tetany.

Unit III: Endocrinology III

Adrenal cortex and medulla- Histology, chemical nature, mechanisms of action, functions, regulation of secretion of the hormones. Diseases and disorders associated with hypo and hyperactive states of the gland. Disorders- Cushing's syndrome, congenital adrenal hyperplasia, Addison's disease, Pheochromocytoma.

Unit IV: Endocrinology IV

Pancreas- Histological structure of pancreatic islets, chemical nature, mechanisms of action, functions, and regulation of secretion of the hormones. Diseases associated with hypo and hypersecretion of these hormones. Disorders- Diabetes mellitus, hyperinsulinism, Zollinger-Ellison syndrome.

Unit V: Endocrinology V

Gastrointestinal hormones: chemical nature, mechanisms of action, functions, and regulation. Hormones secreted from heart, kidney, liver, thymus gland.

MDC CC 6 Practical: (1 CREDIT; 25 MARKS)

1. Quantitative estimation of percent glucose by Benedict's method.
2. Random blood sugar estimation using glucometer.
3. Determination of serum cholesterol using biochemical kit.

Distribution of questions:

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

PAPER: MDC CC7

(Reproductive Physiology, Developmental Biology, and environmental Biology)

MDC CC7 THEORY (3 CREDITS; 75 MARKS)

Unit-I: Reproduction-I

General components and basic anatomy of Reproductive system. Sexual development- *in utero*, after birth, Puberty. Menopause, male climacteric. Primary and accessory sex organs and secondary sex characters. Male reproductive tract, histology of testis, spermatogenesis, testicular hormones: chemical nature, functions. Hypothalamic-pituitary-testicular axis.

Unit-II: Reproduction II

Female reproductive tract. Anatomy and histology of ovary. Growth, development and function of the ovarian follicle, ovulation, formation, function, and degeneration of corpus luteum. Ovarian hormones-functions. Hypothalamic control. Human menstrual cycle and its regulation. Structure and functions of placenta., endocrine and other physiological changes during pregnancy. physiology of parturition, development of mammary glands, lactation and its hormonal control.

Unit-III: Reproductive Health

Male infertility- mechanism and treatment, diseases associated with male reproductive tract. Female infertility- mechanism and treatment. Abnormalities in menstrual cycle, Maintenance of pregnancy, pregnancy test. Conception and contraception.

Unit-IV: Developmental Biology

Fertilization- process. Totipotency, Pluripotency, and multipotency. Cleavage- Types of cleavage based on plane and pattern. Formation of morula Blastocyst formation and implantation, Gastrulation and germ layer differentiation, Placenta- Structure, types, functions, and hormonal role. Foetal Circulation- anatomy and peculiarities. Changes after birth. Endochondral ossification.

Unit-V: Environmental Biology

Pollution: Noise, Air, Water, Soil- causes, pathophysiological effects, and preventive measures. Green House Effect. Carbon footprint. Toxic effects of Heavy metals on human health: Arsenic, lead, cadmium, mercury, aluminium. Effects of Pesticides on human health. Particulate toxicity- pneumoconiosis, silicosis, asbestosis, bagasosis.

MDC CC7 PRACTICAL (1 CREDIT; 25 MARKS)

1. Study of different stages of oestrous cycle from permanent slides.
2. Pregnancy test by immunological method using kit using synthetic hCG solution.
3. Determination of WBGT index,
4. Estimation of Noise level of a given area.

Distribution of questions:

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

SEMESTER-VI

PAPER MDC CC8

(Epidemiology, Microbiology & Immunology, Dietetics and Therapeutic Nutrition)

MDC CC8 THEORY (3 CREDITS; 75 MARKS)

Unit-1: Epidemiology:

Definition, methods and surveys, study designs- case control and cohort studies (prospective and retrospective), Techniques of sampling, sources of bias, Data: Primary and Secondary Sources. Epidemiological concept of rate, ratios and proportions, Definition, of infant, child & maternal mortality rates, Under five mortality rate, Birth Rate and Crude death rate with sources of relevant statistics. Growth charts: plotting and monitoring, Assessment of nutritional status by anthropometry; stunting, wasting, and undernutrition. Epidemiological questionnaire: Basic concepts.

