DEBRA THANA S.K.S. MAHAVIDYALAYA
(AUTONOMOUS)

Chakshyampur, Debra, Paschim Medinipur, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE (HONOURS)

MAJOR IN PHYSIOLOGY

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2024-2025)

Based on

Curriculum & Credit Framework for Undergraduate Programmes (CCFUP), 2023 & NEP, 2020

DEBRA THANA S.K.S. MAHAVIDYALAYA (AUTONOMOUS)
BACHELOR OF SCIENCE (HONOURS) MAJOR IN PHYSIOLOGY
(Under CCFUP, 2023)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. (Hons.)	1st	I	**SEMESTER-I**							
			Major-1	**PHYHMJ101**	**T: System Physiology & Haematology** **P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			SEC	**PHYSEC01**	**P: Clinical Hematology**	**3**	**0-0-3**	**10**	**40**	**50**
			AEC	**AEC01**	Communicative English -1 (***common for all programmes***)	**2**	**2-0-0**	**10**	**40**	**50**
			MDC	**MDC01**	Multidisciplinary Course -1 (***to be chosen from the list***)	**3**	**3-0-0**	**10**	**40**	**50**
			VAC	**VAC01**	ENVS (***common for all programmes***)	**4**	**2-0-2**	**50**	**50**	**100**
			Minor (Disc.-I)	**PHYMI01**	**T: Basic Human Physiology; P: Practical *(To be taken by students of other Disciplines)***	**4**	**3-0-1**	**15**	**60**	**75**
					Semester-I Total	**20**				**400**
		II	**SEMESTER-II**							
			Major-2	**PHYHMJ102**	**T: Basic Biochemistry and Enzymology** **P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			SEC	**PHYSEC02**	**P: Clinical Blood Biochemistry**	**3**	**0-0-3**	**10**	**40**	**50**
			AEC	**AEC02**	MIL-1 (***common for all programmes***)	**2**	**2-0-0**	**10**	**40**	**50**
			MDC	**MDC02**	Multi Disciplinary Course-02 (***to be chosen from the list***)	**3**	**3-0-0**	**10**	**40**	**50**
			VAC	**VAC02**	Value Added Course-02 (***to be chosen from the list***)	**4**	**4-0-0**	**10**	**40**	**50**
			Minor (Disc.-II)	**PHYMI02**	**T: Biophysical, Biochemical principles and Metabolism; P: Practical *(To be taken by students of other Disciplines)***	**4**	**3-0-1**	**15**	**60**	**75**
			Summer Intern.	**CS**	Community Service	**4**	**0-0-4**	**-**	**-**	**50**
					Semester-II Total	**24**				**400**
					TOTAL of YEAR-1	**44**				**800**

❖ **After completion of SEM-I & SEM-II, name of the certificate course: Phlebotomy and clinical biochemistry in Human Physiology**.

MJ = Major, MI = Minor Course, SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, VAC = Value Added Course; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial- Practical, MIL = Modern Indian Language, ENVS = Environmental Studies

MAJOR (MJ)

MJ-1: System Physiology & Haematology **Credits 04 (Full Marks: 75)**

MJ-1T: System Physiology & Haematology **Credits 03**

Course contents:

Unit I: Introduction and Historical background of Human Physiology:
The term physiology was first coined by Jeam Fernel in 1543 and the basic Physiology was introduced by Subodh Chandra Maholanobish, in Presidency College, 1901 in our country. Evolution of Human Physiology: Ancient to Modern Era. Summary of key changes: From Holistic to mechanistic, from observational to experimentation, from organ level to molecular level understanding and from passive observation to active intervention. Key contributor behinds this evolution of Human Physiology. Nobel Prize winning discoveries in Physiology/Medicine and their relevance to UG Human Physiology syllabus: Neuron Doctrine (1906) – Ramón y Cajal & Golgi, Chemical Transmission (1936) – Dale & Loewi, Cori Cycle (1947) – Carl & Gerty Cori, Krebs Cycle (1953) – Hans Krebs, Action Potentials (1963) – Hodgkin & Huxley, cAMP Second Messenger (1971) – Sutherland, Visual Cortex Mapping (1981) – Hubel & Wiesel, Nitric Oxide in Vasodilation (1998) – Furchgott et al., Oxygen Sensing (2019) – Kaelin, Ratcliffe, Semenza, DNA Structure (1962) – Watson & Crick, Cell Cycle Regulation (2001) – Hartwell et al.

