

Murshidabad University

Berhampore, Murshidabad

West Bengal-742101

Curriculum Framework for Undergraduate Programme

In

PHYSIOLOGY

3 Year B.Sc. (Programme)

&

4 Year B.Sc. (Honours) or B.Sc. (Honours with Research)

(Courses effective from 2025-26 sessions)

Courses of B.Sc. Honours Physiology underFramework of NEP 2020

SEM-I									
Course Code	**Course Title**	Core Topics	Nature of Course	Credit of Course	Class hour/week	Evaluation			**Total**
						Internal	Semester End		
							T	**P**	
PHY-M-101	Basics of Physiology-1	Contribution of the Scientists in Physiology, Cellular Physiology, Blood and Body Fluids,	Major	**04**	**05**	**20**	**40**	**20**	**80**
PHY -Mi-101	Foundation Physiology-1	Cellular Basis of Physiology, Blood and Body Fluids	Minor	**04**	**05**	20	40	20	80
PHY- MDC-101/IDC-101		Physiology of Nutrition and Dietetics /Exercise Physiology and Yoga	Multidisciplinary Course	**03**	**03**	**15**	**45**	**-**	**60**
AEC-101				**04**	**04**	**20**	**60**	**-**	**80**
PHY-SEC-101		Physiological Techniques Related to Hematology	Skill Enhancement Course	**03**	**04**	**15**	**30**	**15**	**60**
VAC-101				**02**	**02**	**10**	**30**		**40**
Internship/Dissertation				**-**					

Courses of B.Sc. Honours Physiology underFramework of NEP 2020

SEM-II									
Course Code	**Course Title**	**Core Topics**	**Nature of Course**	**Credit of Course**	**Class hour/week**	**Evaluation**			Total
						Internal	Semester End		
							T	**P**	
PHYH-M-201	Basics of Physiology-2	Chemistry of Biomolecules, Principles of Biophysics, Enzymes	Major	**04**	**05**	20	40	20	80
PHY -Mi-201	Foundation Physiology-2	Chemistry of Biomolecules, Principles of Biophysics, Enzymes	Minor	**04**	**05**	20	40	20	80
PHY- MDC-201/IDC-201	Community Health/Environmental Physiology and its management		Multidisciplinary Course	**03**	**03**	**15**	**45**	**-**	**60**
AEC-201				**04**	**04**	**20**	**60**	**-**	**80**
PHY-SEC-201	Applied Physiology Applied and Diagnostic Physiology		Skill Enhancement Course	**03**	**04**	**15**	**30**	**15**	**60**
VAC-201				**02**	**02**	**10**	**30**		**40**
Internship/Dissertation				**04**					

Semester I

MAJOR (M)
PHY-M-101: Basics of Physiology-1 Credits 04 (Full Marks: 80)

PHY-M-T-101: Basics of Physiology-1 Credits 03

Unit-I

Background of Physiology and contribution of scientists in the field of physiology and brief overview of physiological systems

Claude Bernard, Louis Pasteur, Camillo Golgi, Sir Charles Scott Sherrington, Sir Ronald Ross William Harvey, Claude Bernard, Ivan Pavlov, Sir Charles S, Dilip Mahalanabis, Sambhu Nath Dey, James Watson and Francis Crick, Har Gobind Khorana, Sherrington, Subodh Chandra Mahalanobis, N. M. Basu, Sacchidananda Banerjee, Autar Singh Paintal, Karl Landsteiner

Unit-II

CellularPhysiology

Basic concept of structure and functions of intracellular organelles animal tissues: and cells: Anatomy, electron microscopic structure and functions of animal tissues, eukaryotic cells and cell organelles (Nucleus, endoplasmic reticulum, ribosomes, Golgi bodies, mitochondria) lysosomes, peroxisomes, cytoskeletal elements, centrosomes and plasma membrane: Concept about tight junctions, gap junctions, adherens junctions, desmosomes and cell adhesion molecules, Extracellular matrix components.structure and function of Cell membrane: 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. Cell Signaling: Cell surface receptor proteins – ion channel coupled, G-protein coupled and enzyme-coupled. Intracellular messengers – cAMP, cGMP, IP3, DAG,Protein kinases, Ca^{2+},CO, NO. Signal transduction pathways: Phosphatidylinositides, MAP kinase, JAK-STAT, SMAD.

