UNIVERSITY OF CALCUTTA

Notification No. CSR/57/2025

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 21.08.2025 approved the new revised Course structure and syllabus (Semester-1 to 6) of Physiology (4-year Honours & Honours with Research /3-year MDC), after incorporating some amendments in the said syllabus, under CCF.

The new CSR shall be applicable for semester-1 to 6 and shall take effect from the Odd semester examinations, 2025 and onwards.

27/8/2025

Prof.(Dr.) Debasis Das

Registrar

SENATE HOUSE

Kolkata-700073

27.08.2025

CURRICULUM FRAMEWORK FOR UNDERGRADUATE PROGRAMME

IN

PHYSIOLOGY

REVISED SYLLABUS

(SEMESTER – I TO SEMESTER – VI)

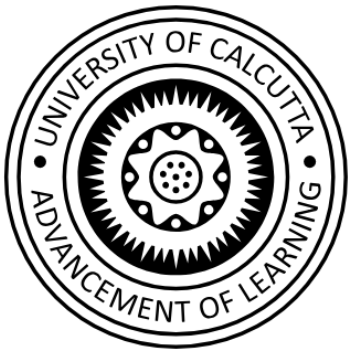
FOR

4 YEARS HONOURS/HONOURS WITH RESEARCH

AND

3 YEARS MDC COURSES IN PHYSIOLOGY

(Under Curriculum & Credit Framework, 2022, NEP)



UNIVERSITY OF CALCUTTA

University of Calcutta
Physiology Syllabus (1st Sem - 6th Sem)
Major-Minor-MDC

Sem-1

Paper	Course	Name of the Paper	Credit	Pg. No.
DSCC1	PHYM	Introductory Physiology: Human Body Organisation, Body Fluids and Biophysics	3+1=4	4
SEC 1	PHYM	Laboratory methods in Microscopy and Clinical Haematology	2+2=4	5
MN 1	MPHY	Introductory Physiology: Human Body Organisation, Body Fluids and Biophysics	3+1=4	33
CC1	MPHY-MDC-CC	Introductory Physiology: Human Body Organisation, Body Fluids and Biophysics	3+1=4	33
SEC 1	MPHY-SEC	Clinical haematology, therapeutic nutrition, public hygiene, basic lab. techniques and food adulterants	2+2=4	35
IDC 1	PHYD	Elementary Physiology	2+1=3	34

Sem 2

Paper	Course	Name of the Paper	Credit	Pg. No.
DSCC2	PHYM	Chemistry of Biomolecules and Enzymes	3+1=4	7
SEC 2	PHYM	Tools and Techniques in Clinical & Analytical Biochemistry and Environmental Assessment	2+2=4	8
MN 2	MPHY	Chemistry of Biomolecules and Enzymes	3+1=4	36
CC 2	MPHY-MDC-CC	Chemistry of Biomolecules and Enzymes	3+1=4	36
SEC 2	MPHY-SEC	Clinical haematology, Therapeutic Nutrition, Public hygiene, Basic Lab. techniques and Food adulterants	2+2=4	35
IDC 2	PHYD	Elementary Physiology	2+1=3	34

Sem 3

Paper	Course	Name of the Paper	Credit	Pg. No.
DSCC 3	PHYM	Digestive System, Nutrition and Dietetics	3+1=4	9
DSCC 4	PHYM	Metabolism	3+1=4	11
SEC 3	PHYM	Tools and Techniques in Community Physiology	2+2=4	12
MN 1	MPHY	Introductory Physiology: Human Body Organisation, Body Fluids and Biophysics	3+1=4	33
CC 3	MPHY-MDC-CC	Digestive System, Nutrition, Dietetics and Metabolism	3+1=4	37
MDC-Mn-1	MPHY-MDC-Minor	Introductory Physiology: Human Body Organisation, Body Fluids and Biophysics	3+1=4	33
SEC 3	MPHY-SEC	Clinical haematology, Therapeutic Nutrition, Public hygiene, Basic Lab. techniques and Food adulterants	2+2=4	35
IDC 3	PHYD	Elementary Physiology	2+1=3	34

Sem 4

Paper	Course	Name of the Paper	Credit	Pg. No.
DSCC 5	PHYM	Cardiovascular and Respiratory Physiology	3+1=4	13
DSCC 6	PHYM	Genetics and Molecular Biology	3+1=4	14
DSCC 7	PHYM	Nerve Muscle Physiology, Renal Physiology, Integumentary System and Altered Environment	3+1=4	16
DSCC 8	PHYM	Neurophysiology and Stress Physiology	3+1=4	17
MN 2	MPHY	Chemistry of Biomolecules and Enzymes	3+1=4	36
CC 4	MPHY-MDC-CC	Cardiovascular, Respiratory, Nerve-Muscle and Renal Physiology	3+1=4	38
CC 5	MPHY-MDC-CC	Nervous and integumentary system, Environmental Physiology, Community & Public Health	3+1=4	40
MDC-Mn-2	MPHY-MDC-Minor	Chemistry of Biomolecules and Enzymes	3+1=4	36

Sem 5

Paper	Course	Name of the Paper	Credit	Pg. No.
DSCC 9	PHYM	Special Senses, Biomedical Techniques, Aviation and Space Physiology	3+1=4	18
DSCC 10	PHYM	Higher Functions of Brain, Neuroendocrinology, Neurodegeneration and Chronobiology	3+1=4	19
DSCC 11	PHYM	Endocrinology	3+1=4	21
DSCC 12	PHYM	Reproductive Physiology and Developmental Biology	3+1=4	22
MN 3	MPHY	Digestive System, Nutrition, Dietetics and Metabolism	3+1=4	37
MN 4	MPHY	Cardiovascular, Respiratory, Nerve-Muscle and Renal Physiology	3+1=4	38
CC 6 (both CC1 & 2)	MPHY-MDC-CC	Special Senses, Endocrine and Reproductive Physiology	3+1=4	41
CC 7 (forCC1 only)	MPHY-MDC-CC	Histology, Clinical Biochemistry, Molecular Biology, Evolution and Biostatistics	3+1=4	42
MDC-Mn-3	MPHY-MDC-Minor	Digestive System, Nutrition, Dietetics and Metabolism	3+1=4	37
MDC-Mn-4	MPHY-MDC-Minor	Cardiovascular, Respiratory, Nerve-Muscle and Renal Physiology	3+1=4	38

Sem 6

Paper	Course	Name of the Paper	Credit	Pg. No.
DSCC 13	PHYM	Microbiology, Immunology and Cancer Biology	3+1=4	23
DSCC 14	PHYM	Work & Sports Physiology, Ergonomics and Occupational Health	3+1=4	24
DSCC 15	PHYM	Community & Public Health, Parasitology, Pharmacology, and Biostatistics-II	3+1=4	26
MN 3	MPHY	Digestive System, Nutrition, Dietetics and Metabolism	3+1=4	37
MN 4	MPHY	Cardiovascular, Respiratory, Nerve-Muscle and Renal Physiology	3+1=4	38
CC 7 (for CC2 only)	MPHY-MDC-CC	Histology, Clinical Biochemistry, Molecular Biology, Evolution and Biostatistics	3+1=4	42
CC 8 (bothCC1 & 2)	MPHY-MDC-CC	Microbiology, Immunology, Work & sports Physiology, Ergonomics and Occupational Health	3+1=4	43
MDC-Mn-5	MPHY-MDC-Minor	Special Senses, Endocrine and Reproductive Physiology	3+1=4	41
MDC-Mn-6	MPHY-MDC-Minor	Microbiology, Immunology, Work & sports Physiology, Ergonomics and Occupational Health	3+1=4	43

* *Abbreviations:
PHYM- Physiology Major
MPHY- Physiology Minor
DSCC- Discipline Specific Core Course
SEC- Skilled Enhancement Course
IDC- Interdisciplinary Course
MN- Minor paper (4 yrs.)
MDC- Multidisciplinary Course (3 Yrs.)
CC- Core Course (3 Yrs)
MN- Minor paper (3 Yrs)

DETAILED SYLLABUS

PHYSIOLOGY HONOURS (MAJOR)

SEMESTER-I

PAPER: DSCC-1

*(*Introductory Physiology: Human Body Organisation, Body Fluids and Biophysics*)*

Total credit – 04 *Total marks: 100*

DSCC 1 Theory (3 Credits, 75 Marks)

Unit I: Cell I

Structure and functions of the eukaryotic nucleus, mitochondria and its biogenesis, Golgi apparatus, endoplasmic reticulum, ribosome, lysosomes, and peroxisomes. Cytoskeletal proteins—microtubules, microfilaments,intermediate filaments, andcentrioles. Integrative functions of the GERL system and lysosome & peroxisome. Cell division—mitosis and meiosis. Cell cycle—phases and their significance.

Unit II: Cell II

Lipid bilayers, micelles, plasma membrane and subcellular membranes. Membrane asymmetry and fluidity. Lipid raft. Artificial membrane liposomes. Junctional complex—tight junctions, gap junctions, anchoring junctions, desmosomes, and hemidesmosomes. Cell adhesion molecules. Extracellular matrix.

Transport across cell membranes—simple diffusion, osmosis, ion pores, ion pumps, and ion channels—voltage-gated and ligand-gated. mechanically gated and leaky channels, ionophores. Carrier-mediated transport: uniport, symport, and antiport. Passive (facilitated diffusion) and active transport (primary and secondary). Vesicular transport—phagocytosis, pinocytosis, transcytosis, endocytosis, and exocytosis. Exosome.

Unit III: Tissues&Outline of Human Anatomy

Study of tissues. General characters, types, structure, distribution, and functions of epithelial, connective, muscular, and nervous tissue. Idea about organ system.

Anatomical planes of the human body—sagittal, frontal (coronal), and transverse (horizontal). *Axial region*: head, neck, and trunk. *Abdominal regions*—upper and lower quadrants, midclavicular, subcostal, intertubercular lines. Hypochondriac, lateral and inguinal, epigastric, umbilical, and hypogastric regions. *Appendicular region*- appendages, parts of upper and lower limbs. Skeleton-skull, facial, auditory ossicles, vertebral column, thoracic cage, upper limb, pectoral girdle, pelvic girdle & lower limb. *Body cavities and membranes:*dorsal—cranial and vertebral canal;ventral—thoracic and abdominopelvic cavity lined by serous membranes, pleura (parietal and visceral), peritoneum, periosteum, mesentery, greater & lesser omentum. *General Anatomy of Skeletal Muscle:*attachment, origin, insertion& belly. Fascicle Orientation: fusiform, parallel, convergent, pennate & circular. Coordinated Action of Muscle Groups: agonist, synergist, antagonist & fixator. Muscles of the body and their anatomical positions —masseter, platysma, sternocleidomastoid, trapezius, deltoid, latissimus dorsi, pectoralis major, pectoralis minor, rectus abdominis, biceps femoris, triceps brachii, gluteus maximus, gracilis, gastrocnemius, and soleus.

Unit IV: Haematology and Body Fluids

Concept of body fluid compartments. Composition and function of blood, lymph., and synovial fluid.Formation and circulation of lymph.Plasma and serum—differences and clinical importance. Plasma protein-origin, types, and functions.Plasmapheresis. Body fluid disorders—edema. Structure and functions of red blood cells,white blood cells, and platelets. Erythropoiesis—medullary and extramedullary. Blood cell turnover. Factors regulating erythropoiesis (erythropoietin, hypoxia, vitamins, and minerals). Outline of leukopoiesis and thrombopoiesis.

Hemoglobin structure, biosynthesis, and catabolism. Compounds and derivatives of hemoglobin. Normal variants: embryonic, foetal, and adult haemoglobins.Hemostasis—definition and stages. Blood clotting mechanism—coagulation factors and pathways. Procoagulants and anticoagulants. Fibrinolysis. Blood group systems—ABO and Rh. Biochemical basis of blood group antigens.

Unit V: Biophysical Principles

Diffusion—Fick's laws and physiological application. Osmosis—osmolarity and tonicity, Van't Hoff's laws, physiological applications. Surface tension and viscosity—factors influencing and physiological applications. Colloids—classification,properties (optical, electrical, electrokinetic), physiological importance of colloids, Gibbs-Donnan membrane equilibrium. Dialysis and ultrafiltration. Proteolysis of water, pH. Determination of pH by hydrogen electrode and glass electrode methods. Basic concept of indicators. Acid-base neutralization curves. Buffer-Henderson-Hasselbalch equation—derivation and application. Common physiological buffers.

Thermodynamics—Concepts of systems and surroundings. First Law—Internal energy, enthalpy. Second Law—Entropy and spontaneity of reaction. Gibbs free energy (ΔG), free change (ΔG_0), and standard free energy change ($\Delta G_0'$). Endergonic and exergonic reactions Reversible and irreversible processes Relationship between ΔG, ΔH (enthalpy), and ΔS (entropy) and equilibrium constant. Physiological steady state. Living body as a thermodynamic system. Radioisotopes and their physiological uses.

DSCC 1 Practical (1 Credit, 25 Marks)

1. Fresh tissue experiments-Staining of squamous epithelial cells and cornified epithelial cells with methylene Blue.
2. Preparation and staining of blood film with Leishman's stain and identification of formed elements of blood.
3. Preparation of phosphate buffer (pH 6, 6.8, and 7.4) using Henderson Hasselbach equation and measurement of pH using pH meter.
4. Identification of anatomical planes and muscles from photographs. *Anatomical planes*-sagittal, frontal (Coronal), transverse (Horizontal). *Muscles*- masseter, platysma, sternocleidomastoid, trapezius, deltoid, latissimus dorsi, pectoralis major, pectoralis minor, rectus abdominis, biceps femoris, triceps brachii, gluteus maximus, gracilis, gastrocnemius and soleus.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-AShort definitive type (20 marks):****A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-BBrief answer type/short note (15 marks):****5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-CDescriptive type: (40 marks):****5questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: SEC-1

(Laboratory methods in Microscopy and Clinical Haematology)

Total credit – 04 *Total marks: 100*

SECI Theory (2 Credits, 50 Marks)

Unit I:Microscopy

Fundamentals of Microscopy- resolution, Abbe's law, magnification, contrast, and numerical aperture. Principles of image formation. Köhler illumination principle. Types of contrast generation: brightfield,darkfield, and differential. Principles of construction, uses, advantages, and disadvantages of optical microscopes—compound microscope phase contrast microscope, fluorescence microscope (upright and inverted), polarizing microscope, confocal laser scanning microscope, TIRF microscope, electron microscope(SEM &TEM).

Unit II: Histological Techniques

Tissue fixation—objectives,classification, and examples of physical and chemical fixatives. Choice of fixatives. Fixation artifacts. Decalcification. Dehydration—steps and significance. Clearing agents and significance. Embedding: paraffin wax, resin. Microtomy: working principle and uses of rotary, rocking, cryostat microtome, and ultramicrotome. Preparation of thin section, step section, and serial section.
Dyes and stains in histology and histochemistry: types and examples of natural, synthetic, acidic, basic, neutral, and amphoteric dyes. Principle, procedure, and importance of different staining techniques—progressive, regressive, vital, and supravital. Direct and indirect staining. Mordants and accentuators. Methods of Staining. Simple—methylene blue, silver nitrate. Differential-Romanowski stain (Leishman, Wright, Giemsa), hematoxylin-eosin.Histochemical staining—Sudan III & IV /Black, PAS. Staining artifacts.

Unit III: Clinical Haematology-I

Haemocytometer, parts and uses. Normal values, variations, and clinical significance of Total Count of RBC, WBC and platelets, Differential count, Arneth count. Concept of complete hemogram. Determination and significance of PCV and red blood cell indices-MCV, MCH, MCHC, ESR- Westergren method. Clinical significance of polycythemia, leukocytosis, leukopenia, thrombocytopenia. Automated haematological analyzer- Coulter principle and Optical analysis. Bone marrow aspiration and staining by Giemsa and Perls Prussian Blue. Emergency granulopoiesis.