Unit II: Brief outline of physiological system:
Major organs involved and their role in physiological systems like., Cardiovascular system, Respiratory system, Digestive system, Excretory system, Endocrine system, Reproductive system and Nervous system (Brain and Spinal cord).

Unit III: Cell, Tissue, Organ and Human Anatomy:
Brief overview of human surface anatomy with general working knowledge of different anatomical parts of the body. Regional anatomy: Head, Neck, Face, Brain, Thorax, Abdomen, Upper and Lower Extremities. Bones and Joints: Parts, classification of epiphyses, Ossification, blood & nerve supply of long bone, Applied Anatomy; Synovial joints and fluids; Cartilages: Definition, types, structure, distribution, functions.

Structural organizations and functions of intracellular organelles: Anatomy, electronmicroscopic structure and functions of prokaryotic and eukaryotic cells and cell organelles. Electro-microscopic (EM) structure and functions of Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, microsome, peroxisomes, endoplasmic reticulum, Endoplasmic reticulum (smooth and rough), microtubules, vacuoles and ribosome. Intercellular communication: Basic idea of tight junctions, gap junctions, adherens junctions, desmosomes and cell adhesion molecules, Extracellular matrix components. Cell membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes. Basic concept of cytoskeleton structure, functions and types of animal cells.

Tissue Organization: Structure, classification, distribution and functions of different tissues. Development and organization of different organs and systems of the human body.

Unit IV: Blood and Body Fluids:

Basic idea of intracellular and extracellular compartments of body fluid. Water: intake and excretion. Volumes of body water in different compartments and their estimation. Water balance and its regulation. Dehydration and oedema. Lymph and tissue fluids: Composition, formation, circulation, function and fate of lymph and tissue fluids.

Composition and function of Blood. Plasma proteins: Classification, normal value, origin and functions, Plasmapheresis. Erythrocytes: Morphology, fate and functions; Steps of erythropoiesis, role of different factors on erythropoiesis. Hemoglobin: chemistry, biosynthesis, functions, catabolism; derivatives like oxyhemoglobin, methemoglobin, carboxyhemoglobin and hemin. Abnormal hemoglobin: thalassemia, sickle cell anemia. Normal value and clinical significane of ESR, TC, DC, PCV, MCH, MCHC, MCV. Anemia: megaloblastic and microcytic, pernicious, aplastic, hypo-chromic. Polycythemia. Blood groups: ABO system; Rh- antigens, blood transfusion and its hazards.

Blood group incompatibility- erythroblastosis fetalis. Leucocytes: Morphology, classification, life cycles, functions. Significance of Arneth count, Schilling index, reticulocyte count. Platelet-Morphology, life cycles, functions. Significance of platelet count. Haemostasis Coagulation factors, mechanism of blood coagulation, disorders of coagulation; anticoagulants (natural and artificial) and their mode of action, coagulation time, bleeding time, prothrombin time, hemolysis.

Blood volume: Normal values, determination by dye method and isotope method and factors influencing blood volume. Regulation of blood volume.

MJ-1P: System Physiology & Haematology (Practical) Credits 01

1. **Histology:** Study of compound microscope and its maintenance, Study and Identification of stained sections of different mammalian tissue and organs like Bone, Cartilage, Trachea, Lungs, Spleen, Lymph gland, Esophagus, Stomach, Duodenum, Ileum, Jejunum, Large Intestine, Liver, Kidney, Ureter, Salivary glands, Pancreas, Adrenal gland, Thyroid gland, Testes, Ovary, Spinal Cord, Cerebral cortex, Cerebellum, Skin, Artery, Vein, Tongue.

2. **Fresh tissue:** Stanning of Squamous and columnar epithelium, Adipose tissue.