Unit III:

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. 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 anemiaAnemia: megaloblastic and microcytic, pernicious, aplastic, hypo-chromic. Polycythemia. Blood groups: ABO system; Rh- antigens, blood transfusion and its hazards. Blood group incompatibility-erythroblastosisfetalis. 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,

PHY-M-P-101: Basics of Physiology-1 (1 course x 1 credit = 1credit: Marks: 20)

1. Preparation of blood smear by Leishman's stain and identification of blood cells.
2. Estimation of Hemoglobin by Sahli's Hemoglobinometer
3. Preparation and staining of bone marrow
4. Total Count of RBC (Demo)
5. Total count of WBC (Demo)
6. ESR (Demo)
7. Hematocrit (Demo)
8. Study and Identification of Stained Sections of Different Mammalian Tissues and Organs: Lungs, Spleen, Lymph gland, Esophagus, Stomach, Duodenum, Ileum, Jejunum, large Intestine, Liver, Kidney, Salivary glands, Pancreas, Adrenal gland, Thyroid gland, Testes, Ovary, Spinal Cord, Cerebral cortex, Cerebellum, Skin, Cardiac muscle, Skeletal muscle, Smooth muscle, Artery, Vein, Tongue, Uterus.

MINOR (Mi)

PHY-Mi-101: Foundation Physiology -1 Credits 04 (Full Marks: 80)

PHY-Mi-T-101: Foundation Physiology-1 Credits 03

Cellular Basis of Physiology

Basic concept of structure and functions of intracellular organelles animal tissues: and cells: Anatomy, electron microscopic structure and functions of animal tissues, eukaryotic cells and cell organelles (Nucleus, endoplasmic reticulum, ribosomes, Golgi bodies, mitochondria) lysosomes, peroxisomes, cytoskeletal elements, centrosomes and plasma membrane. :

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.

Blood and Body 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. Anemia. Blood groups: ABO system; Rh- antigens, blood transfusion and its hazards. Blood group incompatibility- erythroblastosisfetalis. Leucocytes: Morphology, classification, life cycles, functions. 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 pressure: Definition, types, controlling factors, regulation (Chemical and Neural).

PHY-Mi-P-101: Foundation Physiology-1 (1 course x 1 credit = 1credit: Marks: 20)

1. Estimation of bleeding time by Duke's method
2. Estimation of cloting time by Capillary tube method
3. Estimation of Hemoglobin by Sahli'sHemoglobinometer
4. Preparation of Hemin crystal
5. Estimation of Blood group
6. Study and Identification of Stained Sections of Different Mammalian Tissues and Organs: Lungs, Esophagus, Stomach, Duodenum, Ileum, Jejunum, large Intestine, Liver, Kidney, Salivary glands, Pancreas, Adrenal gland, Thyroid gland, Cardiac muscle, Skeletal muscle, Smooth muscle, Artery, Vein, Tongue,

Multidisciplinary Course (MDC)

PHY-MDC-101: Physiology of Nutrition and Dietetics Credits 03 (Full Marks: 60)

1. Constituents of food and their significance
2. BMR, SDA, ACU, NPU Respiratory quotient
3. Vitamins and Minerals
4. Dietary fibres
5. Nitrogen balance
6. Essential amino acid
7. Starvation and Obesity
8. Principles of diet survey
9. Principles of formulation of Balanced diets for growing child, adult man, women, pregnant and lactating women
10. A hand written report submitted on the basis of physiological parameters of Human (at least three parameters) or Anthrpometric measurements of Human (at least three parameters) of your class.

Interdisciplinary Course (IDC)

PHY-IDC-101: Exercise Physiology and Yoga Credits 03 (Full Marks: 60)

1. Importance of regular exercise in health and well being
2. Types and degrees of exercise
3. Energy sources during exercises
4. Cardio-respiratory changes during exercise
5. Nutritional supplements in exercise
6. Effects of training on physical performance
7. Concept of Yoga, Asanas and Pranayama
8. Importance of Yoga in modern daily life
9. Application of Yoga in promotion of general health and wellbeing

SKILL ENHANCEMENT COURSES (SEC)

PHY-SEC-101: Physiological Techniques related to Hematology Credits: 3, Marks: 60

PHY-SEC-T-101: Physiological Techniques related to Hematology (Marks: 45)

Plasma proteins: Classification, normal value, origin and functions, Plasmapheresis. Normal value and clinical significane of ESR, TC, DC, PCV, MCH, MCHC, MCV. Clotting time, bleeding time, prothrombin time, hemolysis. Blood pressure: Definition, types, controlling factors, regulation (Chemical and Neural); Blood volume: Normal values, determination by dye method and isotope method and factors influencing blood volume. Regulation of blood volume.