Unit IV: Clinical Haematology-II

Anemia- classification, diagnostic criteria, and management. RBC enzymopathies: G6PD deficiency, pyruvate kinase deficiency. Abnormal RBC morphology—anisocytosis and poikilocytosis. Hemoglobinopathies—sickle-cell anemia and thalassemia. Glycated hemoglobin. Leukaemia, lymphoma and purpura-types and significance. Bleeding time and clotting time. Acquired and inherited bleeding and clotting disorders -DIC, Vitamin K deficiency bleeding, Haemophilia, Von Willebrand disease. Hyper coagulopathy. Fibrinogen degradation product and D-dimer. Thrombolysin and other thrombolytic agents.

Unit V: Blood Groups and Blood Transfusion

Blood groups—ABO, Bombay blood group, Rh. Other minor blood groups-Kell, Duffy, MN. Cross-matching techniques and their clinical significance. Concept of blood bank. Blood donation criteria. Apheresis-RBCs, WBCs, plasma, platelets. Cryoprecipitate. Storage conditions and shelf life of blood components. Blood transfusion-indication, precaution, and hazards. Alternatives to blood transfusion-erythropoietin, volume expanders, autologous transfusion. Complement therapy. Erythroblastosis fetalis.

SEC I Practical (2 Credit, 50 marks)

1. Determination of Total count of RBC and WBC from human blood.
2. Differential count of WBC from peripheral human blood smears.
3. Calculation of RBC indices (MCV, MCH, MCHC) from supplied data and interpretation.
4. Identification of megakaryocyte in bone marrow smear (Leishman stain) and measurement of diameter of megakaryocyte using micrometry.
5. Determination of bleeding time by Duke's method and clotting time by capillary tube method.
6. Determination of blood group (ABO & Rh).
7. Staining of adipose tissue with Sudan III/ IV, counter stain with methylene blue.
8. Silver nitrate preparation of urinary bladder and study of cell spaces.

Marks Distribution Guideline:

SEC Theory (50 marks)

1) ***Group A- Short definitive type (10 marks):*** *A total of 8 questions (2 marks each) will be set, taking at least one question from each unit. The examinee is required to answer any 5 questions. (2 marks × 5 questions = 10 marks).*
2) ***Group-B- Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*
3) ***SEC Practical (50 marks):*** *Experiments: 32 (At least two experiments to be set), Viva-voce: 10, Lab. Notebook: 08.*

SEMESTER-II

PAPER: DSCC-2

(Chemistry of Biomolecules and Enzymes)

Total credit – 04 *Total marks: 100*

DSCC 2 Theory (3 Credits, 75 Marks)

Unit-I: Chemistry of Carbohydrates

Definition and classification. *Monosaccharides*- classification, structure, stereoisomerism, optical isomerism, optical activity and epimerism. Cyclic structures—Pyranose and furanose. Anomerism. Mutarotation and its mechanism. Chemical reactions of monosaccharides (Glucose, Galactose& Fructose) – reactions with concentrated mineral acids, alkali, phenyl hydrazine and their biochemical importance. Derivatives of monosaccharides and their biochemical and physiological importance -amino sugars, deoxy-sugar, sugar alcohols, sugar acids, and sugar esters. *Disaccharides*-structure, occurrence, and physiological importance of maltose, lactose, and sucrose. *Polysaccharides*-structure, occurrence, and physiological importance of starch, glycogen, dextrin, cellulose, glycoproteins, glycosaminoglycans, sialic acids, lectins.

Unit-II: Chemistry of Lipids

Lipids- definition and classification. Fatty acids- classification, systematic nomenclature, and structure. Mono, di, and triglycerides. Properties of fat and fatty acids-hydrolysis, saponification, acetylation,hydrogenation, rancidity. Saponification number, acetyl number, iodine number, acid number, Reichert-Meissl number, Polenske value. Cis-trans isomerism. Eicosanoids, phospholipids, glycolipids, sphingolipids,isoprenoids, cholesterol—their structure and physiological importance. Lipoproteins-structure and classification.

Unit III:Chemistry of Amino Acids, Peptides and Proteins

Amino acids-classification, structure, nomenclature and optical properties. Protonic equilibrium-zwitterions, isoelectric point. Titration curve of amino acids. Reactions with ninhydrin and formaldehyde.
Peptides & proteins- structure and properties of peptide bonds- Phi & Psi angles. Reactions with Sanger's and Edman's reagents. Biuret reaction. Different levels of protein structure-primary, secondary, tertiary and quaternary. ß-turn and ω-loop. Ramachandran Plot, domain, motif, and folds. Forces stabilizing these structures. Denaturation and Renaturation.

Unit IV: Chemistry of Purine, Pyrimidine, and Nucleic acid

Chemistry of purine, pyrimidine -structure, nomenclature and tautomerism. Nucleosides and nucleotides-structure. Polynucleotides. DNA double helix—primary, secondary and tertiary structures. A-DNA, B-DNA & Z-DNA. Denaturation and annealing. Hyperchromicity, melting temperature and half Cot value. Structure and function of RNA- mRNA, rRNA, tRNA. Physiological relevance miRNA and snRNA.

Unit V: Enzymes

Enzymes classification. EC nomenclature. Concept of apoenzyme, holoenzyme, coenzyme, cofactors, and prosthetic group. Rate-limiting enzymes. Isozymes. Ribozyme and abzyme. Specificity of enzymes. Enzyme-substrate complex. Mechanism of enzyme action- activation energy and transition state. Models of enzyme-substrate interactions. Concept of initial rate, maximum velocity, and steady-state kinetics. Michaelis-Menten equation. Graphical representation of hyperbolic kinetics. Significance of Km and Vmax. Catalytic efficiency and Kcat. Linear transformation of hyperbolic kinetics, Lineweaver-Burk plot. Factors influencing enzyme-catalyzed reactions- substrate concentration, enzyme concentration, pH, and temperature. Enzyme inhibition-competitive, non-competitive, uncompetitive, and mixed. Regulation of enzyme activities-covalent modifications, allosteric modulation. Sigmoid kinetics and Hill equation. K-and M-series. Feedback inhibition.

DSCC-2 Practical (1 Credit, 25 marks)

1. Qualitative tests for identification of physiologically important substances- Hydrochloric acid, Lactic acid, Uric acid, Albumin, Peptone, Gelatin, Starch, Dextrin, Glucose, Fructose, Lactose, Sucrose, Urea, Acetone, Glycerol, and Bile salt.
2. Preparation of N/10 -Oxalic acid, NaOH, H_2SO_4, HCl.
3. Determination of the strength of supplied NaOH solution by titrating against standard N/10 oxalic acid.
4. Quantitative estimation of the percentage of amino nitrogen of supplied glycine solution by Sorensen's Formol Titration Method.
5. Estimation of amylase activity by colorimetric method.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03.*

PAPER: SEC-II

(Tools and Techniques in Clinical & Analytical Biochemistry and Environmental Assessment)

Total credit – 04 *Total marks: 100*

SEC II Theory (2 Credits, 50 Marks)

Unit I: Clinical Biochemistry-I

Blood sampling methods: coagulated and anticoagulated blood, choice of coagulants, and sample storage. Blood glucose—fasting, postprandial, and random, hyper &hypoglycaemia, oral glucose tolerance test, HbA_{1C}. Lipids-lipid profile, hypercholesterolemia, and hyperlipoproteinemia, atherosclerosis. Proteins-total protein, serum albumin, hypoalbuminemia, hypoproteinaemia, albumin: globulin ratio. Renal function test-urea, blood urea nitrogen, creatinine, uric acid, creatinine clearance test, urinary microprotein, Bence Jones proteins, glucosuria. Uristrip analysis. Serum bilirubin. Serum electrolytes- sodium, potassium, chloride. Diagnostic importance CSF analysis.

Unit II: Clinical Biochemistry-II

Pathophysiological significance of serum enzymes- lactate dehydrogenases (LDH1-LDH5), creatine kinase (CK-MM, MB, BB), pancreatic amylase, pancreatic lipase, acid phosphatase, alkaline phosphatases, Regan isoenzyme, β-glucuronidase, alanine transaminase, aspartate Transaminases, γ-glutamyl transferase, Cardiac troponins. Thyroid profile. PTT, APTT and INR. Complement assay, anti-nuclear antigen, rheumatoid factor, CRP.

Unit III: Separation Techniques

Principles, methods and applications of centrifugation, density-gradient centrifugation, ultracentrifugation. Dialysis. Chromatography-principles, methods and uses of paper chromatography, thin layer chromatography, size exclusion chromatography, affinity chromatography, ion exchange chromatography, HPLC, GC. Electrophoresis-principle, method and uses of cellulose acetate electrophoresis, agarose gel electrophoresis, native PAGE, SDS-PAGE, and iso-electric focusing (IEF). Blotting techniques- Southern blot, Northern blot, Western blot. Autoradiography.

Unit IV: Food additives and adulterants

Food additives-definition and classification with examples. Preservatives. 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. Detection Adulteration with Rapid Test (DART) by *fssai*. Pathophysiological effects-metanil yellow, Rhodamine B, saccharin, monosodium glutamate, chicory, feed grade urea, malachite green, Bisphenol A and S, and Dioxins,margarine. Indian case studies on Food adulteration. Food safety guidelines.

Unit V: Environmental Pollution

Pollution definition.Pollutants—classification. Ambient air quality monitoring and standards—National Ambient Air Quality Standards of India. Air quality index. Air pollution—sources and effects of pollutants (NOx, SOx, CO, CO_2, hydrocarbons and VOCs, PM, smog) on human health and control measures. Indoor air pollution—sources and effects. Acid rain. Greenhouse effect. Water pollution—sources and impacts –BOD, COD. Heavy metals toxicity.Noise pollution—permissible ambient noise levels, impacts on humans, and control measures. Light pollution—causes and consequences. Radioactive pollution—impact on health and control strategies.

SEC II Practical (2 Credits, 50 marks)

1. Clinical biochemistry: Estimation of -
   a) Blood glucose by Folin Wu method,
   b) Serum protein by Biuret method,
   c) Serum albumin (BCG method) and A:G ratio.
2. Paper chromatography of amino acid solution.
3. Detection of food adulterants-metanil yellow in laddu, chicory in coffee, malachite green in vegetables, chalk powder in sugar, starch in milk.
4. Detection of lead, aluminium, and arsenic in supplied water samples.
5. Measurement of noiseby noise-level meter.

Marks Distribution Guideline:

SEC Theory (50 marks)

1) ***Group A- Short definitive type (10 marks):*** *A total of 8 questions (2 marks each) will be set, taking at least one question from each unit. The examinee is required to answer any 5 questions. (2 marks × 5 questions = 10 marks).*
2) ***Group-B- Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*
3) ***SEC Practical (50 marks):*** *Experiments: 35 (three experiments to be set), Viva-voce: 08, Lab. Notebook: 07.*

SEMESTER-III

PAPER: DSCC-3

(Digestive System, Nutrition and Dietetics)

Total credit – 04 *Total marks: 100*

DSCC 3 Theory (3 Credits, 75 Marks)

Unit I: Digestive system-I

Anatomy and histology of the alimentary canal. Digestive glands- salivary glands, pancreas, liver- their anatomical positions and histological structure. Structure of gastric and intestinal glands. GALT and MALT. Mesentery as an organ.

Digestive Juices- composition, functions, and regulation of secretion of salivary, gastric, pancreatic, biliary, and intestinal secretion.

UnitII: Digestive System-II

Digestion and absorption of carbohydrates, proteins, lipids, and nucleic acids. Role of enzymes, bile salts and circulatory system in the process. Enterohepatic circulation. Deglutition and movements of the

stomach and intestine- basal electrical rhythm,peristalsis, anti-peristalsis, pendular and segmental. Gastric reflux and vomiting. Defecation.
Concept of gut microbiome and gut brain axis. Eubiosis, dysbiosis.
Disorders of GI tract- Peptic ulcer, gastro-esophageal reflux disorder, jaundice, gallstones, lactose intolerance, irritable bowel syndrome (IBS), Crohn's disease, constipation.

Unit III: Fundamentals of Human Nutrition

Food and nutrients- definition, functions, and classification. *Carbohydrates in nutrition*- types, glycaemic index, and glycaemic load. Dietary fibers. *Proteins in nutrition*- essential amino acids, limiting amino acid, nitrogen balance, biological value of proteins, protein efficiency ratio, net protein utilization, protein digestibility-corrected amino acid score (PDCAAS), supplementary action of proteins, and protein sparers. *Lipids in nutrition*- visible and invisible fats, saturated, MUFA, PUFA, trans fats, omega-3 and omega-6 fatty acids.
Calculation of total energy expenditure (TEE), Physical Activity Level (PAL), specific dynamic action (SDA). BMR-factors affecting BMR. Equations for prediction of BMR. Respiratory quotient. Determination of energy content in food.

Unit IV: Micronutrients

Vitamins- classification, sources, chemistry, physiological functions, and deficiency symptoms of vitamin A, D, E, K, thiamine, riboflavin, niacin, pyridoxine, pantothenic acid, biotin, folic acid, cyanocobalamin, ascorbic acid, and inositol. Concepts of hypervitaminosis and antivitamins. *Minerals*- sources, physiological functions, and deficiency symptoms of calcium, phosphorus, iron, sodium, potassium, iodine, zinc, selenium, and fluorine. Basic concept of bioavailability and nutrient interactions: calcium–iron, zinc–copper, vitamin C-iron and phytate-micronutrients absorption. Role of dietary antioxidants—vitamins, flavonoids, and carotenoids. Probiotics, prebiotics, postbiotics, and synbiotics.

Unit V: Dietetics

RDA, EAR, EER, TUL based on latest ICMR guidelines. Concept of five food group system, food guide pyramids,food exchange list. Balanced diet—principles, formulation of diet for growing children, adult men and women, pregnant and lactating women. Principles of diet surveys and dietary assessment methods (24-hour recall, food frequency questionnaire). Composition and nutritional value of common Indian foodstuffs: rice, pulses, milk, potatoes, spinach, banana, groundnuts, egg, chicken, and fish. Concept and practice of food fortification (iron, iodine, vitamin A). Concept of functional food and personalized nutrition. Physiology of starvation and obesity.

DSCC3 Practical (1 Credit; 25 marks)

1. Study and identification of stained sections of different parts of the Digestive System: Tongue, Parotid gland, Submaxillary gland, Sublingual gland, Oesophagus, Stomach, Duodenum, Jejunum, Ileum, Large Intestine, Liver & Pancreas.
2. Quantitative estimation of free and total acidity in the supplied gastric juice.
3. Quantitative estimation of ascorbic acid in a supplied sample by DCPIP method.
4. Determination of TEE using Standard equation (ICMR).
5. Formulation of diet chart-normal sedentary adult male and female, lactating and pregnant female (As per latest guidelines of ICMR).

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-4

(Metabolism)

Total credit – 04 *Total marks: 100*

DSCC 4 Theory (3 Credits, 75 Marks)

UnitI: Metabolism I

Carbohydrate metabolism: pathways, rate limiting steps, inhibitors (if applicable), energetics, and metabolic significance of Glycolysis, TCA Cycle, Gluconeogenesis, Glyceroneogenesis, Pentose Phosphate Pathway, Glycogenesis, and Glycogenolysis. R-L cycle. Glucose-alanine cycle. Cori cycle. Pyruvate Dehydrogenase complex. Amphibolic nature of TCA cycle. Anaplerotic reactions.

UnitII: Metabolism II

Lipid metabolism- pathways, rate limiting steps, energetics, and metabolic significance of β-oxidation of saturated and unsaturated fatty acids, biosynthesis of saturated and monounsaturated fatty acids. Biosynthesis of Triglycerides. Biosynthesis of Cholesterol. Biosynthesis of Phospholipids - phosphatidyl choline and phosphatidyl serine. Metabolism of Ketone bodies.