SKILL ENHANCEMENT COURSE (SEC)

SEC 1P: Clinical Hematology (Practical) **Credits 03 (Full Marks: 50)**

a) Preparation of blood film of your own blood. Staining of the blood film with Leishman's stain.
b) Identification of different types of blood corpuscles.
c) Determination of TC of RBC, WBC and platelets by haemocytometer and Analyser.
d) Differential count of WBC with measurement of diameter of the cell.
e) Determination of ESR of human blood.
f) Estimation of haemoglobin by haemoglobinometer and Cyano method.
g) Preparation of haemincrystals.
h) Determination of Blood groups.
i) Determination of clotting time, bleeding time.

MJ-2: Basic Bio-Chemistry & Enzymology **Credits 04 (Full Marks: 75)**

MJ-2T: Basic Bio-Chemistry & Enzymology **Credits 03**

Course contents:

Unit I: Chemistry of Biomolecules:

Composition, structure and function of biomolecules:

Carbohydrate: Definition and Classification, structure, stereoisomerism, optical isomerism, optical activity, epimerism. Derivatives of monosaccharides: Amino sugars, deoxy sugars, sugar alcohols, sugar acids, sugar esters, their biochemical and physiological importance. Disaccharides - Maltose, Lactose and Sucrose: Occurrence, Structure, bio-chemical properties and Physiological importance. Polysaccharides - Starch, Glycogen, Dextrin, Cellulose, Glycosaminoglycans, Glycoproteins.

Amino acids and Proteins: Structure and properties of peptide bonds. Different levels of protein structure - Primary, Secondary (α-helix and β- pleated sheet), Tertiary and Quarternary. Forces stabilizing the structures (Covalent bonds, Ionic and hydrogen bonds, Van-derWaals forces and hydrophobic interactions). Amino acids: Classification, Structure, Nomenclature and Optical properties. Zwitterions and Isoelectric point. Nucleic acids: Nucleosides and Nucleotides - structure. Polynucleotides. DNA double helix - Primary, Secondary and Tertiary structure. Purine and Pyrimidine: Structure, nomenclature and tautomerism.

Lipids: Definition and classification. Fatty acids: Classification and structure. Properties of Fat and Fatty acids -Hydrolysis, Saponification, Saponification number, Iodine number.

Vitamins: Definition, Classification, Function and Clinical Importance.

Minerals: Na, K, Ca, Fe, Phosphorus, Sulfur, Iodine-Physiological Importance, Level in blood. Clinical condition of Hyper and Hypo mineralization.

Unit-II: Enzyme:

Definition, Chemical nature, Classification- EC nomenclature, Structure- Coenzymes, Prosthetic Groups, Apoenzyme, Holoenzyme, Mechanism of enzyme action –active site, specificity and enzyme- substrate complex, Factors influencing enzyme-catalyzed reactions: Substrate concentration, Enzyme concentration, pH, Temperature. Enzyme Kinetics: Michaelis-Menten equation, Maximum velocity, Michaelis-Menten constant, Hyperbolic kinetics, Graphical representation of Hyperbolic kinetics, Significance of Km and Vmax, Lineweaver-Burk double reciprocal plot,

Enzyme Inhibition: reversible, irreversible, competitive, non-competitive and uncompetitive Inhibition, Allosteric enzymes, Sigmoid kinetics, K- and M- series enzymes, Isoenzymes, Pro- enzymes, Ribozymes, Abzymes, Rate limiting enzyme**s.** Regulation of enzyme activities--covalent modifications, allosteric modifications: Feed-back inhibition. Enzymes in clinical diagnosis (amylase, acid and alkaline phosphatase, SGOT, SGPT, LDH and CPK).

MJ-2P: Basic Bio-Chemistry & Enzymology (Practical) **Credits 01**

i) Estimation of different pH
ii) Preparations and study the properties of different buffer solutions.
iii) Biochemistry (Qualitative assay): Qualitative analysis of carbohydrate and noncarbohydrate- Glucose, Fructose, Sucrose, Lactose, maltose, Starch, Albumin, Gelatin, Acetone, Bile salt, Glycerol, HCl, Urea.
iv) Enzyme: Determination of enzyme (CAT, Amylase, Acid Phosphatase) from tissue sample.