PHY-SEC-P-101: Physiological Techniques related to Hematology (Marks: 15)

1. Estimation of bleeding time by Duke's method.
2. Estimation of cloting time by Capillary tube method
3. Estimation of Hemoglobin by Sahli's Hemoglobinometer
4. Preparation of Hemin crystal
5. Estimation of Blood group
6. Measurement of Blood pressure.

Semester-II

MAJOR (M)

PHY-M-201: Basics of Physiology-2 Credits 04 (Full Marks: 80)

PHY-M-T-201: Basics of Physiology-2 Credits 03

Unit-I

Chemistry of Biomolecules

Carbohydrates:Classification, structure, stereoisomerism, optical isomerism, optical activity, epimerism. Cyclic structures- Pyranose and furanose forms, anomerism, mutarotation and its mechanism, glycosidic bond formation, osazone formation.

Lipids: Properties of Fat and Fatty acids Hydrolysis, rancidity of fatty acids, Saponification number, Iodine number,Acetyl number, Acid number. *Cis-trans* isomerism, Eicosanoids, Phospholipids, Glycolipids, Sphingolipids, Steroids and sterols, Cholesterol & its ester -their structure and physiological importance. Lipoproteins - Structure and classification. Micelle, bilayer, Liposome.

Proteins: Amino acids:Classification, Structure, Nomenclature and Opticalproperties. Zwitterions, Isoelectric point, titration curve of amino acids. Reactions with ninhydrin and formaldehyde. Reactions with Sanger's and Edman's reagent.Biuret reaction. Denaturation and RenaturationPeptides and Proteins: Structure Different levels of protein structure -- Primary, Secondary (α-helix and β-pleated sheet), Tertiary and Quarternary. Forces stabilizing thestructures.Concept ofPhi and Psi angles.Nucleic Acids: A-DNA, B-DNA and Z-DNA. RNA -Structure and types.

Unit-II

Principles of Biophysics

Diffusion: Its characteristics, factors influencing and physiological applications.

Osmosis: Osmotic pressure – laws, determination – freezing point, depression method and physiological applications.Surface tension &viscosity:- Physiological applications.pH& Buffer- Henderson Hasselbach- equation (quantitative problems). Determination of pH. Colloids: Classification, properties – optical, electrical, electrokinetic. Physiologicalimportance of colloids.Gibbs-Donnan membrane equilibrium.

Thermodynamics :Type of surroundings and systems. First Law– Internal energy, enthalpy. Second Law – Entropy, Free energy change, Endergonic and Exergonic reactions, Reversible and Irreversible processes, Equilibrium constant. Physiological steady-state, Living body as a thermodynamic system.

Unit-III

Enzymes

Classification-EC nomenclature, Concept of apoenzyme, holoenzyme, coenzyme, cofactors and prosthetic group.Michaelis constant, Michaelis-Menten equation, Graphical representation of hyperbolic kinetics-- Lineweaver-Burk plot.Significance of Km and Vmax.Factors influencing enzyme-catalyzedreactions: substrate concentration, enzyme concentration, pH, temperature. Competitive, noncompetitive and uncompetitive inhibitions. Regulation of enzyme activities—covalent modifications, allosteric modifications: K- and M-series. Feed-back inhibition. Ratelimiting enzymes.Isozymes, Ribozymes and Abzymes

PHY-M-P-201: Basics of Physiology-2 (course x 1 credit = 1credit: Marks: 20)

1. Qualitative tests for the identification of physiologically importantsubstances: Hydrochloric acid, Lactic Acid, Uric Acid, Albumin, Gelatin, Peptone, Starch, Dextrin, Glucose, Fructose, Lactose, Sucrose, Urea, Acetone, Glycerol and Bile salts.
2. Preparation of Buffer and pH measurement
3. Estimation of SGOT and SGPT

MINOR (Mi)
PHY-Mi-201
PHY-Mi-201: Foundations Physiology-2 Credits 04 (Full Marks: 80)

PHY-Mi-T-201: Foundations Physiology-2 Credits 03

Chemistry of Biomolecules

Carbohydrates:Classification, structure, stereoisomerism, optical isomerism, optical activity, epimerism. Cyclic structures- Pyranose and furanose forms, anomerism, mutarotation and its mechanism, glycosidic bond formation, osazone formation.

Lipids: Properties of Fat and Fatty acids Hydrolysis, rancidity of fatty acids, Saponification number, Iodine number, Acetyl number, Acid number. Cis-trans isomerism, Lipoproteins - Structure and classification. Micelle, bilayer, Liposome.