UnitIII: Metabolism III

Amino acid metabolism. Concepts of glucogenic and ketogenic amino acids, amino acid pool, deamination - oxidative and non-oxidative, trans deamination, decarboxylation, transamination. Urea cycle - metabolic pathway and energetics. One-carbon compounds and transmethylation - metabolic outlines and significance. Metabolism of glycine, methionine, tryptophan, and phenylalanine -metabolic outlines and significance of the end-products.
Metabolism of Purine and Pyrimidines-biosynthesis (De novo and salvage pathways) and catabolism.

Unit IV: Biological Oxidation, Oxidative stress & antioxidants

Redox potential. Mitochondrial Electron Transport Chain- organization and functions of different components. Oxidativephosphorylation-Chemiosmotic hypothesis.Substrate level phosphorylation. Inhibitors and uncouplers of ETC. High-energy compounds. Definition of oxidative stressand oxidative damage. Generation of free radicals- superoxideanion free radical (O_2^-), hydroxyl radical (•OH), and hydrogen peroxide (H_2O_2). Basic concept of antioxidants.

UnitV: Common Metabolic Disorders

Etiology and symptoms of Glycogen Storage Diseases - Von Gierke's, Pompe's disease. Amino acid metabolism disorders - Phenylketonuria, Maple syrup urine disease. Lipid metabolism disorders-dyslipidaemia, Lysosomal storage disorders. Gout. Metabolic Syndromes (MetS). Hemochromatosis and Wilson's disease.

DSCC4 PRACTICAL (1 Credit; 25 marks)

1. Estimation of blood glucose by GOD-POD method using biochemical kit.
2. Estimation of serum cholesterol by CHOD-PAP method using biochemical kit.
3. Estimation of serum urea by DAM method using biochemical kit.
4. Diabetes Risk Score assessment (Questionnaire method)in peer group.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: SEC-III

(Tools and Techniques in Community Physiology)

Total credit – 04 *Total marks: 100*

SECIII Theory (2 Credits, 50 Marks)

UnitI: Epidemiology

Definition and applications of epidemiology. Data-primary and secondary sources. Study designs- cross-sectional, longitudinal and cohort studies (prospective and retrospective). Epidemiological concept of rate, ratios, and proportions. Definition of crude birth rate and crude death rate, infant, child & maternal mortality rates, under five mortality rate, life expectancy. Growth monitoring and growth charts. Disease epidemiology. Basic concepts of endemic, epidemic, pandemic disease.

UnitII: Community nutrition

Nutritional requirement and dietary management of adolescence and geriatric population. Basic concepts of diet therapy. Classification of therapeutic diets based on nutrient restriction/ modification, food, and texture. Nutritional concern and dietary management of obesity, diabetes, hypertension, and nutritional anaemias. Special diets-gluten free diet, lactose intolerance diet, renal diet, keto diet, DASH.

UnitIII: Anthropometry & Its Application

Definition and types of anthropometry-Static, Dynamic and Newtonian. Standard postures. Common terminologies used in anthropometry. Different body dimensions measured in anthropometry and their applications. Assessment of nutritional status by anthropometry -weight for age, height for age, weight for height, head circumference, MUAC, BMI, WHR, and skinfold thickness.

UnitIV: Biostatistics-I

Definition, scope, and applications of biostatistics. Types of variables-qualitative and quantitative. Population and sample. Sampling techniques. Organisation of data-class, class intervals, class limits. Presentation of data-pie diagram, bar diagram, frequency distribution, frequency polygon, histogram. Statistics of location: mean, quantiles, percentile ranks, median, mode. Measures of dispersion-range, variance, standard deviation, interquartile range, quartile deviation, percent coefficient of variation. Standard error of the mean and confidence interval. Standard score-z score. Degrees of freedom.

UnitV: Public Hygiene and First Aid

Awareness about food and water safety. Sources and potability of water. Water and food borne infections. Causative factors, symptoms, mode of transmission and methods of prevention of Hepatitis A, rotavirus diarrhoea, bacillary dysentery, cholera, amoebiasis, botulism, salmonellosis, shigellosis. Hygiene – Definition; Personal, Community, Medical and Culinary hygiene. Microbial Standards for Foods and Water. Basic concept of Control and Disposal of Solid Wastes- Burning, Incineration, Pyrolysis, Dumping (Landfilling), Composting, Vermiculture.Waste water (Sewage) Treatment- Primary or physical treatment, secondary or biological treatment- trickling filter method, activated sludge method and tertiary treatment.

First Aid-definition and importance. Wounds-types, and management. Burns-types, severity assessment and management. Contents of an ideal first aid kit. Emergency response- CPR, and its steps. First aid in drowning and poisoning- snake bite, insect bites, and sting.

SECIII Practical (2 credit; 50 marks)

1. Descriptive epidemiological study in campus/locality on any one of the followings- hypertension, hypotension, obesity, anaemia, undernutrition. Minimum sample size should be 30.
2. Diet survey of one's own family by 24 hours recall method / weighment method (7 days)
3. Anthropometric measurements- Weight. *Standing*-stature, elbow height. *Sitting*-height,shoulder height, elbow rest height, knee height, popliteal height, buttock popliteal length. *Segmental*- head

length, head width, foot length, foot width. *Reach & span*- arm reach from wall, vertical reach. *Girth/circumference*- head circumference, mid upper arm circumference, waist circumference, and hip circumference.

4. Computation of mean, median, mode, standard deviation, standard error of mean. Plotting of pie diagram, histogram, frequency polygon from a given data set.
5. Data handling using MS Excel- Calculation of mean, median, standard deviation, standard error,5th and 95th percentile. Plotting of a simple and stacked bar/column diagram, and pie diagram.
6. Demonstration: Assessment of dietary intake using Nutrify India Now mobile app.
7. Demonstration: CPR technique and wound dressing.

Marks Distribution Guideline:

SEC Theory (50 marks)

1) ***Group A- Short definitive type (10 marks):*** *A total of 8 questions (2 marks each) will be set, taking at least one question from each unit. The examinee is required to answer any 5 questions. (2 marks × 5 questions = 10 marks).*
2) ***Group-B- Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

SEC Practical (50 marks): *Survey report: Diet-10(6+4) andepidemiology-5,Experiments: 20 (two experiments to be set), Viva-voce: 08, Lab. Notebook: 07.*

SEMESTER-IV

PAPER: DSCC-5

(Cardiovascular and Respiratory Physiology)

Total credit – 04 *Total marks: 100*

DSCC 5 Theory (3 Credits, 75 Marks)

UnitI: Cardiovascular Physiology-I

Anatomy of the heart. Properties of cardiac muscle. Stannius ligature. Origin and propagation of cardiac impulse. Cardiac cycle: Events, Pressure and Volume changes. Heart sounds and murmurs. Histology and characteristics of blood vessels- artery, vein, and capillary. Pulse- arterial and venous, Cardiac Output-definition, measurement usingFick's principle and factors affecting cardiac output. Starling's law of heart. Blood pressure-definition and principle of measurement. Hypertension and hypotension. Factors affecting blood pressure. Electrocardiography- normal electrocardiogram (ECG), electrocardiographic leads and vectorial analysis. Electrical axis of heart. Principle of Echocardiography.

UnitII: Cardiovascular Physiology - II

General circulation and microcirculation. Dynamics of blood flow.Haemorheology. Bernoulli's law,Poiseuille's law, Laplace's law. Reynold's number. Coronary circulation-anatomy and peculiarities. Blood volume- determination and factors affecting.

Causes and symptoms of cardiovascular disorders-cardiac arrhythmias, myocardial infarction, coronary artery diseases (arteriosclerosis and atherosclerosis), myocardial necrosis and myocarditis, cardiac hypertrophy, heart failure, ischemic heart disease, and aneurysm. Coronary bypass, coronary angioplasty.

UnitIII: Cardiovascular regulation

Innervation of heart and blood vessels.Baroreceptors and chemoreceptors. Cardiac vasomotor centre.Short term and long-term regulation of cardiovascular functions. Cardiac reflexes-baroreceptor reflex, chemoreceptor reflex, Bainbridge reflex, Bezold-Jarisch reflex, Cushing reflex. Role of epinephrine, norepinephrine, ADH, renin-angiotensin-aldosterone system (RAAS), ANP. Local metabolic vasodilators. Cardiovascular adjustments after haemorrhage.

UnitIV: Respiratory Physiology - I

Anatomy, tissue morphology and functional organization of the airways and the lungs. Composition of gases in inspired. alveolar and expired air. Mechanism of breathing. Role of respiratory muscles and glottis. Mechanical events. Compliance. Pressure- volume relationships, Surfactant. Work of breathing. Lung volumes and lung capacities. Dead space. Pulmonary circulation- peculiarities.Ventilation and ventilation-perfusion ratio.Oxygen transport. Carbon-dioxide transport. Oxy-hemoglobin dissociation Curve and factors affecting. Bohr effect, Haldane effect. Non-respiratory functions of lungs.

Unit V: Respiratory Physiology - II

Regulation of Respiration: *Neural Control*- Respiratory centers in the medulla and pons. Pre-Botzinger complex. *Chemical control*-role of central and peripheral chemoreceptors. Respiratory reflexes-Hering-Breuer reflex, J-receptor reflex, chemoreceptor reflex and cough reflex. Role of lungs in pH regulation. Respiratory acidosis, and alkalosis. Pulmonary function tests (PFTs) and its interpretation. Hypoxia- types. Respiratory disorders- COPD, asthma, emphysema, asphyxia, hyperpnoea, dyspnoea,sleep apnoea, cystic fibrosis, cyanosis, tuberculosis, pneumonia,infant respiratory distress syndrome (IRDS). Periodic breathing - Kussmaul, Cheyne-Stokes, and Biot's breathing.

DSCC5 Practical (1 credit, 25 marks)

1. Measurement of systolic and diastolic arterial blood pressure by sphygmomanometer and determination ofpulse pressure and mean pressure.
2. a) Identification of major pulse points- carotid, brachial, radial, popliteal.
3. b) Determination of pulse rate and blood oxygen saturation level by Pulse Oximeter.
4. Kymographic recording of normal unperfused heart of toad at different drum speeds.
5. Recording and interpretation of electrocardiogram of college student.
6. Pulmonary function test using digital/manual spirometer.
7. Pneumographic recording of normal chest movements and effect of hyperventilation on breath holding time.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-6

(Genetics and Molecular Biology)

Total credit – 04 *Total marks: 100*

DSCC 6 Theory (3 Credits, 75 Marks)

Unit I: Basic Genetics

Basic concepts of Mendelian Genetics. Laws of inheritance. Chromosome: structure and classification, Euchromatin and heterochromatin. Centromere and telomere. Nuclear & Mitochondrial DNA. Concept of Pedigree analysis - autosomal and sex-linked inheritance, dominant and recessive with examples. Crossing over, linkage and recombination, Basic concepts of Epistasis, Penetrance, Expressivity, Pleiotropism and Karyotyping. Morgan unit- Basic concept. Chromosomal DNA packaging, nucleosomes, and higher levels of organization of chromatin

Unit II: Human Genetics

Human genome and its characteristics -basic concept. X-chromosome Inactivation. Genetic basis of ABO and RH blood grouping.Genetic diseases and its classification- single gene disorder (Cystic fibrosis), chromosomal disorders (Down's, Turner's, Klinefelter syndrome), multifactorial disorders (coronary artery disease, hypertension, schizophrenia), mitochondrial disorders (LHON), and acquired somatic genetic diseases (SLE)– causes and symptoms. Genetic testing and counselling-aims, indications, ethics. Prenatal diagnosis- amniocentesis and chorionic villus sampling. Human Genome Project.

Unit III: Molecular Biology-I

Concept of Gene and Genome.Coding gene - housekeeping and inducible, non-coding gene- regulatory, enhancer, operator, terminator.Mutation and mutagens. Basic concept of Transposons. DNA supercoiling and topology. Basic concepts of central dogma of molecular biology. Messelson-Stahl experiment.DNA replication in prokaryotes. DNA repair-types.

Unit IV: Molecular Biology-II

Transcription in prokaryotes. Post-transcriptional modifications - capping, splicing, polyadenylation. mRNA stability- influence of - *cis*-acting elements, 5′ cap structure, 3′ poly(A) tail length, 5′ and 3′ untranslated regions (UTRs), AU-rich elements (AREs), GC content and secondary structures.Introns, exons and differential splicing. Transcriptome-types and application. Genetic code and its characteristics. Wobble hypothesis. Translation in prokaryotes. Post-translational modifications.

Unit V: Molecular Biology-III

Regulation of Gene Expression. Operon concept in prokaryotes – *lac* and *trp* operons. Epigenetic regulation -types (DNA methylation, histone modification, non-coding RNAs) Transcriptional regulation in prokaryotes – role of transcription factors, enhancers, silencers. Gene silencing and RNA interference (RNAi) – mechanisms of siRNA, miRNA-mediated regulation.

DSCC 6 Practical (1 credit, 25 marks)

1. Isolation of DNA from banana/onion.
2. Estimation of DNA by DPA method.
3. Pedigree analysis of Colour blindness, ABO blood group.
4. Identification of chromosomal aberration in humans from Karyotype photographs- Down Syndrome, Turner Syndrome, and Klinefelter Syndrome.
5. Identification of Davidson body in peripheral blood neutrophils using Giemsa.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-7

(Nerve Muscle Physiology, Renal Physiology, Integumentary System and altered environment)

Total credit – 04 *Total marks: 100*

DSCC 7 Theory (3 Credits, 75 Marks)

Unit I: Nerve Physiology

Neurons, neuroglia, and nerves-classification, structures, and functions. Properties of nerve fibers. Myelinogenesis. Axoplasmic transport -anterograde and retrograde. Concepts of voltage gated ion channels. Resting membrane potential-origin Nernst potential, Hodgkin-Huxley-Goldman-Katz constant field equation. Electrotonic potential. Action potential-ionic basis. Compound Action Potential. Propagation of nerve impulse. Current of injury. Synapse -types, structure, and properties. Synaptosomes. Neurotransmitters, co-transmitters, and neuromodulators. Molecular basis of synaptic transmission. EPSP, IPSP. Neuromuscular junction-structure, transmission, EPP, MEPP. Post-tetanic potential. Injury to peripheral nerves. Degeneration and regeneration in nerve fibers. Denervation hypersensitivity.

Unit II: Muscle Physiology

Microscopic and electron microscopic structure of skeletal, cardiac, and smooth muscles. Elastic components of muscles. Sarcotubular system. Red and white striated muscle fibers, Single and multi-unit smooth muscles. Muscle groups- agonists and antagonists. Properties of skeletal muscle. Optimum load and optimum length of muscle fibers-basic concepts. Skeletal and smooth muscle contraction and relaxation-molecular basis, electrical, chemical, and thermal changes. Preload and afterload. Isometric and isotonic contractions. Muscle length-tension and force-velocity relationship. Electromyography and Myasthenia gravis.

Unit III: Renal Physiology

Anatomy of kidney, histological structures of nephron.JG apparatus.Peculiarities of renal circulation and autoregulation. Formation of urine-glomerular and tubular functions, GFR, Tm, tubuloglomerular feedback. Counter current multiplier and counter current exchanger systems. Mechanism of formation of hypertonic urine. Renal regulation of osmolarity and blood volume, acid-base balance.Acidification of urine. Physiology of urinary bladder- micturition.Renal function tests-creatinine, inulin, and ureaclearance tests. Non-excretory functions of the kidney. Urine–normal and abnormal constituents. Common diseases of excretory system- glomerulonephritis, UTI, Haemodialysis.