SEC 2P: Clinical Blood Biochemistry (Practical) **Credits 03 (Full Marks: 50)**

Quantification of diabetic, lipid, renal, LFT, vitamins and electrolyte profiles by photometric/semi-auto analyzer techniques from human body fluids.

MINOR (MI)

MI – 1: Basic Human Physiology. **Credits 04 (Full Marks: 75)**

MI – 1T: Basic Human Physiology.

Credits 03

Course contents:

Unit-I: Cellular Physiology:

Concept of eukaryotic and prokaryotic cell, Electron microscopic structure and functions of the organelles of eukaryotic cells: Structure of plasma membrane - Bio-chemical components, their arrangement, membrane asymmetry and fluidity; Functions; Fluid mosaic model. Membrane transport: active and carrier mediated transport; Mechanism of exocytosisand endocytosis. Structure, functions of ion channels. Endoplasmic reticulum: EM structure and functions of smooth and rough ER. Microsomes: basic functional aspects. Golgi complex: structure, its storage and processing functions. Lysosomes and its functions. EM structure and functions of nucleus. Peroxisomes and its function. Mitochondria: EM structure and its functions. EM structure of nucleus-structure of nuclear membrane and nucleolus. Ribosomes – EM structure and functions.

Unit-II: Blood, body fluid and immune System:

Blood, body fluid: Basic idea of intracellular and extracellular body fluid. Volumes of body water in different compartments. Water balance and its regulation. Dehydration and edema. Composition, properties and functions of blood, blood cell formation and related disorders, Blood transfusion and its hazards, Blood clotting (types), mechanism; Blood volume: Definition, Determination of blood volume, factors influencing blood volume, regulation of blood volume; Erythropoiesis: Definition, steps of erythropoiesis, role of different factors on erythropoiesis; Platelets: Structure, functions. Significance of platelets counts. Haemoglobin: Structure, properties and functions of haemoglobin. Abnormal haemoglobin. Blood grouping: The ABO systems, The Rh systems and erythroblastosis fetalis, The MN system.

Fundamental concept of Immune System: Overview of Immune System - properties of immune system; types of immunity: innate immunity, acquired immunity, active and passive immunity. First and second line defence. Immuno-competent Cells- Structure and functions of Neutrophil, B-lymphocytes, T-lymphocytes (helper, cytotoxic and suppressor), Natural Killer (NK) cells, monocytes, macrophages. Primary and secondary lymphoid organs. Concept of antigen and antibody. Properties of immunogen, haptens and adjuvants. Classification, structure and functions of immunoglobulins (IgG, IgM, IgA, IgD, IgE). Concept about immunization, Immunization schedules - National and WHO.

Unit-III: Cardiovascular System: Anatomy and histology of the heart. Properties of cardiac muscle. Origin and propagation of cardiac impulse. Structure of arteries, arterioles, capillaries,venules and veins. Cardiac valves, Heart Block. Heart rate and its regulations. Bradycardia and tachycardia. Heart sounds. Frank–Starlings laws of heart. Blood Pressure- Definition, types, Factors affecting blood pressure, Role of Renin- angiotensin system, Vasopressin or ADH in Blood Pressure regulations. Cardiac output –Definition, methods of determination (dye dilution and Fick principle) and factors affecting on it; Cardiac cycle: Definition & Events.

Unit IV: Physiology of Respiratory system: Introduction, anatomical structure and functions of the lungs. Basic concepts about respiratory tract, respiratory muscles and their innervations. Mechanism of respiration; Mechanics of breathing. Role of respiratory centres, central and peripheral chemoreceptors. Gas (CO_2 and O_2) transport mechanism in the lungs; CO_2 and O2-dissociation curve, factors affecting; Respiratory acidosis and alkalosis; non-respiratory functions of lungs. Concept of lung Compliance, surfactants, elasticity and elastic recoil of the lung. Artificial respiration. Respiratory failure. High altitude sickness. Different lung volume and capacities; Lung Function Tests. Hypoxia, O_2 toxicity; Asphyxia: definition, cause, sign and symptoms.