Unit-II Microbiology

Viruses - DNA virus and RNA virus. Viroids and Prions. Bacteriophages. Bacteria-structure and morphological classification. Gram positive and Gram negative and acid-fast bacteria. Pathogenic and non-pathogenic bacteria - definition with a few examples. Physical and chemical methods used in disinfection, sterilization and pasteurization. Nutritional requirement – complex and synthetic media, preparation of media; physical factors required for growth (temperature, pH and gaseous requirement). Bacterial growth curve. Elementary idea of bacteriostatic and bacteriocidal agents.

Unit-III Immunology

Immune system and immunological organs. Immunological barriers. Immunogens, antigens, and hapten. Overview of innate and acquired immunity. Overview of Humoral and cell mediated immunity. T cells, B cells, antigen presenting cells- Functions. Phagocytosis. Antibody-classification, structure, and functions. Epitope and paratope. Antigen-Antibody reaction. Toxins and toxoids. Vaccination – Passive and active immunisation, types and uses of vaccine. Immunological basis of allergy and inflammation.

Unit-IV: Dietetics & Therapeutic Nutrition

Principles of formulation of balanced diet.Nutritional requirement and dietary management of pregnancy, lactation, and old age. Basic concepts of diet therapy. Classification of therapeutic diets based on texture and nutrient restriction/modification. Nutritional concern and management of Obesity, Nutritional anaemia, Diabetes, Hypertension (DASH), and renaldiseases. Gluten free diet in celiac disease, Autoimmune diet. Keto diet.

Unit-V: Food Additives & Adulterants**:** Food additives: Definition and classification (preservatives, colouring agents, flavour enhancers, sugar substitutes and emulsifiers). Food adulterants: Definition, classification (intentional, & non intentional). Common adulterants in Food samples: Milk, honey, ghee, butter, coffee, turmeric powder, chili powder, mustard seed/oil, besan and black pepper. DART. Pathophysiological effects: Metanil yellow, Rhodamin B, Saccharin, Monosodium glutamate, Chicory, feed grade urea, Malachite green and Margarine.

MDC CC8 PRACTICAL (1 CREDIT: 25 MARKS)

1. Food Adulteration Tests: As per DART guidelines (Turmeric powder, chili powder, green vegetables, milk, honey, coffee)
2. Diet chart formulation in Pregnancy/Lactation, and Diabetes/Hypertension.

Distribution of Questions*:*

1. CC Theory: One question of 15 marks from each unit with one alternative to be set. The 15 marks question may be subdivided (Maximum marks not to exceed 5).
2. CC Practical: Experiments: 17 (Minimum 2 experiments to be set), Viva-voce-04, Lab. Notebook: -04.

Suggested Readings for Minor & MDC:

1. CC Chatterjee's Human Physiology. Volumes I and II. CBS Publishers and Distributers Pvt Ltd.
2. Concise Medical Physiology. Sujit K. Chaudhuri. New Central Book Agency.
3. Essentials of Medical Physiology. K.Sembulingam and P. Sembulingam.Jaypee Brothers Medical Publishers (P) Ltd.
4. Essentials of Medical Physiology. A.B.S. Mahapatra and G.S. Mahapatra. Current Books International.
5. Principles of Physiology, D.Pramanik, Academic Publishers, Kolkata.
6. Joshi's Physiology: Prep Manual for Undergraduates, Sadhana Joshi-Mendhurwar. Elsevier
7. Parks Text Book of Preventive and Social Medicine. K.Park. Banarasidas Bhanot Publishers
8. Biochemistry. D.Das. Academic Publishers.
9. Biochemistry. U.Satyanarayana and U. Chakrapani. Elsevier.
10. Biophysics. R. N. Roy. New Central Book Agency
11. A Text Book of Microbiology. P.Chakraborty.New Central Book Agency.
12. Immunology: Introductory Text Book. Nandini Shetty. New Age International Publishers.
13. *Sharirbigyan* (Bengali) Vol. I & 2, J. Debnath, Sridhar Prakashani.
14. *Byaboharik Sharirbigyan.*(Bengali). J Debnath. Sridhar Prakashani
15. *Paripak, Bipak 0 Pusti,*(Bengali) D. Das, Paschim Banga Rajya Pustak Parshad.
16. *Snatak Sharirbidya*, (Bengali). A. Bandopadhyay, Calcutta Book House.
17. *Snatak Sharirbidya*. (Bengali). Masanta Das, Santra Publication.
18. Practical Physiology (Bengali), by M.K. Manna, Sritara Prakashani, Kolkata
19. Nutritive Value of Indian Foods by C. Gopalan and other, NIN, Hyderabad. 20.