Unit IV: Integumentary system

Structure and functions of skin, hair, and nails. Cutaneous circulation- peculiarities. Triple response. Sweat glands –structure and types. Sweat –composition, mechanism of formation and regulation of secretion. Sebaceous gland. Composition and function of sebum. Cerumen. Insensible perspiration. Regulation of body temperature in homeotherms - physical and physiological processes, neuro-humoral control. Hyperthermia, hypothermia, and pyrexia. Acne and Albinism- causes and symptoms.

Unit V: Physiology in Altered Environment

Physiological response to high altitude- acute and chronic responses. Acclimatization to high altitudes. Acute mountain sickness. HAPE, HACE. Effect of hyperbaric environment- deep-sea diving. Decompression sickness (Caisson's diseases)- symptoms and preventive measures. Heat Stress and heat acclimatization. Heat disorders- types, symptoms, and prevention. Cold stress and Cold acclimatization. Frostbite.

DSCC7 PRACTICAL (1 credit, 25 marks)

1. Histological staining of skeletal muscle with methylene blue.
2. Histological stainingof Node of Ranvier by silver nitrate.
3. Kymographic recording of isotonic muscle contraction in sciatic-gastrocnemius preparation of toad and study of the effect of load. Calculation of work done by the muscle.
4. Biochemical identification of normal and abnormal constituents of urine.
5. Assessment of heat stress by WBGT index.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-8

(Neurophysiology and Stress Physiology)

Total credit – 04 *Total marks: 100*

DSCC 8 Theory (3 Credits, 75 Marks)

UnitI: General Organization of Nervous System

Brain and spinal cord- structural organization of different parts, Receptors- definition, classification, and properties. Receptor potential. Muller's law of specific nerve energies. Weber-Fechner law, Steven's power law. Reflex action- definition, reflex arc, classification, and properties. Babinski's sign. Autonomic nervous system- outflow, ganglia, centers, functions. Chemical transmission in autonomic nervous system. CSF- formation, circulation, and functions. Blood-Brain Barrier and Blood-CSF Barrier. Lumbar puncture. Hydrocephalus. Cerebral circulation-anatomy and peculiarities. Cerebrovascular stroke.

Unit II: Nervous System-I

Ascending and descending tracts- origin, courses, terminations, and functions. Proprioception and kinaesthetic sensation.Effect of lesions of spinal cord-complete and incomplete transection and hemisection-Brown Sequard syndrome. Syringomyelia. Spinal animal, thalamic animal, decerebrate and decorticate rigidity. Pain-nociception,neural pathway, and perception. Gate control theory. Referred pain. Analgesia-endogenous pain inhibitory system. Hyperalgesia. Muscle spindle and Golgi-tendon organ - structure, innervations, and functions.

Unit III: Nervous System-II

Different parts of the brain-structures and functions of cerebral cortex, thalamus, hypothalamus, brainstem, cerebellum, reticular formation, basal ganglia. Vestibular apparatus. Limbic system -structure, and functions. Papezcircuit, higher control. Emotion. Causes and symptoms of hypotonia, rigidity, nystagmus, thalamic syndrome, Parkinson's disease, Huntington's chorea, Kluver Bucy syndrome.

Unit IV: Cell Signalling

Cell surface receptor proteins – ion channel coupled, G-protein coupled andenzyme-coupled. Intracellular messengers – cAMP, cGMP, IP3, DAG,Ca^{2+},Protein kinases, CO,NO. Signal transduction pathways: Phosphatidylinositide,MAP kinase, JAK-STAT, SMAD.

Unit V: Molecular Neurobiology

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

DSCC 8 Practical (1 credit, 25 marks)

1. Permanent slides-(12)- cerebral cortex, cerebellum, spinal cord, bone, hyaline cartilage, artery, vein, lung, trachea, kidney, ureter, skin.
2. Identification of parts of brain and spinal cord using photographs/models.

3. Determination of visual reaction time by ruler drop test.
4. Determination of threshold distance for two-point discrimination.
5. Demonstration-knee jerk, and plantar reflex.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

SEMESTER-V

PAPER: DSCC-9

(Special Senses, Biomedical Techniques, Aviation and Space Physiology)

Total credit – 04 *Total marks: 100*

DSCC 9 Theory (3 Credits, 75 Marks)

UnitI: Fundamentals of Special Senses and Chemical senses

Concept of general and special senses. Characteristics of special senses. Sensory coding. Olfactory and gustatory pathway- receptor organs, neural pathways, and centers. Signal transduction of olfactory and gustatory stimuli. Olfactory and gustatory coding. After taste. Smell and taste disorders-ageusia, hypogeusia, anosmia, hyposmia.

Unit II: Audition

Audition: Sound waves, decibel. Structure and functions of auditory apparatus-external, middle and internal ears. Organ of Corti. Mechanism of hearing- auditory transduction and theories of hearing, auditory pathway. Different electrical potentials of the internal ear. Discrimination of sound frequency and loudness. Localization of sound sources. Audiometry. Deafness.

Unit III: Vision

Outline structure of eyeball. Lens. Mechanism of accommodation. Light reflexes. Argyll Robertson Pupil. Retina Errors of refraction and their corrections, cataract, astigmatism, presbyopia. Aqueous humor - formation, composition, circulation, and function. Vitreous humor. Glaucoma. Histology of retina peripheral retina, fovea, and blind spot. Photochemical changes in retina and photo transduction.Electrical changes in retina on exposure to light.Visual pathway. Effects of lesion in visual pathway. Photopic and scotopic vision. Positive and negative after images- contrast phenomenon. Light and dark adaptation. Colour vision - trichromatic, single, and double opponent theories. Colour blindness. Visual field –perimetry. Visual acuity-factors affecting. Critical fusion frequency. Ferry-Porter Law.

Unit IV: Biomedical techniques

Principles, applications, advantages, and limitations of – X-ray, EEG, ERG, EMG, CT, MRI, USG. Artificial pacemaker. Dialyzer.

Unit V: Aviation and Space Physiology

Physiology of aviation. Physical and physiological zones of the atmosphere. Effect of linear acceleratory and deceleratory forces on body. Physiological adjustments in flight environments. Concept of effective performance time (EPT) and time of useful consciousness (TUC) in various altitudes. Spatial disorientation. Altitude induced decompression sickness. Jet lag.

Space Biology- Historical perspectives and milestones. Study of parameters related to space flight- acceleration, deceleration, weightlessness, thermal extremes, high G-forces. Physiological effect of positive and negative g-forces. Physiological effects of cosmic radiation. Effects of microgravity on cardiovascular, digestive, musculoskeletal, and neuro-vestibular systems. Nutritional strategies for astronauts. Post-flight rehabilitation of astronauts.

DSCC 9 Practical (1 credit; 25 marks)

1) Identification of 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) Recording of SpO_2 using pulse oximeter before and after breath holding (5, 10, 15 sec).
6) Demonstration: Study of the impact of Head-down tilt test on blood pressure and pulse rate.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-10

(Higher Functions of Brain, Neuroendocrinology, Neurodegeneration and Chronobiology)

Total credit – 04 *Total marks: 100*

DSCC 10 Theory (3 Credits, 75 Marks)

Unit-I: Higher functions of brain

Neural basis of Learning and Memory. Synaptic plasticity- forms, functions and mechanisms of short-term and long-term plasticity. Learning - types and neurological basis of habituation, sensitization, classical and operant conditioning. Memory-classification and molecular basis. Memory consolidation- role of hippocampus. Inter-cortical transfer of memory. Speech-organs and processes involved. Speech centers in the brain- Broca's and Wernicke's area. Neural pathways for comprehension and production of speech. Sleep-classification. EEG changes in various stages of sleep. Neural basis of REM and non-REM sleep. Brief concept of executive functions of brain-role of the prefrontal association cortex. Causes and clinical manifestation of-aphasia, dyslexia, dysgraphia, amnesia, dementia, insomnia, narcolepsy, and sleep apnoea.

Unit-II: Neuroendocrinology

Definition of neuroendocrinology. Key differences and interactions of neural vs. endocrine signaling—speed, specificity, duration. Hypothalamus as master regulator– major hypothalamic nuclei involved in hormone regulation, neurosecretory cells. Hypothalamo-hypophyseal portal system. Hypothalamo-hypophyseal tract. Circumventricular organs—median eminence, organum vasculosum of lamina terminalis, area postrema, sub commissural organ. Hypophysiotropic hormones—CRH, TRH, GnRH, GHRH, PIH, PRF, Somatostatin. Concepts of neuroendocrine axis and feedback regulation.

Unit III: Neurodegenerative Disorders

Normal aging of the brain- structural and cognitive changes. Neurodegeneration – role of mitochondrial dysfunction, oxidative stress and inflammation. Proteinopathy - amyloid-beta plaques, tau tangles, alpha-synuclein, Lewy bodies, mutant Huntington protein, and misfolded Prion proteins. Clinical features, brain

regions involved,risk factors, biomarkers, andpreventive strategies of the following- Alzheimer's disease, Parkinson's disease, Huntington's disease, Amyotrophic Lateral Sclerosis, and Multiple Sclerosis.

Unit IV: Chronobiology

Definition and examples of Physiological Rhythms- ultradian, circadian, and infradian. Differences between circadian and diurnal rhythms. Free running rhythms. Neuroendocrine basis of biological rhythm. Suprachiasmatic nucleus as Master clock- structure, afferent and efferent connections, neurotransmitters in relation to circadian rhythms, Retino-hypothalamic tract. Melanopsin. Peripheral clocks- Basic ideas. Zeitgebers. Entrainment and synchronization. Concept of time keeping genes.

Endocrine biorhythms- cortisol, melatonin, prolactin. Diurnal variations-body temperature, sleep-wakefulness cycle, potassium excretion. Chronotype. Human biorhythm disorders-Jet-lag, shift work sleep disorder.

Unit V: Stress Physiology

Definition and types of stress and stressors. General Adaptation Syndrome (GAS). Role of hypothalamic-pituitary-adrenal axis and Sympatho-adrenal medullary axis in stress response. Effects of stress on cardio-respiratory, musculoskeletal, immune, metabolic, and endocrine systems. Oxidative stress, oxidative damage. Reactive oxygen Species (ROS), Reactive Nitrogen Species (RNS) and their effects on cells. Lipid peroxidation, Antioxidant enzymes- Superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase, glutathione synthetase; their localization and functions. Low molecular weight non-enzymatic antioxidants- Glutathione, Vitamin C, Vitamin E and Melatonin. Pro-oxidants- NADPH oxidase, myeloperoxidase, redox active iron and copper.

DSCC 10 Practical (1 credit, 25 marks)

1. Memory assessment using N-Back test (1-back).
2. Assessment of neurocognition by Montreal Cognitive Assessment (MoCA) test.
3. Project work on assessment of individual differences in human circadian rhythms (chronotype in human population) by questionnaire method.
4. Determination of Circadian/ diurnal variation of body temperature.
5. Assessment of cold stress by CPT (cold pressor test).

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Project Report: 10 (6+4),Experiments: 8 (one experiment to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-11

(Endocrinology)

Total credit – 04 *Total marks: 100*

DSCC 11 Theory (3 Credits, 75 Marks)

UnitI:Endocrine System-I

Anterior and posterior pituitary gland- histology. Pituitary Hormones-chemical nature, mechanism of action, functions, and regulation of secretion. Pineal gland- histology. Melatonin-chemical nature,

biosynthesis, mechanism of action, functions and regulation of secretion. Disorders- Panhypopituitarism, dwarfism, gigantism, acromegaly, Cushing's disease, hyperprolactinemia, diabetes insipidus- neurogenic and nephrogenic, SIADH.

Unit II: Endocrine System-II

Thyroid and Parathyroid Glands- histology. Hormones-chemical nature, biosynthesis of thyroid hormones, mechanism of action, functions and regulation of secretion. Disorders- Non-toxic goiter, myxoedema, cretinism, Hashimoto's thyroiditis, Grave's disease, tetany.

Unit III: Endocrine system-III

Adrenal cortex and medulla- histology. Hormones-chemical nature, mechanism of action, functions and regulation of secretion. Outlines of steroid biosynthesis in different cortical layers. Biosynthesis and catabolism of adrenal medullary hormones. Disorders-Cushing's syndrome, congenital adrenal hyperplasia, Addison's disease, Pheochromocytoma.

Unit IV: Endocrine system-IV

Pancreatic islets- histology. Hormones- chemical nature, mechanism of action, functions and regulation of secretion. Hormones secreted from adipose tissues-types and functions and their role in energy metabolism. Appetite control, obesity and hormones. Disorders- Diabetes mellitus, hyperinsulinism, OGTT.

Unit V: Endocrine system-V

Gastrointestinal hormones- chemical nature, mechanism of action, functions, and regulation of secretion of gastrin, CCK, secretin, ghrelin, motilin. Hormones secreted from heart, kidney, liver, thymus gland- chemical nature, functions, and regulation of secretion. CTGF, PDGF, NGF, Myokines, Osteokines- basic concept.

DSCC 11 Practical (1 credit, 25 marks)

1. Identification of permanent slides-pituitary, adrenal, thyroid, thymus, pancreas, testis, ovary, uterus, lymph gland and spleen.
2. Measurement of external and internal diameter of thyroid follicle using micrometry.
3. Staining of thyroid/liver/intestinal sections using PAS method.
4. Estimation of random blood sugar by glucometer.
5. Kymographic recording of the effects of adrenaline and acetylcholine on intestinal movements of rats in Dale's bath.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Section A- Objective type (20 marks):*** *A total of 15 objective-type questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Section-B- Short notes (15 marks):*** *5 short note questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Section-C- Descriptive questions: (40 marks):****5 descriptive questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The examinee must attempt one question from each unit. (8 marks × 5 questions = 40 marks)*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-12

(Reproductive Physiology and Developmental Biology)

Total credit – 04 *Total marks: 100*

DSCC 12 Theory (3 Credits, 75 Marks)

UnitI: Reproduction-I

General components and basic anatomy of male and female reproductive systems. Sexual development after birth. Neuroendocrinology of onset of puberty and bodily changes during puberty, adrenarche, gonadarche, thelarche, spermarche, pubarche, menarche. Menopause, male climacteric. Primary and

accessory sex organs and secondary sex characters. Male reproductive tract, histology of testis, spermatogenesis, testicular hormones- chemical nature, synthesis, mechanism of action, functions, and regulation of secretion—hypothalamo-pituitary-testicular axis. Brief idea on disorders of male reproductive system-infertility, impotence, azoospermia, oligoasthenoterratozoospermia (OAT), benign prostatic hyperplasia and cryptorchidism.

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-chemical nature, synthesis, mechanism of action, functions, and regulation of secretion—hypothalamo-pituitary-ovarian axis. Human menstrual cycle and its regulation, Oestrous cycle. Abnormalities in menstrual cycle. Brief idea on female infertility, PCOS, endometriosis, dysmenorrhoea, oligomenorrhea.

Unit III: Reproduction-III

Sperm in female genital tract- capacitation, acrosomal reaction. Fertilization, membrane fusion, cortical reaction, early embryogenesis and implantation, Prevention of polyspermy and placentation. Structure and functions of placenta, endocrine and other physiological changes during pregnancy. Maintenance of pregnancy and brief idea on pregnancy related pathophysiology, pregnancy test. Physiology of parturition, development of mammary gland, lactation and its hormonal control.

Unit IV: Developmental Biology-I

Basic idea of stem cells-properties, totipotent, pluripotent, multipotent.Types and properties of Stem Cell: Embryonic Stem Cells (ESCs). Adult Stem Cells. Induced Pluripotent Stem Cells (iPSCs). Basic concept of self-renewal and differentiation by morphogens - Wnt, notch, hedgehog. Cleavage and formation of morula. Types of cleavage based on plane and pattern. Blastocyst formation and implantation, Gastrulation and germ layer differentiation.

