

# UNIVERSITY OF NORTH BENGAL

## SUBJECT: PHYSIOLOGY

Course Curriculum for Physiology major, Minor and Skill enhancement course and multidisciplinary course under Framework for the four-year Undergraduate Programme



### First Year (Implemented from academic session 2023-2024)

SEMESTER	COURSE TYPE	PAPER TYPE	PAPER NAME	PAPER CODE	CREDIT	PAPER LEVEL
1	MAJOR	THEORY AND PRACTICAL	CELLULAR BASIS OF PHYSIOLOGY	UPSIMAJ11001	4(Theory-03, Practical-01)	100 (Basic knowledge and foundational)
1	MINOR	THEORY AND PRACTICAL	CELL PHYSIOLOGY	UPSIMIN10001	4(Theory-03, Practical-01)	100
1	SEC	THEORY AND PRACTICAL	HOMEOSTASIS AND DISEASE	UPSISEC11001	3(Theory-02, Practical-01)	100
2	MAJOR	THEORY AND PRACTICAL	BIOLOGICAL PHYSICS AND ENZYMES	UPSIMAJ11002	4(Theory-03, Practical-01)	100
2	MINOR	THEORY AND PRACTICAL	CELL PHYSIOLOGY	UPSIMIN10001	4(Theory-03, Practical-01)	100
2	SEC	THEORY AND PRACTICAL	CLINICAL BIOCHEMISTRY	UPSISEC12002	3(Theory-02, Practical-01)	100
2	MULTIDISCIPLINARY COURSE-01	THEORY	ERGONOMICS AND SPORTS MEDICINE	UPSIMDC002	3(Theory-03)	100

### Second Year ( Implemented from academic session 2024-2025)

SEMESTER	COURSE TYPE	PAPER TYPE	PAPER NAME	PAPER CODE	CREDIT	PAPER LEVEL
3	MAJOR	THEORY AND PRACTICAL	HAEMATOLOGY	UPSIMAJ11003	4(Theory-03, Practical-01)	200
3	MAJOR	THEORY AND PRACTICAL	BIOCHEMISTRY OF MOLECULES AND METABOLISM	UPSIMAJ11004	4(Theory-03, Practical-01)	200
3	MAJOR	THEORY AND PRACTICAL	CARDIOVASCULAR SYSTEM	UPSIMAJ11006	4(Theory-03, Practical-01)	200
3	SEC	THEORY AND PRACTICAL	HAEMATOLOGICAL TECHNIQUES	UPSISEC23003	3(Theory-02, Practical-01)	100
3	MINOR	THEORY AND PRACTICAL	BLOOD AND BODY FLUIDS	UPSIMIN10002	4(Theory-03, Practical-01)	200
4	MAJOR	THEORY AND PRACTICAL	RESPIRATORY SYSTEM	UPSIMAJ11005	4(Theory-03, Practical-01)	200
4	MAJOR	THEORY AND PRACTICAL	GASTROINTESTINAL PHYSIOLOGY	UPSIMAJ11007	4(Theory-03, Practical-01)	200
4	MAJOR	THEORY AND PRACTICAL	NUTRITION AND DIETETICS	UPSIMAJ11008	4(Theory-03, Practical-01)	200
3	MINOR	THEORY AND PRACTICAL	BLOOD AND BODY FLUIDS	UPSIMIN10002	4(Theory-03, Practical-01)	200

**Note-** Questions will be divided into three groups. In group-A, 5 questions of 1 mark each to be attempted out of 8 questions. In group-B, 3 questions of 5 mark each to be attempted out of 5 questions and in group-C, 2 questions of 10 marks each to be attempted out of 4 questions. Internal assessment can be taken on the basis of regular class performance and/or class test and/or assignment and/or case study of a locality.

**SUBJECT: PHYSIOLOGY  
MAJOR COURSES**

**COURSE-1: Cellular Basis of Physiology**

**PAPER CODE: UPSIMAJ11001**

**PAPER LEVEL- 100**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the structural organization of cell, tissue and systems.
2. Acquire knowledge about intercellular communications.
3. Understand the coordination of functions between different systems

**COURSE-1: Cellular Basis of Physiology (Theory)**

**Lectures required-35**

Introduction, Cell theory, Cells- Types, Distribution, Histology and Functions. Cell Organelles- Nucleus, Mitochondria, Ribosome, Lysosome, Golgi Body, Endoplasmic reticulum, Microtubules etc. GERL system, Transport Across cell Membranes- Diffusion, osmosis, facilitated diffusion, Active transport, Endocytosis, Exocytosis, Symport, Uniport, Antiport

Plasma membrane-models, Fluid mosaic model, Membrane fluidity, receptors, Channels-Ca<sup>++</sup> channel, Voltage gated channel, Ionic flux.

Cell Signalling-Signalling molecules, types and actions of Second Messengers,

Cell Junctions-types, histology and importances,

Organs- Histology and functions of Heart, lung, liver and kidney.