Unit V: Overview of digestive system:
Different parts and functions of gastrointestinal (GI) tract. Digestive glands and their functions. Composition and functions of digestive juice including bile.

MI – 1P: Practical **Credits 01**

Course:

1. Fresh tissue experiments:

a) Study of compound microscope.
b) Examination & staining of fresh tissue: squamous, ciliated & columnar epithelium, skeletal musclefibre (Rat/ Goat) by Methylene blue stain.
c) Transitional epithelium, mesentery (Rat/ Goat) (counter stain by Methylene blue)

2. Hematology:

a) Preparation of blood film of your own blood. Staining of the blood film with Leishman's stain.
b) Identification of different types of blood corpuscles.
c) Determination of TC of RBC and WBC by haemocytometer.
d) Differential count of WBC.
e) Determination of ESR of human blood.
f) Estimation of haemoglobin by haemoglobinometer.
g) Preparation of haemincrystals.
h) Determination of Blood groups.
i) Determination of clotting time, bleeding time.

3. Human Experiment:

a) Measurement of arterial blood pressure by Sphygmomanometer test, Calculate the mean arterial blood pressure (MABP).

b) Measurement of heart rate and pulse rate (30 beats methods) during rest condition.

c) Study of blood pressure.

d) Study of pulse rate as an effect of breath-holding.

e) Determination of Physical Fitness Index (PFI) of an Individual by Modified Harvard Step test.

MI-2: Biophysical, Biochemical principles and Metabolism. Credits 04 (Full Marks: 75)

MI-2T: Biophysical, Biochemical principles and Metabolism Credits 03

Course contents:

Unit I: Biophysical Principles:

Physiological importance of the following processes: diffusion, osmosis, dialysis, ultrafiltration, surface tension viscosity, adsorption, absorption. Brief idea about pH, buffer and maintenance of pH in the body. Brief idea about colloids. Enzyme- definition, classification, factors affecting enzyme action. Concept of co-enzyme, isoenzyme. Colloids: properties and significances, electrokinetic properties; Isoelectric pH and isoelectric precipitation. Gibbs-Donnan membrane equilibrium and its biological importance. Acids and bases as proton donors and acceptors.

Unit II: Chemistry of Biomolecules and metabolism:

Carbohydrates: Definition and Classification, structure, stereoisomerism, optical isomerism, optical activity, epimerism. Derivatives of monosaccharides: Amino sugars, deoxy sugars, sugar alcohols, sugar acids, sugar esters, their biochemical and physiological importance. Disaccharides - Maltose, Lactose and Sucrose: Occurrence, Structure, bio-chemical properties and Physiological importance. Polysaccharides - Starch, Glycogen, Dextrin, Cellulose, Glycosaminoglycans, Glycoproteins.

Peptides and Proteins: Structure and properties of peptide bonds. Different levels of protein structure - Primary, Secondary (α-helix and β- pleated sheet), Tertiary and Quarternary. Forces stabilizing the structures (Covalent bonds, Ionic and hydrogen bonds, Van-derWaals forces and hydrophobic interactions). Amino acids: Classification, Structure, Nomenclature and Optical properties. Zwitterions and Isoelectric point. Nucleic acids: Nucleosides and Nucleotides - structure. Polynucleotides. DNA double helix - Primary, Secondary and Tertiary structure. Purine and Pyrimidine: Structure, nomenclature and tautomerism.

Lipids: Definition and classification. Fatty acids: Classification and structure. Properties of Fat and Fatty acids -Hydrolysis, Saponification, Saponification number, Iodine number.

Digestion and absorption of carbohydrates, lipids, proteins; Glycolysis, TCA cycle. Fatty acid oxidation.

MI-2P: Practical Credits 01

i) Measurement of PH of various solutions using pH indicators and meter.
ii) Preparations and study the properties of different buffer solutions.
iii) Biochemistry (Qualitative and Quantitative assay)

- Qualitative analysis of carbohydrate- Glucose, Fructose, Sucrose, Lactose, Starch, Proteins- Albumin, Gelatin, Acetone, Bile salt, Glycerol, HCl.
- Quantification of glucose, lactose and sucrose in a specific sample.