Unit V: Developmental Biology-II

Development of heart, alimentary canal, urinary system, and genital system. Determination of fetal sex. Gonadal differentiation. Foetal circulation-anatomy and peculiarities. Changes after birth. Ossification of bones. Common developmental defects- spina bifida, congenital heart disease and disorders- autism spectrum disorder, cerebral palsy. Teratogens.

DSCC 12 Practical (1 credit, 25 marks)

1. Pregnancy test by immunological method using synthetic hCG solution.
2. Hematoxylin Eosin staining of sections of ovary, testis, uterus.
3. Measurement of diameter of round seminiferous tubule and graafian follicle by micrometry.
4. Identification of Stages of Oestrous cycle from vaginal smear from permanent slides.
5. Identification of stages of Embryogenesis from permanent slides.
6. Group Project/Mini review on assessment of risk of developingPCOS among college students using standard questionnaire and body composition (BMI and WH ratio). (n=20).

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Project report: 8 (5+3),Experiments: 10 (one experiment to be set), Viva-voce: 04, Lab. Notebook: 03*

SEMESTER-VI

PAPER: DSCC-13

(Microbiology, Immunology and Cancer Biology)

Total credit – 04 *Total marks: 100*

DSCC13 Theory (3 Credits, 75 Marks)

Unit I: Microbiology-I

Diversity of microbes- basic concept of Whittaker's five kingdom and Carl Woese's three kingdom classification system. Techniques employed for the identification of microorganisms-microscopic, biochemical, and molecular methods.

Bacteriology: Bacterial classification based on staining techniques -Gram stain and Acid-fast stain and morphological aspects. Bacterial structure- Gram-positive and Gram-negative cell walls, LPS layer, pili, flagella, chromosome, plasmid, spores, and cysts. Culture of bacteria- nutritional requirements, complex and synthetic media. Physical factors and nutritional requirements for growth. Bacterial growth curve, continuous growth culture and its utility. Control of microbial growth- physical and chemical methods used in sterilization, disinfection, and pasteurization.

Unit II: Microbiology-II

Bacterial metabolism: Fermentation, Glyoxylate cycle and Entner-Doudoroff pathway. Bacterial genetics: transformation, conjugation and transduction, Basic concept of beneficial, opportunistic and pathogenic microorganism. Microbial infection - pathogenicity, virulence, portal of entry, incubation period, clinical manifestations. Causative microorganisms and symptoms - Tuberculosis, Amoebiasis, Candidiasis. Antibacterial agents - chemotherapeutic agents, antibiotics-definition, mode of action of bactericidal, and bacteriostatic antibiotics. Basis concept of antimicrobial resistance (AMR), MRSA and Superbugs. Bacterial chemotaxis and quorum sensing.

Viral structure-virion, prions and bacteriophages, classification of viruses based on nucleic acid composition and host system, replication of bacteriophages-lytic and lysogenic cycles, Interferons. Causative organism, structure, mode of infection, and symptoms - Rhinitis, Influenza, SARS-COV 2, Hepatitis- A and B, AIDS.

Unit III: Immunology-I

Overview of innate and acquired/ adaptive immunity. Structure, functions and properties of immune cells. (antigen presenting cells, T and B lymphocytes) Structure and functions of- MHC molecules, B-cell receptors, T-cell receptors, cluster of differentiation. Primary and secondary lymphoid organs. Barriers of innate immunity. Concept of PAMP and DAMP. Leukocyte trafficking. Immunogens, and antigens-requirements of immunogenicity, haptens, epitopes, paratopes. Adjuvants.

Antibody- structure, types, functions, and properties. Antigen-Antibody interactions- association constant, affinity & avidity, neutralisation, precipitation, agglutination, and opsonization. Complement- components, activation pathways, and biological functions.

Unit IV: Immunology-II

Innate immune responses- phagocytosis, oxidative burst, inflammation. Humoral immune response - plasma and memory cells. Primary and secondary immune responses. T-dependent and T-independent antigens. Antigen processing and presentation (cytosolic and endocytic pathways).Cell mediated immune response,T-cell maturation, differentiation –thymic selection. T cell activation. Mechanisms of action of CTL and NK cells. T-B cooperativity. Chemokines and cytokines. Autoimmunity & hypersensitivity- types with examples. Vaccination-Passive and active immunization. Types and uses of vaccines. Toxins and toxoids. HLA - structure, types and transplantation immunology.

UnitV: Cancer Biology

Cell Cycle – checkpoints. CDKs. Apoptosis – Canonical (intrinsic and extrinsic) and non-canonical pathways. Autophagy and Necrosis – Roles in cancer survival and death. Tumor- benign and malignant. Properties of Cancer cells. Dysplasia, Hyperplasia, Neoplasia. Metastasis- basic concept of epithelial to mesenchymal transition. Types of cancer- Carcinomas, Sarcomas, Adenomas, Leukemia, Lymphomas, myeloma.Oncogenes and cancer induction. Tumor Suppressors. Cancer Stem Cells (CSCs) – Tumor-initiating, therapy-resistant. Basic concept of chemotherapy, radiotherapy, immunotherapy.

DSCC 13 Practical: (1 credit, 25 marks)

1. Identification of bacteria using Gram staining method.
2. Microscopic examination of yeast using Lactophenol cotton blue staining.
3. Spore staining by Malachite green
4. Study of the structure of important animal viruses using of electron microphotographs(rhabdo, influenza, hepatitis A/B, SARS COV 2, and retroviruses)
5. Determination of blood group (ABO & Rh) of human subjects.
6. Demonstration:
    a. Media preparation and aseptic inoculation (plate & slant culture).
    b. Isolation and staining of splenocytes.

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-14

*(*Work & Sports Physiology, Ergonomics and Occupational health*)*

Total credit – 04 *Total marks: 100*

DSCC 14 Theory (3 Credits, 75 Marks)

Unit-I: Work Physiology

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. Physiological responses to work –cardiovascular, respiratory, metabolic, and muscular – short-term and long-term. Concept of acceptable workload. Study of changes in heart rate, oxygen consumption and blood pressure to assess a person's ability to withstand work load. Effect of heat stress on physiological responses to work load. Work-rest cycle and importance of rest pause. Muscular fatigue- central and peripheral fatigue in physical work.

Unit II: Sports Physiology-I

Concept of endurance, strength, and speed in sports activities. Muscle fibre-types and performance. Energetics- concept of work power and energy. Sources of energy. Energy demand for different activities. Nutritional aspects of sports-role of macronutrients and micronutrients in sports performance. Pre-competition diet. Nutritional supplementation. Determination of energy cost by direct and indirect methods. Concept of maximum physical work capacity-factors affecting, methods of measurement by step test, treadmill, and bicycle ergometer. Significance of maximal oxygen consumption ($\dot{V}O_2$ max) and excess

post-exercise oxygen consumption (EPOC), Aerobic and anaerobic capacity. Lactate threshold, lactate tolerance and their usefulness.

Unit III: Sports Physiology-II

Training principles for different sports activities. Principles and their impact on performance level in sports with reference to cardiovascular, respiratory, and muscular changes. Overtraining and detraining and their physiological effects. Warm up and cool down. Physical fitness and its assessment by Harvard and modified Harvard Step Tests. Muscular fitness and its assessment. Methodologies for the analysis of body composition. Somatotyping and its role in selection of sports activity. Ergogenic aids and ergolytic agents. Doping- dope substances and drug abuse in sports. Blood doping.

Unit IV: Ergonomics

Introduction and multidisciplinary approach to Ergonomics -definition, brief history, scope, and classification. Concept of man-machine-environment interaction. Basic concepts of reach, clearance, posture and range of motion. Application of anthropometry in designing. Concept of percentile and its calculation and use of percentile values in anthropometry.Brief concept of manual material handling (MMH). Ergonomic principles of safe load handling. Evaluation of working posture using OWAS, REBA and RULA methods. Cognitive ergonomics. Display and Control units in system design. Ergonomic interventions for safety and health improvements. Definition of Industrial Productivity. Role of ergonomics for the improvement of productivity. Ergonomics in the risk assessment, mitigation, and hazards control. Industrial accidents and safety. Ergonomic assessment of the workplace environment. Industrial Temperature assessments: Assessment of thermal comfort. Heat Stress Index. Effect of extreme heat on worker's performance. Illumination- Assessment of the level of illumination, effect of illumination on work performances. Industrial noise –Assessment of industrial noise, effect of noise on work performance. Noise Induced Hearing Loss (NIHL): Definition and assessment of NIHL, non-auditory effects of noise. Vibration: Definition- Assessment of hand arm and whole body vibration, effects of vibration on the human body. Work Related Musculo-skeletal disorders (WRMSDs)- definition, prevalence, causative factors, and determination. Role of ergonomics towards mitigation of WRMSDs.

Unit V: Occupational Health

Introduction to Occupational Health-definition, scope, and importance. Occupational Hazards- physical, chemical, biological, ergonomic, and psychosocial. Causative factors, physiological effects, and preventive measures of common occupational diseases- - asbestosis, silicosis, byssinosis, and pneumoconiosis. Workplace Stress and Mental Health. Introduction to OSHA and ISO Standards. Use of personal protective device (PPD)against thework-related hazards -PPD inthermal protection, face and eye protection, noise protection, and respiratory protection. Ionizing and non-ionizing radiation. Definition and assessment in the work environmentThreshold Limit Value and Permissible Exposure Limit of Hazards.

DSCC 14Practical: (1 credit, 25 marks)

1. Determination of Physical fitness by modified Harvard Step Test.
2. Determination of $\dot{V}O_2$ max by Queen's College Test.
3. Determination of flexibility and anaerobic power by Sit and reach and Vertical jump test respectively.
4. Determination of hand grip strength and fatigue by hand grip dynamometer.
5. Estimation of postural stressamong college student using RULA.
6. Determination of illumination and noise in the college premises (3-4 sites).

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Section A- Objective type (20 marks):*** *A total of 15 objective-type questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Section-B- Short notes (15 marks):*** *5 short note questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Section-C- Descriptive questions: (40 marks):****5 descriptive questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The examinee must attempt one question from each unit. (8 marks × 5 questions = 40 marks)*

DSCC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: DSCC-15

(Community & Public Health, Parasitology, Pharmacology, and Biostatistics-II)

Total credit – 04 *Total marks: 100*

DSCC 15 Theory (3 Credits, 75 Marks)

UnitI:Community and Public Health-I

Definition of Health. Changing concept of health and its determinants. Definition of community. Concept of community health and its importance. Difference between community health and public health. Public health challenges in India.

Communicable and non-communicable diseases with examples. Common NCDs in India—etiology, risk factors, and management of hypertension, diabetes mellitus, and obesity. Malnutrition in a community. Concept of undernutrition and overnutrition Causes, symptoms, and social implications of PCM—marasmus & kwashiorkor, endemic goiter, nutritional anemia, rickets, xerophthalmia, beriberi, and pellagra. Communicable diseases-etiology, epidemiology, and prevention of — malaria, tuberculosis, dengue, cholera, pneumonia, typhoid, Covid-19, andAIDS.

Population problem. Principles and methods of family planning. Problem of infertility and assisted reproductive technologies (ART). Principle and social importance of immunization against diseases.

Unit II: Community and Public Health-II

Concept of Public Health. Public health issues in India. Concept of water quality and potability. Common waterborne infectious diseases—viral (hepatitis A, B and C), bacterial (Vibrio cholerae), protozoal (Entamoeba histolytica), and helminthic (Ascaris lumbricoides). Public health hazards due to contaminated foods—foodborne infections (botulism, salmonellosis, shigellosis, and staphylococcal food poisoning) and foodborne intoxications (e.g., aflatoxicosis). BIS standards for common foods and drinking water.

Maternal and child health. MCH indicators—MMR, NMR, IMR, and U5MR. Antenatal, intranatal, and postnatal care. Importance of breastfeeding. Breast Milk bank.

Overview of government programs and policies- Janani Suraksha Yojana (JSY) and Pradhan Mantri Matru Vandana Yojana (PMKVY), Integrated Child Development Services (ICDS). Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCH+A), PM Poshan Midday Meal Programme. National AIDS Control Programme.

Unit III: Parasitology

Definition of Parasites. Types-Protozoa, Helminths, and Arthropods. Concept of ecto and endoparasite. Classification of hosts-definitive, intermediate, reservoir, paratenic. Host specificity. Concepts of infection, invasion, pathogenicity, virulence, toxigenicity, carriers and their types. Host-parasite interactions. Hyperparasitism. Parasitoids. Opportunistic and nosocomial infections. Life cycle of Entamoeba histolytica, Plasmodium falciparum, Leishmania donovani -associated diseases and clinical symptoms.

Unit IV: Basic principles of Pharmacology

Drug- Definition, classifications, names-generic, trade, prescription, and over-the-counter drugs. Routes of administration of drugs. Pharmacokinetics. Absorption-bioavailability. Distribution-volume of distribution. Metabolism-first-pass metabolism, biotransformation, bioaccumulation. Excretion - routes, first order and zero order elimination. Half-life of drugs. Pharmacodynamics-targets of drug action, receptors. Drug-receptor interactions- agonists, partial agonists, inverse agonists, and antagonists. Mechanism of action of drugs. Dose of drug and dose-response curves, efficacy and potency, LD50, ED50 and therapeutic index. Adverse drug effects.

Unit V: Biostatistics-II

Probability. Normal and Student's t distribution. Skewness and Kurtosis. Hypothesis Testing- Null and Alternative hypothesis. Errors of inference-Type I and Type II error. Level of significance, p-values. One-tail and two-tail tests. Parametric Tests-Student's t-test (one-sample, unpaired, and paired). Analysis of variance (ANOVA)- models of ANOVA, one-way ANOVA. Correlation-product-moment correlation (Pearson's r). Scatter plot. Regression-types and models. Simple Linear Regression. Non-parametric statistics. Chi-Square test, Yates' correction.

DSCC15 Practical: (1 credit, 25 marks)

1. A handwritten report on field survey on any of the following (at least three physiological/ anthropometricparameters)/ epidemiological study. Descriptive statistics, hypothesis testing and plots (if any) can be done in MS-Excel.
2. Student's t test (unpaired and paired), Chi-square test and calculation of Pearson's r.
3. Evaluation of socioeconomic status of a familyusing updated Kuppuswamy Scale.
4. Study of the following using permanent slides: Amoeba, Entamoeba, Paramecium, Plasmodium, *Leishmania donovani*, *Wuchereria bancrofti* and *Ascaris lumbricoides.*

Marks Distribution Guideline:

DSCC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

DSCC Practical (25 marks): *Field study: 10 (6+4),Experiment: 8 (One experiment to be set), Viva-voce: 04, Lab. Notebook: 03*

Suggested Readings:

General Physiology

1. Ganong's Review of Medical Physiology, Kim E. Barrett et al., McGraw-Hill Education
2. Guyton and Hall'sTextbook of Medical Physiology, John E. Hall, Elsevier
3. The Living Body: A Text in Human Physiology (Best and Taylor's Physiological Basis of Medical Practice), John B. West, Taylor and Francis
4. Physiology, R. M. Berne, M. N. Levy, Elsevier Mosby
5. Lippincott Illustrated Reviews: Physiology, R. R. Preston, T. E. Wilson, Wolters Kluwer
6. Human Physiology: The Mechanisms of Body Function, A. J. Vander, J. H. Sherman, D. S. Luciano, McGraw-Hill
7. Boron & Boulpaep Concise Medical Physiology, By Walter F. Boron, Emile L. Boulpaep
8. Medical Physiology for Undergraduate Students, I Khurana & A Khurana, Elsevier India
9. Textbook of Medical Physiology, Indu Khurana, Arushi Khurana & N G Kowlgi, Elsevier India
10. Essentials of Medical Physiology, K. Sembulingam, Perumal Sembulingam, Jaypee Brothers Medical Publishers
11. Human Physiology, Volume 1 & 2, C. C. Chatterjee, CBS Publishers & Distributors
12. Principles of Physiology, Debasis Pramanik, Jaypee Brothers Medical Publishers
13. Human Physiology: An Integrated Approach, D. U. Silverthorn, Pearson Education
14. Human Physiology: From Cells to Systems, L. Sherwood, Cengage Learning
15. Fundamentals of Human Physiology, L. Sherwood, Cengage Learning
16. Human Physiology, S. I. Fox, McGraw-Hill Education
17. Principles of Anatomy and Physiology, G. J. Tortora, Bryan H. Derrickson, Wiley
18. Seeley's Anatomy & Physiology. A. Russo, C. VanPutte, J. Regan, McGraw-Hill
19. TextBook of Physiology. Vols. I & II by H.D. Patton. A.F. Ruchs. B.Hille. W.B. Saunders of Co.
20. Samson Wright's Applied Physiology, C.A. Keele. E Neil & N. Toels. Oxford University Press.