Proteins: Amino acids: Classification, Structure, Nomenclature and Optical properties. Zwitterions, Isoelectric point, titration curve of amino acids. Reactions with ninhydrin and formaldehyde. Denaturation and Renaturation Peptides and Proteins: Structure Different levels of protein structure -- Primary, Secondary (α-helix and β-pleated sheet), Tertiary and Quarternary.

Principles of Biophysics

Diffusion: Its characteristics, factors influencing and physiological applications.

Osmosis: Osmotic pressure – laws, determination – freezing point, depression method and physiological applications. Surface tension &viscosity:-Physiological applications. pH& Buffer- Henderson Hasselbach- equation (quantitative problems). Determination of pH.Colloids: Classification, properties – optical, electrical, electrokinetic. Physiologicalimportance of colloids.Gibbs-Donnan membrane equilibrium.

Enzymes

Classification-EC nomenclature, Concept of apoenzyme, holoenzyme, coenzyme, cofactors and prosthetic group.Michaelis constant, Michaelis-Menten equation, Significance of Km and Vmax. Factors influencing enzyme-catalyzedreactions : substrate concentration, enzyme concentration, pH, temperature. Competitive, noncompetitive and uncompetitive inhibitions. Ratelimiting enzymes. Isozymes, Ribozymes and Abzymes

PHY-Mi-P-201: Foundations Physiology-2 (1 course x 1 credit = 1credit: Marks: 20)

1.Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, Lactic Acid, Uric Acid, Albumin, Gelatin, Peptone, Starch, Dextrin, Glucose, Fructose, Lactose, Sucrose, Urea, Acetone, Glycerol and Bile salts.

Multidisciplinary Course (MDC)

PHY-MDC-201: Community Health, Credits 03 (Full Marks: 60)

1. Basic idea about health, public health, hygiene and disease
2. Epidemiology and prevention of AIDS and Hepatitis; Concept of communicable and non-communicable diseases
3. Malnutrition in community, over nutrition, issues of obesity, possible remedial measures
4. Air, water, food borne diseases: causes, symptoms and control measures
5. Noise and air pollution as a community health issue, definition, concept, source and effects on human health
6. Human health in extreme situation like heat waves (heat stress), flood, earthquake, land slide etc

Interdisciplinary Course (IDC)

PHY-IDC-201: Environmental Physiology and its management, Credits 03 (Full Marks: 60)

1. Definition of Environment
2. Components of Environment
3. Interaction between human and environment
4. Ecosystem:Food chain,Food web, Food Pyramid
5. Pollution: Air, Water, Noise
6. Natural resources (Air, Water, Soil)
7. Energy resources (renewable and non-renewable)
8. Green house effect
9. Environmental ethics
10. Conservation of Sanctuary, National park, Biosphere, Wild life
11. Bhopal gas tragedy, Minamata disease, Chipko movement

PHY-SEC-201

PHY-SEC-201: Applied and Diagnostic Physiology Credits 03 (Full Marks: 60)

PHY-SEC-T-201: Applied and Diagnostic Physiology (Marks: 45)

Microbiology and Immunology:

Types of microbes, Beneficial and harmful bacteria with examples. Identification of Gram positive and Gram negative Bacteria. Definition of Antigen and Antibody, Immunodiffusion (Ouchterlony Double Diffusion and Single radial Immunodiffusion).

Common Diseases and Pathophysiological tests

Diabetes mellitus, Haemophilia, Thalassaemia, Stroke, Hypothyroidism, Obesity. Pathophysiological tests, their normal range in the system and indicative diseases: Fasting and Post-prandial blood sugar tests, Glycosylated haemoglobin, Bilirubin, Urea, Uric acid, Creatinine, SGOT, SGPT, Alkaline Phosphatase, Acid Phosphatase

PHY-SEC-P-201: Applied and Diagnostic Physiology (Marks 15)

1. Ouchterlony Double Diffusion
2. Gram Staining of bacteria and identification of Gram-positive & Gram-negative bacteria.
3. Staining and identification of bacterial spores.
4. Estimation of blood chloride (silver nitrate method), Colorimetric estimation of blood constituents: Inorganic Phosphate (Fiske-Subbarow as given in Hawk's Physiological Chemistry, 14th edition) and Sugar (Folin-Wu method) / GOD-POD Method (kit method), Estimation of serum protein (Biuret Method, by plotting standard Curve), SGPT & SGOT / (AST/ALT Kit method).