General Biochemistry

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

Anatomy

1. Handbook Of General Anatomy. B. D. Chaurasia. CBS Publishers.
2. Principles of General Anatomy. A. K. Dutta. Current Books International.
3. Anatomy Physiology, K.S. Saladin, McGraw-Hill.
4. Human Anatomy & Physiology.E.N. Marieb and K. Hoehn. Pearson.

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, R. Cotterill. Wiley
5. A Textbook of Biophysics. R.N. Roy, New Central Book Agency (P) Limited

Biostatistics

1. Statistics in Biology and Psychology by D. Das and A. Das. Academic Publishers.
2. Medical Statistics by B.K. Mahajan. Jaypee Brothers, Medical Publishers Pvt. Ltd.
3. An Introduction to Biostatistics, N. Gurumani, M.J.P. Publishers, Chennai.
4. Biostatistical Analysis by J.H Zar, Pearson.
5. Statistical Methods in Biology, Norman T.J. Bailey, Cambridge University Press.
6. Essentials of Biostatistics & Research Methodology. I. Saha and B. Paul. Academic Publishers
7. Biostatistics, Computer applications and Bioinformatics. Er. A. Gopi et al. Saras Publication

Cancer Biology

1. Textbook of Cancer Biology. Dr. Pradeep Kumar. Prachi Digital Publication.
2. Molecular and Cell Biology of Cancer. Rita Fior and Rita Zilhao (eds). Springer

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 &Febiger
4. Molecular Biology of the Gene, by J.D. Watson, H.H. Nancy & others; Benjamin Cummings.
5. Molecular Biology of the Cell, B. Alberts and others, Garland.
6. Molecular Cell Biology, Berk, Kaiser, Lodish et.al, WH Freeman.
7. Cell Biology, Genetics and Molecular Biology. Halder, Kar. NCBA.

Chronobiology

1. Chronobiology – The Biological Timekeeping, J.C. Dunlap, Sinauer Associates
2. The Rhythm of Life, M. Kelly, The New York Times Bestseller

3. Biological Rhythms, Vinod Kumar, Narosa Publishers

Clinical Biochemistry

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

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. Mahajan BK, Roy RN, Saha I, Gupta, MC. Textbook of Preventive and Social Medicine, Jaypee Brothers Medical Publishers.
4. Essential of Community Medicine. Aviraj K S. White Falcon Publishing.
5. Manual of First aid. LC Gupta. Jaypee Brothers Medical.
6. First Aid Manual. Sanju Sira. CBS Publishers.

Embryology

1. Langman's 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. I. Singh & G.P. Pal. McMillan.
4. Carlson BM. 2014. Human Embryology and Developmental Biology. 5th Edn. Elsevier.

Endocrinology:

1. William's TextBook of Endocrinology, S. Melmed, K. S. Polonsky, P.R. Larsen, H. M. Kronenberg, Elsevier.
2. Endocrinology, M. E. Hadley, Pearson Education
3. Behavioural Endocrinology, R.J. Nelson, Sinauer Associates
4. Endocrinology. Vol. I, II and III, L.O. DeGroot. W.B. Saunders Co. Langman's
5. Endocrine Physiology, P. E. Molina, McGraw Hill Lange.
6. Introduction to Endocrinology by Chandra S. Negi, PHI Learning Pvt. Ltd.

Environmental Physiology/Pollution

1. Pesticides by P.K. Gupta, Interprint. 4
2. Environmental Chemistry by P.K De. Wiley Eastern Ltd.
3. Water Pollution. Causes effects and Control. P K Goel. New Age Internationals.
4. Textbook of Air Pollution and its Control. S C Bhatia. Atlantic Publication.

Ergonomics

1. Fitting the task to the man: A textbook of Occupational Ergonomics. KHE 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 Human Factors and Ergonomics, R.S. Bridger, Routledge: Taylor & Francis group.
7. Occupational health, industrial safety. and Ergonomics for beginners. Dr. Subhashis Sahu. Spellbound.

Genetics

1. Genetics: Analysis of Genes and Genomes, D. L. Hartl, E. W. Jones, Jones & Bartlett Publishers
2. Genetics, G. StrickBerger, Pearson Education
3. Genetics, P. J. Russell, Pearson Education
4. Genetics: A Conceptual Approach, B. A. Pierce, W. H. Freeman and Company

5. An Introduction to Genetic Analysis, A. J. F. Griffiths, J. H. Miller, D. T. Suzuki, R. C. Lewontin, W. M. Gelbart, Macmillan Learning
6. Problems on Genetics, Molecular Genetics and Evolutionary Genetics, P. K. Banerjee, Books and Allied (P) Ltd.
7. Fundamentals of Genetics, B. D. Singh, Medtech Science Press.
8. Essentials of Medical Genetics. Dr Asim Kumar Dutta. A.R.K. Publications.
9. Cell biology, Genetics, Evolution & Ecology. P S Verma. S Chand.
10. Genetics. Veer Bala Rastogi. Medtech.

Haematology

1. Practical Haematology. Dacie and Lewis, Churchill Livingstone, 10th edition.
2. Essential Haematology. A.V. Hoffbrand, J. E. Pettit, P. H. A. Moss and Hoffbrand V. Blackwell Scientific Publications
3. Haematology: Basic Principles and Practice, Ronald Hoffman, Edward J. Benz Jr., Leslie E. Silberstein, Helen Heslop, Jeffrey Weitz, John Anastasi, Elsevier
4. Wintrobe's- Clinical Haematology, J. P. Greer et.al., Wolters Kluwers
5. William's Haematology, E. Beutler et. Al., Mc Grawhil.
6. Essentials in Haematology and Clinical Pathology. R Nayak, S Rai. 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. Wellignton, Oxford University Press.

Human Evolution

1. The Study of Science: Human Evolution. Rusty Huddle (ed). Britanica.
2. Human Evolution. Bernard Campbell. Taylor and Francis Inc.

Immunology

1. Kuby Immunology, T. J. Kindt, R. A. Goldsby, B. A. Osborne, W. H. Freeman
2. Essential Immunology, I. M. Roitt, Blackwell Scientific Publications
3. Cellular and Molecular Immunology, A. K. Abbas, A. H. Lichtman, S. Pillai, Elsevier
4. Janeway's Immunobiology, K. Murphy, P. Travers, M. Walport, Garland Science
5. Fundamental Immunology, W. E. Paul, Lippincott Williams & Wilkins

Instrumentation & Methodology

1. Biomedical Instrumentation & Measurements, L. Cromwell, F. J. Weibel, E. A. Pfeiffer, Prentice-Hall
2. Handbook of Biomedical Instrumentation, R. S. Khandpur, Tata McGraw-Hill
3. Biophysics and Molecular Biology: Tools & Techniques, Pranav Kumar, Pearson
4. Introduction to Biomedical Instrumentation, D. J. Walker, Palgrave Macmillan
5. Physical Biochemistry: Principles and Applications, D. Sheehan, Wiley-Blackwell

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
5. Essentials of Medical Microbiology. Apurba S Sastry. Jaypee Brothers Medical.
6. Textbook of Microbiology. R Ananth Narayan and Paniker. Universities Press (India) Pvt. Ltd.

Neurophysiology

1. Neurobiology, G.M. Shepherd, Oxford University Press

2. TextBook of Neuro-Anatomy, M.B. Carpenter; the Williams and Wilkins Company.
3. The Human Nervous System, C. Nobach, McGraw Hill Book Co.
4. The Human Nervous System, M.L. Barr & J.A. Kierman, Harper & Row. Essential
5. Neuroscience-by Dale Purves, George J Augustine, David Fitzpatrick, Lawrence C Katz, Anthony-Samuel LaMantia, James O McNamara, and S Mark Williams.
6. Principles of Neural Science, Eric R. Kandel, James Harris Schwartz, Thomas Jessell. McGraw-Hill Companies.
7. Lippincott illustrated Reviews: Neuroscience. South Asian edition, Wolters Kluwer India.
8. Essentials of Neuroanatomy. A K Dutta. Current Books International.

Nutrition &Dietetics

1. Food and Nutrition. M. Swaminathan. The Bangalore Printing & Publishing Co.
2. Nutritive Value of Indian Foods. C. Gopalan and others. NIN, Hyderabad.
3. Nutrition Science. B. Srilakshmi. New Age International (P) Ltd.
4. Davidson and Passmore's Human Nutrition & Dietetics. R. Passmore and M.A. Eastwood. Churchill Livingstone.
5. Clinical Dietetics and Nutrition.F. P. Anita and P. Abraham. Oxford University Press, Delhi.
6. Fundamentals of Foods and Nutrition. S.R. Mudambi and M.V. Rajgopal. Wiley Eastern Ltd,1990.
7. Nutrient Requirements and Recommended Dietary Allowance for Indians, Indian Council of Medical Research: New Delhi.
8. Rapid Detection of Food Adulterants and Contaminants: Theory and Practice Shyam Narayan Jha. Academic Press.

Parasitology

1. Biology of Disease. N. Ahmed, M. Dawson, C. Smith, E.D. Wood. Taylor and Francis Group.
2. Medical Parasitology. D.R. Arora and B. Arora. CBS Publications and Distributors
3. Textbook of Medical parasitology. P. Chakraborty. New Central Book Agency.
4. Essentials of Medical Parasitology. Apurva S Sastry. Jaypee Brothers Medical.

Pharmacology

1. Goodman and Gilman's The Pharmacological basis of Therapeutics, McGraw-Hill.
2. Basic and Clinical Pharmacology by E. G Katzung. Appletons and Lange.
3. Textbook of Pharmacology by Seth and Seth Elsevier.
4. Essentials of Medical Pharmacology. K D Tripathy. Jaypee Brothers Medical Publishers.

Space Biology & Aviation

1. Astrobiology and space medicine. Amartya Nandi and Bhaskar R. Puri. Notion Press.
2. Fundamentals of Space Biology.Makoto Asashima and George M Malacinski. Japan Scientific Societies Press.Springer Verlag.

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.

Stress physiology

1. Physiology of Stress, Hans Selye, Jones, and Bartlett Publishers
2. Free Radicals in Biology and Medicine by Barry Halliwell, John M. C. Gutteridge, Oxford University Press

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

Practical Physiology

1. Ghai's Textbook of Practical Physiology. V.P. Varshnay and Monal Bedi. Jaypee Brothers Medical Publishers.
2. Practical Physiology Book. M. Chandrasekar and Nitesh Mishra. Jaypee Brothers Medical Publishers.
3. Textbook of Practical Physiology. G. K. Pal and Pravati Pal. Universities Press.
4. Practical Physiology. Prasunpriya Nayak. Taurean Publications.
5. Practical Biochemistry. Nita Sahi. Jaypee Brothers.
6. Practical Biochemistry. Ranjana Chawla. Jaypee Brothers.

PSI Lab Notebooks:

1. *Note Book on Practical Biochemistry (Published by the Physiological Society of India, Kolkata.)*
2. *Note Book 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: In order 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.

PHYSIOLOGY MDC & MINOR
SEMESTER-I
PAPER: MDC CC-I/ MN-1/ MDC-Mn-1

(Introductory Physiology: Human Body Organisation, Body Fluids and Biophysics*)*

Total credit – 04 *Total marks: 100*

MDC CC1 Theory (3 Credits, 75 Marks)

Unit I: Cell -I

Electron microscopic structure and functions of eukaryotic nucleus, mitochondria, Golgi apparatus, endoplasmic reticulum, ribosome, lysosomes, peroxisomes, cytoskeletal proteins, and centriole. Plasma membrane. Membrane asymmetry and fluidity. Lipid raft. Junctional complex--tight junctions, gap junctions and anchoring junctions. Membrane transport- simple diffusion, osmosis, ion channels, ionophores. Carrier-mediated transport- uniport, symport and antiport, Passive (facilitated diffusion) and Active transport (primary and secondary).

Unit II: Cell-II

Basic concepts of Mendelian Genetics. Laws of inheritance. Chromosome: structure and classification, Chromosomal DNA packaging-nucleosomes and higher level of organisation of chromatin. Euchromatin and heterochromatin. Karyotyping. Human genome and its characteristics (basic concept). Nuclear & Mitochondrial DNA. Cell cycle– events. Cell division- Mitosis & Meiosis phases and significance.Crossing over, linkage.Basic concept of Recombination.

Unit III:Tissues and outline of Human Anatomy

Types, structure, general characters, distribution, and functions of epithelial, connective, muscular, and nervous tissue. Muscles in human body-agonist, synergist, antagonist & fixator with examples. Anatomical positions and functions of—masseter, deltoid, biceps brachii, triceps brachii, biceps femoris, gastrocnemius and soleus.

Unit IV: Haematology and Body Fluids

Concept of body fluid compartments. Composition and function of blood and lymph, Plasma and Serum. Plasma protein-components and their functions. Plasmapheresis. Structure and functions of formed elements-Red Blood Cells, White Blood Cells and Platelets. Haematopoiesis. Erythropoiesis-factors regulating. Leukopoiesis and thrombopoiesis-an outline. Haemoglobin-structure, compounds and derivatives, normal variants- embryonic, fetal, and adult haemoglobins. Haemoglobin catabolism. Hemostasis. Blood coagulation-factors and pathways. Procoagulants and anticoagulants. Fibrinolysis. Body fluid disorders- edema, hypovolemia and electrolyte imbalance

Unit V: Biophysical principles

Diffusion-Fick's laws and biological application. Osmosis- osmolarity and tonicity, Van't Hoff's laws, biological applications. Surface tension and viscosity- biological applications. Colloids-classification, properties, biological importance. Gibbs-Donnan membrane equilibrium. Dialysis and ultrafiltration.Concept of pH and buffer. Henderson-Hasselbalch equation and its application. Common physiological buffers. Basic concept of indicators. Radioisotopes. and their biological uses.

. **MDC CC1 PRACTICAL (1 credit, 25 marks)**

1. Fresh tissue experiments- (a) Staining of squamous epithelial cells with methylene blue, (b) Staining of Adipose tissue with Sudan III or IV
2. Preparation and staining of blood film with Leishman's stain and identification of formed elements of blood.

3. Estimation of total hemoglobin by Drabkin's method.
4. Problems on Mendelian inheritance. Haemophilia/Blood Group.
5. Identification of anatomical planes and muscles from photographs. Anatomical planes-sagittal, frontal (Coronal), transverse (Horizontal). Muscles- masseter, deltoid, biceps brachii, triceps brachii, biceps femoris, gastrocnemius and soleus.

Marks Distribution Guideline:

MDC CC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: IDC

(Elementary Physiology)

Total credit – 03 *Total marks: 75*

IDC Theory (2 Credits, 50 Marks)

UnitI: 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, Intestines, Kidney, Sense organs, Reproductive organs.

UnitII: Biophysical and Biomolecular Phenomena

Importance of major biophysical parameters in Physiology: Diffusion, Osmosis, Enzyme. Macro and Micronutrients and biomolecules involved in maintenance of human health: Definition with primary classifications, examples and functions of Carbohydrate, Protein, Lipids, Vitamins.

UnitIII: 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. Definition of hormone. Major secreting hormones and their important functions: Pituitary, Adrenal, Thyroid and Pancreas. Primary concept on Nerve fibers, Synapses, reflex action.

UnitIV: Applied Physiology

Basic concepts of Ergonomics and its importance in occupational health. Sports and Exercise Physiology: Physical fitness. Classification of sports, Basic concept of anthropometry. 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. First Aid-definition. Wounds-types, CPR. First aid in drowning and poisoning- snake bite, insect bites, and sting.

UnitV: Common Diseases and pathophysiological significance

Prevailing global communicable and non-communicable diseases, their primary causes and suggested measures: Influenza, Tuberculosis, Hepatitis, COVID-19, Diabetes mellitus, Haemophilia, Thalassemia, COPD,

Malaria, Dengue. Obesity, Pathophysiological tests, their normal range in the system and indicative diseases: TC, DC, ESR. Fasting and Postprandial blood sugar tests, Glycosylated haemoglobin, BilirubinSGOT, SGPT, Uric acid, Creatinine.

IDC Practical: (1 credit: 25 marks)

1. Determination of pulse 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 (WHO classification for Asians), waist-hip ratioof human subject.
4. Determination of Blood group.

Marks distribution pattern:

IDC Theory (50 marks)

1) A total of 25 MCQ questions (2 marks each) will be set, with 5 questions from each unit. The examinee is required to answer all 25 questions. (2 marks × 25 questions = 50 marks).

IDC Practical (25 marks): *Experiment: 18 (Two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: MDC-SEC

Clinical haematology, Therapeutic nutrition, public hygiene, Basic Lab. Techniques and Food adulterants

Total credit – 04 *Total marks: 100*

MDC SEC Theory (2 Credits, 50 Marks)

Unit I: Clinical Haematology and Haematological Techniques

Concept of complete hemogram. Definition,normal values, and clinical significance of total count of RBC, WBC, platelets, differential count of WBC, PCV, MCV, MCH, MCHC, ESR, bleeding time, clotting time. Anemia-classification, diagnostic criteria and management. Glycated haemoglobin. Blood grouping- ABO and Rh. Bombay Blood group.Concept of Blood bank. Blood donation criteria. Blood transfusion-, indication, precaution, and hazards. Erythroblastosis fetalis. Haematological disorders-polycythemia, leukocytosis, leukopenia, leukaemia, thrombocytopenia,and purpura, haemophilia. Hemoglobinopathies- Sickle-cell anaemia and Thalassemia.

Unit II: Therapeutic Nutrition

Assessment of nutritional status by anthropometry -weight for age, height for age, weight for height, head circumference, chest circumference, mid upper arm circumference, Body mass index, Ponderal index Waist hip ratio. Nutritional requirement and dietary formulation for children, adolescent and geriatric population. Basic concepts of diet therapy. Classification of therapeutic diets based on nutrient restriction/ modification, texture of food. Nutritional concern and dietary management of obesity, diabetes, hypertension, and nutritional anaemias.

Unit III: Public Hygiene and First Aid

Awareness about food and water safety. Sources and potability of water. Water and food borne infections. Causative factors,symptoms, mode of transmission and methods of prevention of Hepatitis A, rotavirus diarrhoea, bacillary dysentery, cholera, amoebiasis, botulism, salmonellosis, shigellosis. Hygiene – Definition; Personal, Community, Medical and Culinary hygiene. Ideal hand washing method. Microbial Standards for Foods and Water. Waste and sewage disposal.

First Aid-definition and importance. Wounds-types, and management. Burns-types, severity assessment and management. Contents of an ideal first aid kit. Emergency response- CPR, and its steps. First aid in drowning and poisoning- snake bite, insect bites, and sting.

Unit IV: Basic laboratory instrumentation and techniques

Fundamentals of Microscopy- resolution, magnification. and numerical aperture. Principles of construction, uses, advantages and disadvantages of compound microscope. Principles of centrifugation. Principles and uses of paper chromatography, Electrophoresis- principle, method and uses of agarose gel electrophoresis, Basic concepts of colorimetry.

Unit V: Food additive and adulterants

Food additives-definition and classification with examples. Food adulterants-definition and classification. Common adulterants in food samples-Cereals, pulses, wheat flour, besan, milk, honey, ghee, butter, coffee, turmeric powder, chilli powder, coriander powder, mustard seed/oil, and black pepper. Adulteration with rapid test by fssai. Pathophysiological effects of metanil yellow, rhodamine B, bisphenol, aluminium foil, dioxin, saccharin, monosodium glutamate, chicory, feed grade urea, malachite green and margarine.

MDC SEC Practical (2 credits; 50 Marks)

1) Determination of bleeding time and clotting time.
2) Preparation of hemin crystal.
3) Determination of blood group.
4) Assessment of BMI, ponderal index, waist-hip ratio, MUAC.
5) Qualitative tests for detection of common adulterants - milk (detergent, starch, water), green vegetables (malachite green), turmeric powder (metanil yellow), coffee (chicory), sugar (chalk powder).

Marks Distribution Guideline:

SEC Theory (50 marks)

1) ***Group A- Short definitive type (10 marks):*** *A total of 8 questions (2 marks each) will be set, taking at least one question from each unit. The examinee is required to answer any 5 questions. (2 marks × 5 questions = 10 marks).*
4) ***Group-B- Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*
2) ***SEC Practical (50 marks):*** *Experiments: 35 (three experiments to be set), Viva-voce: 08, Lab. Notebook: 07.*

SEMESTER-II

PAPER: MDC CC2/MN-2/MDC-Mn-2

(Chemistry of Biomolecules and Enzymes)

Total credit – 04 *Total marks: 100*

MDC CC2 Theory (3 Credits, 75 Marks)

UnitI: Chemistry of Carbohydrates

Carbohydrates-definition and classification. Monosaccharides- structure, occurrence, isomerism (stereoisomerism, optical isomerism, and epimerism) and physiological importance. Cyclic structures—pyranose and furanose. Anomerism. Mutarotation. Chemical reactions of monosaccharides (Glucose & Fructose) – reactions with concentrated mineral acids, alkali, and their biochemical importance. Disaccharides-structure, occurrence, and physiological importance of maltose, lactose and sucrose. Polysaccharides-structure, occurrence, and physiological importance of starch, glycogen, dextrin, cellulose.

UnitII: Chemistry of Lipids

Lipids- definition and classification. Fatty acids- classification, systematic nomenclature, and structure. Mono, di, and triglycerides. Properties of fat and fatty acids- hydrolysis, saponification, saponification number, iodine number, hydrogenation, rancidity, acid number, Cis-trans isomerism of fatty acids. Physiological importance of phospholipids, glycolipids, sphingolipids and cholesterol. Lipoproteins- structure and classification.

Unit III: Chemistry of Amino Acids, Peptides and Proteins

Amino acids -classification, structure, nomenclature and optical properties. Protonic equilibrium- zwitterions, isoelectric point. Reactions with ninhydrin and formaldehyde. Peptides & proteins- structure and properties of peptide bonds. Biuret reaction. Different levels of protein structure-primary, secondary, tertiary and quaternary. Denaturation and Renaturation.

UnitIV: Chemistry of Purine, Pyrimidine, and Nucleic acid

Chemistry of purine, pyrimidine -structure, nomenclature and tautomerism. Nucleosides and nucleotides—structure. Polynucleotides. DNA double helix—primary, secondary and tertiary structures. A-DNA, B-DNA & Z-DNA. Denaturation and annealing. Hyperchromicity, melting temperature and half Cot value. RNA— mRNA, rRNA, tRNA and their structures.

Unit V: Enzymes

Enzymes classification. EC nomenclature. Concept of apoenzyme, holoenzyme, coenzyme, cofactors, and prosthetic group. Rate-limiting enzymes. Isozymes. Ribozymes and abzymes. Specificity of enzymes. Enzyme-substrate complex. Mechanism of enzyme action- activation energy and transition state. Models of enzyme-substrate interactions. Concept of initial rate, maximum velocity, and steady-state kinetics. Michaelis-Menten equation. Michaelis constant. Significance of Km and Vmax. Factors influencing enzyme-catalyzed reactions-substrate concentration, enzyme concentration, pH and temperature, Q10. Enzyme inhibition-competitive and non-competitive. Covalent modification and allosteric modulation of enzymes. Feedback inhibition.

MDC CC 2 Practical (1 credit; 25 marks)

1) Qualitative tests for identification of physiologically important substances- Hydrochloric acid, Lactic acid, Albumin, Peptone, Gelatin, Starch, Glucose, Fructose, Lactose, Sucrose, Urea, Acetone, Glycerol, and Bile salt.
2) Quantitative estimation of percentage of glycine amino nitrogen (Sorensen's Formol Titration Method).
3) Quantitative estimation of total quantityof glycine amino nitrogen (Sorensen's Formol Titration Method).

MDC CC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

SEMESTER-III

PAPER: MDC CC3/MN-3/MDC-Mn-3

(Digestive System, Nutrition, Dietetics and Metabolism)

Total credit – 04 *Total marks: 100*

MDC CC3 Theory (3 Credits, 75 Marks)

Unit I: Digestion

Anatomy and histology of the alimentary canal. Digestive glands and their histological structure- salivary glands, pancreas, liver, gastric and intestinal glands. Digestive juices- composition and functions of salivary, gastric, pancreatic, biliary, and intestinal secretions. Digestion and absorption of carbohydrates, proteins and lipids. Enterohepatic circulation. Deglutition and movements of the intestine. Gastric reflux and vomiting. Defecation.Gut microbiome, probiotics and prebiotics. Disorders of GI tract: Peptic ulcer, jaundice, gallstones, constipation.

UnitII: Nutrition

Food and nutrients. Macro and micronutrients. Carbohydrates in nutrition- glycaemic index, Dietary fibres-types and significance. Proteins in nutrition-essential amino acids, nitrogen balance, biological value of proteins, protein sparers. Supplementary action of proteins, Protein efficiency ratio and net protein utilization. Fats in nutrition- visible and invisible fats, saturated, monounsaturated, polyunsaturated, trans fats, omega-3 and omega-6 fatty acids. Vitamins-sources, physiological functions and deficiency symptoms of vitamin-A, D, E & K, Vitamin B complex. Minerals—Sources, physiological functions and deficiency symptoms of sodium, potassium, calcium, phosphorus, iron, iodine.

Unit III: Dietetics

RDA (As per latest ICMR guideline). Respiratory quotient, Basal Metabolic Rate-factors affecting. SDA of food. Balanced diet and principles of formulation of balanced diet for adult man and woman, pregnant woman and lactating woman. Methods of diet survey (latest ICMR guideline). Composition and nutritional value of common foodstuffs– rice, wheat, pulses, milk, potatoes, egg, chicken, and fish (Rohu).

Unit IV: Metabolism-I

Carbohydrate Metabolism: pathways, energetics and metabolic significance of Glycolysis, TCA Cycle. Amphibolic roles of TCA cycle. Glycogenesis, glycogenolysis, gluconeogenesis and pentose phosphate pathways. Outline of the components of ETC. Oxidative phosphorylation. Substrate level phosphorylation.

Unit V: Metabolism-II

Lipid Metabolism- β-Oxidation of saturated fatty acid. Ketone body synthesis. Glucogenic and ketogenic amino acids, amino acid pool, deamination, transamination, trans -deamination. Urea cycle - metabolic pathway.

MDC CC3 Practical (1 credit, 25 marks)

1) Study and identification of stained sections of different parts of the digestive system: tongue, salivary gland, oesophagus, stomach, small intestine, large intestine, liver,and pancreas.
2) Qualitative analysis of common foodstuffs (rice, pulse, potato, milk).
3) Diet survey of one's own family by 24 hours recall method / weighment method.

Marks distribution pattern:
MDC CC Theory (75 marks)

1. ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2. ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks).*
3. ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Diet survey: 10 (7+3),Experiment: 8 (One experiment to be set), Viva-voce: 04, Lab. Notebook: 03*

SEMESTER-IV

PAPER: MDC CC4/MN 4/MDC-Mn-4

(Cardiovascular, Respiratory, Nerve-Muscle and Renal Physiology)

Total credit – 04 *Total marks: 100*

MDC CC4 Theory (3 Credits, 75 Marks)

Unit I: Cardiovascular Physiology

Anatomy of the heart. Properties of cardiac muscle. Stannius ligature. Origin and propagation of cardiac impulse. Cardiac cycle: Events, Heart sounds. Concept of heart rate and pulse rate. Cardiac Output-definition, measurement by application of Fick's principle and factors affecting cardiac output. Starling's law of heart. Blood pressure-definition and principle of measurement. Hypertension and hypotension. Factors affecting

blood pressure. Electrocardiography- normal electrocardiogram (ECG), electrocardiographic leads. Coronary circulation-anatomy and peculiarities. Innervation of heart, baroreceptors and chemoreceptors, cardiac vasomotor centre. Cardiac reflexes -baroreceptor reflex, chemoreceptor reflex, Bainbridge reflex. Cardiovascular disorders-tachycardia, bradycardia, myocardial infarction.

Unit II: Respiratory Physiology

Anatomy and histology of the airways and the lungs. Mechanism of breathing-role of respiratory muscles. Alveolar surfactant. Lung volumes and capacities. Physiological dead space. Pulmonary circulation-peculiarities. Transport of gases- oxygen and carbon dioxide. Oxygen-hemoglobin dissociation curve- factors affecting. Bohr effect. Haldane effect. Regulation of respiration- neural and chemical. Hypoxia and Cyanosis. Cheyne-Stokes breathing, sleep apnea, asthma and COPD.

Unit III: Nerve Physiology

Classification, structures, and functions of neurons, neuroglia. Velocity of impulse in different types of nerve fibre. Properties of nerve fibers-excitability, conductivity, all or none law, refractory period, indefatigability, chronaxie, rheobase and utilization time. Resting membrane potential-origin. Action potential-ionic basis and propagation. Saltatory conduction. Synapse -types, structure and mechanism of transmission. EPSP, IPSP. Neurotransmitters. Neuromuscular junction-structure and transmission. EPP and MEPP. Motor unit. Degeneration and regeneration of nerve fibers.

Outline of general organization and functions of Nervous system.

Unit IV: Muscle Physiology

Structure of skeletal, cardiac, and smooth muscles. Sarcotubular system. Red and white muscle fibers, Single and multi-unit smooth muscles. Muscle groups- agonists and antagonists. Properties of skeletal muscle-all or none law, summation, beneficial effect, refractory period, tetanus, and fatigue. Excitation-contraction coupling. Mechanism of skeletal muscle contraction and relaxation, electrical, chemical, Isometric and isotonic contractions.

Unit V: Renal Physiology

Anatomy of the kidney. Histological structures of nephrons. JG apparatus. Peculiarities of renal circulation and autoregulation. Mechanism of formation of urine. Basic concept of Counter current multiplier and counter current exchanger systems. Non-excretory functions of the kidney. Renal regulation of acid-base balance.Physiology of micturition. Constituents of urine- normal and abnormal with pathophysiological significance. Diabetes insipidus, Renal dialysis.

MDC CC4 Practical (1 Credit, 25 marks)

1. Measurement of arterial blood pressure by sphygmomanometer. Determination of mean pressure and pulse pressure.
2. Measurement of arterial pulse rate.
3. Measurement of peak flow rate by peak flow meter.
4. Pneumographic recording of normal chest movements and effect of breath holding.
5. Staining of skeletal muscle fibre by methylene blue.
6. Identification of normal (Chloride, sulphate, phosphate, urea, creatinine) and abnormal (glucose, protein, acetone,bile salt) constituents of urine.

MDC CC Theory (75 marks)

1. ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2. ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3. ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: MDC CC5

*(*Nervous and integumentary system, Environmental Physiology, Community & Public Health)

Total credit – 04 *Total marks: 100*

MDC CC5 Theory (3 Credits, 75 Marks)

Unit I: Nervous system-I

Central and peripheral nervous system. Structure and function of spinal cord. Ascending tracts- fasciculus gracilis, fasciculus cuneatus and lateral spinothalamic tract. Descending tracts- pyramidal tracts. Pain- types. Reflex action- definition, reflex arc, classification, and properties. Outline of function of brainstem. Cerebrovascular stroke.

Unit II: Nervous System-II

Histological structure and localisation of functions of the cerebral cortex. Different nuclei and functions of thalamus and hypothalamus. Structure and functions of cerebellum. CSF- composition, formation, circulation and functions. Organization and functions of the autonomic nervous system. Brief idea of sleep stages, speech centers in brain, learning and memory. Aphasia. Insomnia. Dementia. Alzheimer's disease.

Unit III: Integumentary system

Structure and functions of skin. Cutaneous circulation-peculiarities. Sweat glands –structure and types. Sweat –composition, mechanism of formation and regulation of secretion. Sebaceous gland. Composition and function of sebum. Cerumen. Insensible perspiration. Regulation of body temperature in homeotherms - physical and physiological processes. Hyperthermia, hypothermia, and pyrexia. acne, alopecia, leukoderma and albinism.

Unit IV: Environmental Physiology

Physiological response to high altitude- acute and chronic. Acclimatization to high altitudes. Acute mountain sickness. Effect of hyperbaric environment- Caisson's disease. Acclimatization in hot and cold environments. Heat disorders- types, symptoms and prevention. Cold related illness.

Pollution-definition. Classification of pollutants. Air pollution- types, sources, and effects of pollutants on human health and preventive measures. Indoor air pollution- sources and effects. SMOG, Air quality index, Acid rain. Greenhouse effect. Water pollution- sources, impacts and preventive measures. BOD, COD. Noise pollution- permissible ambient noise levels, impacts on human health, and control measures.

Unit V: Community and Public Health

Concept of Health and disease. Brief idea of community health and public health. Public health challenges in India. Communicable and non-communicable diseases with examples. Common non-communicable disease in India- etiology, and management of hypertension, diabetes mellitus, obesity, endemic goiter, nutritional anemia, rickets. Causes, symptoms, and social implications of protein calorie malnutrition. Common communicable diseases in India— etiology, and prevention of malaria, tuberculosis, dengue, hepatitis, typhoid, Covid-19, and AIDS. Population problem. Principles and methods of family planning. Problem of infertility and assisted reproductive technologies (ART). Principles and social importance of immunization against diseases. Maternal and child health indicators—MMR, NMR, IMR, and U5MR. Overview of government programs and policies- Integrated Child Development Services (ICDS). PM Poshan (Midday Meal Programme).

MDC CC5 Practical (1credit; 25 marks)

1. Preparation of nodes of Ranvier by silver nitrate.

2. Permanent histological slides- cerebrum, cerebellum, spinal cord, kidney, ureter, skin, lung and trachea.
3. Assessment of thermal load using WBGT index.
4. Assessment of noise at college premises by sound level meter.
5. A handwritten report on field survey on any of the following (at least three physiological/ anthropometric parameters)/epidemiological studies.

MDC CC Theory (75 marks)

1. ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2. ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3. ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Field work -8 (5+3), Experiments: 10 (one experiment to be set), Viva-voce: 04, Lab. Notebook: 03*

SEMESTER-V

PAPER: MDC CC6/MDC-Mn-5

*(*Special Senses, Endocrine and Reproductive Physiology)

Total credit – 04 *Total marks: 100*

MDC CC6 Theory (3 Credits, 75 Marks)

Unit I: Special Sense-I

Characteristics of special senses. Weber-Fechner law, Steven's power law. Olfaction and gustation -receptor organs, neural pathways and centers. Signal transduction of olfactory and gustatory stimuli. After taste. Disorders of smell and taste- dysgeusia, ageusia, anosmia, hyposmia, hypogeusia. Structure and functions of auditory apparatus. Organ of Corti -Structure and its role in hearing. Auditory pathway. Signal transduction of auditory stimuli. Hearing loss.

Unit II: Special Sense-II

Outline structure of eyeball. Crystalline Lens. Histology of Retina. Visual pathway- receptors, course, termination and centers. Mechanism of accommodation. Light reflex. Aqueous humor- functions. Basic concepts of photopic and scotopic vision.Photochemical changes in retina. Phototransduction. visual acuity, and colour vision. Light and dark adaptation. Positive and negative after images. Errors of refraction and their corrections.Glaucoma and cataract.

Unit III: Endocrinology-I

Cell surface receptor proteins – ion channel coupled, G-protein coupled andenzyme-coupled. Intracellular messengers – cAMP, cGMP, IP3, DAG,Ca^{2+},Protein kinases.

Hormones-classification. Elementary idea of mechanism of hormone action. Hypothalamus as a neuroendocrine organ. Hypothalamic-hypophyseal tract and portal system. Hypothalamic releasing and inhibitory hormones. Feedback regulation- basic concept. Pituitary gland- histology, chemical nature, and functions of hormones. Hypo and hypersecretory disorders-dwarfism, gigantism, acromegaly. Thyroid and Parathyroid Glands- histological structures, chemical nature, and functions of hormones. Disorders- non-toxic goiter, myxoedema, cretinism, Hashimoto's thyroiditis, Grave's disease, tetany.

Unit IV: Endocrinology-II

Adrenal cortex and medulla- histology, chemical nature, and functions of adrenal hormones. Hypo and hypersecretory disorders. Cushing's syndrome, Addison's disease. Pancreas- Histological structure of pancreatic islets, chemical nature, and functions of the hormones. Diabetes mellitus and hyperinsulinism. Pineal gland and melatonin. Brief idea of gastrointestinal hormones- gastrin, secretin, CCK-PZ. Renin, erythropoietin.

UnitV: Reproductive Physiology

Basic anatomy of male and female reproductive systems. Primary and accessory sex organs and secondary sex characters. Male reproductive system-histology of testis, spermatogenesis, testicular hormones and their functions.

Female reproductive system- histology of ovary. Oogenesis. Ovarian hormones and their functions. Menstrual cycle and its hormonal control, Menarche, and menopause. Fertilization, early embryogenesis and implantation. Structure and functions of placenta, Maintenance of pregnancy-role of hormones. Parturition. Development of mammary gland. Lactation and its hormonal control.

MDC CC6 Practical (1 credit, 25 marks)

1. Determination of Visual acuity by Snellen's chart.
2. Deafness test using Tuning fork.
3. Assessment of colour blindness by Ishihara chart.
4. Permanent slides- thyroid gland, adrenal gland, testis, ovary, uterus, spleen, artery, vein.

MDC CC Theory (75 marks)

1. ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2. ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3. ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

PAPER: MDC CC7

(Histology, Clinical Biochemistry, Molecular Biology, Evolution and Biostatistics)

Total credit – 04 *Total marks: 100*

MDC CC7 Theory (3 Credits, 75 Marks)

Unit I: Histological techniques

Tissue fixation: objectives, classification and examples of fixatives Choice of fixatives. Dehydration-steps and significance, Clearing-agents and significance. Embedding- paraffin wax, Microtomy-working principle and uses of rotary microtome. Dyes and stains in histology-types and examples of natural, synthetic, acidic, basic, neutral, and amphoteric dyes. Brief idea of different staining techniques progressive, regressive, vital, and supravital. Staining methods: simple (Methylene Blue, Silver nitrate, Double/differential (Leishman, and Haematoxylin-Eosin stain).

Unit II: Clinical Biochemistry

Carbohydrates: fasting, postprandial, and random blood glucose, oral glucose tolerance test, HbA1C, hyper &hypoglycemia. Lipids-lipid profile, hypercholesterolemia, atherosclerosis. Proteins: total protein, serum albumin, hypoproteinemia, albumin: globulin ratio. Bence Jones proteins. Pathophysiological significance of urea, creatinine, uric acid, bilirubin, sodium, potassium. Pathophysiological significance of lactate dehydrogenases, pancreatic amylase, alkaline phosphatase, SGOT, SGPT, Cardiac troponins. Thyroid profile (T3, T4, TSH).

Unit III: Molecular Biology

Basic concepts of Central Dogma of Molecular Biology. DNA replication in prokaryotes-role of topoisomerase, DNA polymerases and ligase. Transcription in prokaryotes- role of RNA polymerases and transcription factors. Introns, exons. Genetic code and its characteristics. Translation in prokaryotes. Regulation of Gene Expression in prokaryotes- lac operon. Enzymes and components required forRecombinant DNA Technology. Application of recombinant DNA technology in human health- recombinant insulin. Gene therapy.

Unit IV: Human evolution

Definition and significance of evolution. Convergent and divergent evolution. Evidence in evolution-morphological, embryological, and paleontological. Geological time scale, Brief Overview of evolutionary theories: Lamarckism, Darwinism, and Modern Synthesis. Origin of Homo sapiens and comparison with earlier species–Australopithecus, Homo habilis, Homo erectus and Neanderthals. Major transitions in hominin Evolution- Bipedalism, evolution of brain size and intelligence. Population genetics: Hardy Weinberg Equilibrium.

Unit V: Biostatistics

Concept of Variables, Population & sample. Parameters and statistics. Presentation of data- Frequency distribution, Pie diagram, Bar diagram, Frequency polygon, Histogram. Central tendencies-mean, median and mode. Standard deviation and standard error.

MDC CC 7 Practical (1 credit. 25 marks)

1. Calculation of Mean, median, mode.
2. Pie diagram, bar diagram using physiological data.
3. Random blood glucose estimation using glucometer.
4. Identification of hominins from photographs- Australopithecus, Homo habilis, Homo erectus and Neanderthals.

MDC CC Theory (75 marks)

1. ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2. ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*
3. ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

SEMESTER-VI

PAPER: MDC CC8/MDC-Mn-6

*(*Microbiology, Immunology, Work and Sports Physiology, Ergonomics and Occupational Health)

Total credit – 04 *Total marks: 100*

MDC CC8 Theory (3 Credits, 75 Marks)

Unit I: Microbiology

Bacterial structure- Gram-positive and Gram-negative cell walls, LPS layer, pili, flagella, chromosome, plasmid, spores. Bacterial classification based on staining techniques (Gram stain & acid-fast stain) and morphological aspects. Culture of bacteria- nutritional requirements, complex and synthetic media, Physical factors required for growth. Bacterial growth curve. Microbial growth in response to environment -temperature, pH, solute and water activity, and oxygen. Pathogenic and non-pathogenic bacteria with examples. Control of microbial growth- physical and chemical methods used in sterilization, disinfection, and pasteurization. Elementary idea of chemotherapeutic agents and antibiotics- bactericidal, and bacteriostatic action. Bacterial diseases-tuberculosis, typhoid, pneumonia.

Structure of virus -virion, prion and bacteriophages, Classification of viruses based on nucleic acid composition and host system, Interferons. Viral diseases -influenza and hepatitis.

Unit II: Immunology

Overview of active and passive immunity. Innate and acquired/ adaptive immunity. Barriers of innate immunity. Immunogens, and antigens-requirements of immunogenicity, haptens; epitopes.Adjuvants. Antibody- structure, types, functions, and properties. Antigen-Antibody interactions- neutralization, precipitation, opsonization and agglutination. Primary and secondary immune response. Generation of Humoral Immune and Cell Mediated Immune Response. Hypersensitivity- types with examples. Inflammation. Autoimmunity. Vaccination-Types of vaccines. Toxins and toxoids.

Unit III: Sports Physiology

Concept of endurance, strength, and speed in sports activities. Muscle fibre-types and performance.Sources of energy. Concept of maximum physical work capacity-factors affecting, and measurement by bicycle ergometer. Significance of maximal oxygen consumption (VO2 max) and excess post-exercise oxygen consumption (EPOC). Aerobic and anaerobic capacity. Lactate threshold, Training principles for different sports activities. Physical fitness and its assessment by modified Harvard Step Tests, Nutritional aspects of sports-role of macronutrients and micronutrients in sports performance. Ergogenic Aids. Doping- dope substances and drug abuse in sports.

UnitIV: Work and Exercise Physiology

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. Workload – light, moderate (submaximal) and heavy (maximal) depending on intensity and duration of work. Physiological responses to work –cardiovascular, respiratory, metabolic, and muscular – short-term and long-term. Work-rest cycle and importance of rest pause. Muscular fatigue- central and peripheral fatigue in physical work.

Unit V: Ergonomics and Occupational Health

Introduction to Ergonomics -definition, and classification. Concept of man-machine-environment interaction. Brief concept of manual material handling (MMH) -types. Ergonomic principles of safe load handling. Evaluation of working posture using OWAS, RULA and REBA methods. Role of ergonomics in the improvement of productivity and ensuring industrial safety. Ergonomic assessment of workplace: Illumination, temperature and noise.

Introduction to Occupational Health- definition and importance. Occupational Hazards -types (physical, chemical, biological, ergonomic, and psychosocial). Causative factors, physiological effects, and preventive measures of common occupational diseases- - asbestosis, silicosis, byssinosis, pneumoconiosis, and noise-induced hearing loss. Work related Musculoskeletal Disorder (WRMSD)-definition, prevalence of WRMSD among workers and causative factors for the initiation of WRMSD. Role of ergonomics towards mitigation of WRMSD. Definition of personal protective device (PPD) and efficacy of using personal protective device in different work related hazardous sectors.

MDC CC8 PRACTICAL (1 credit, 25 marks)

1) Assessment of PFI by modified Harvard step test.
2) Assessment of $\dot{V}O_2$max by Queens college test.
3) Measurement of Handgrip strength by handgrip dynamometer.
4) Lactophenol Cotton Blue staining of dietary yeast.

MDC CC Theory (75 marks)

1) ***Group-A Short definitive type (20 marks):*** *A total of 15 questions (2 marks each) will be set, with three questions from each unit. The examinee is required to answer any 10 questions. (2 marks × 10 questions = 20 marks).*
2) ***Group-B Brief answer type/short note (15 marks):*** *5 questions, one from each unit, will be set. The examinee should attempt any three (5 marks × 3 questions = 15 marks)*

3) ***Group-C Descriptive type: (40 marks):*** *5 questions of 8 marks will be set, taking one from each unit, along with an alternative question of equal weightage. The question should be subdivided with maximum marks not exceeding 6 marks. (8 marks × 5 questions = 40 marks).*

MDC CC Practical (25 marks): *Experiments: 18 (two experiments to be set), Viva-voce: 04, Lab. Notebook: 03*

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. Exercise Physiology and Ergonomics. Asis Goswami. Academic Publishers.
14. Physiological basis of Sports and Exercise Sciences.Dr. Anupam Bandyopadhyay. Notion Press.
15. *Sharirbigyan* (Bengali) Vol. I & 2, J. Debnath, Sridhar Prakashani.
16. *Byaboharik Sharirbigyan.* (Bengali). J Debnath. Sridhar Prakashani
17. *Paripak, Bipak O Pusti,*(Bengali) D. Das, Paschim Banga Rajya Pustak Parshad.
18. *Snatak Sharirbidya*, (Bengali). A. Bandopadhyay, Calcutta Book House.
19. *Snatak Sharirbidya*. (Bengali). Masanta Das, Santra Publication.
20. Practical Physiology (Bengali), by M.K. Manna, Sritara Prakashani, Kolkata
21. Nutritive Value of Indian Foods by C. Gopalan and other, NIN, Hyderabad. 20.