Systems-histology and functions of Cardiovascular system, Digestive system, respiratory system, Nervous system, muscular system, urogenital system,

Tissues-Epithelial tissue, Connective tissue, Muscular tissue, Nervous tissue, Adipose tissue. Bone and Cartilage.

Glands, Cell Cycle, Cell Division- Mitosis, Meiosis.

**COURSE-1: Cellular Basis of Physiology (Practical)**

1. Staining and identification of squamous epithelium.
  2. Staining and identification of Cornified epithelium.
  3. Staining and identification of skeletal muscle fiber.
  4. Staining and identification of Cardiac muscle fiber.
  5. Staining and identification of Adipose tissue.
  6. Staining and identification of Corneal cell space.
- (2 questions of 7.5marks each to be set=15, Viva voce=2, Lab Note Book=3)**

**COURSE-2: Biological Physics and Enzymes**

**PAPER CODE: UPSIMAJ11002**

**PAPER LEVEL- 100**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the biophysical principles of the body.
2. Acquire knowledge about enzymes and their significances to maintain homeostasis.
3. Understand the principles and methods of different laboratory techniques.

**COURSE-2: Biological Physics and Enzymes (Theory)**

**Lectures required-35**

Units for Measuring, Concentration of solutes: Moles, Equivalent, Osmoles; Principles of dilution, pH, Buffers, Bonds and Forces in Biomolecules, Colloids: Properties, Importance. Surface tension, Specific Gravity, Viscosity and Resistance, Acids, Bases, Buffers, and pH, Dialysis and Ultracentrifugation, Chromatography, Electrophoresis, Autoradiography, Cell Fractionation and Tracer Techniques, Nanoparticles and its application in Physiology, Laminar and Streamline flow, Poiseuille-Hagen Formula, Laws of Laplace, Osmosis and Diffusion, Thermodynamics : Laws , Application in Physiology, Enzymes : Structure, coenzymes, Prosthetic Groups, Mechanism of enzyme action, Kinetics, Michaelis constant, Enzyme Inhibition Modulation of Enzymes Activities, Factors regulating enzyme activities, Isoenzymes, Allosteric enzymes, Pro-enzymes, Ribozymes, Abzymes, Concept of Rate limiting enzymes, Micelle, Liposome

**COURSE-2: Biological Physics and Enzymes (Practical)**

1. Determination of Systolic and Diastolic Blood Pressure by non-invasive methods (Auscultatory Method) in resting condition.
2. Determination of Pulse and Mean Blood Pressure by non-invasive methods (Auscultatory Method) in resting condition.
3. Determination of pulse rate and heart rate under resting condition.
4. Determine carotid pulse and radial pulse
5. Determination of pulse rate and heart rate in sitting and lying posture.
6. Determine the change in pulse rate and heart rate in sitting and lying posture.

**(One question to be set=15, Viva Voce=2, Laboratory Note Book=3)**

**SUBJECT: PHYSIOLOGY  
MINOR COURSES**

**COURSE-1: Cell Physiology**

**PAPER CODE: UPSIMIN10001**

**PAPER LEVEL- 100**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the structural organization of cell, tissue and systems.
2. Acquire knowledge about intercellular communications.
3. Understand the coordination of functions between different systems

**COURSE-1: Cell Physiology (Theory)**

**Lectures required-35**

Introduction, Cell theory, Cells- Types, Distribution, Histology and Functions. Cell Organelles- Nucleus, Mitochondria, Ribosome, Lysosome, Golgi Body, Endoplasmic reticulum, Microtubules etc. GERL system, Transport Across cell Membranes- Diffusion, osmosis, facilitated diffusion, Active transport, Endocytosis, Exocytosis, Symport, Uniport, Antiport

Plasma membrane-models, Fluid mosaic model, Membrane fluidity, receptors, Channels-Ca<sup>++</sup> channel, Voltage gated channel, Ionic flux.

Cell Signalling-Signalling molecules, types and actions of Second Messengers,

Cell Junctions-types, histology and importances,

Organs- Histology and functions of Heart, lung, liver and kidney.

Systems-histology and functions of Cardiovascular system, Digestive system, respiratory system,

Nervous system, muscular system, urogenital system,

Tissues-Epithelial tissue, Connective tissue, Muscular tissue, Nervous tissue, Adipose tissue. Bone and Cartilage.

Glands, Cell Cycle, Cell Division- Mitosis, Meiosis.

**COURSE-1: Cell Physiology (Practical)**

1. Staining and identification of squamous epithelium.
  2. Staining and identification of Cornified epithelium.
  3. Staining and identification of skeletal muscle fiber.
  4. Staining and identification of Cardiac muscle fiber.
  5. Staining and identification of Adipose tissue.
  6. Staining and identification of Corneal cell space.
- (2 questions of 7.5marks each to be set=15, Viva voce=2, Lab Note Book=3)**

## **MINOR COURSES**

### **COURSE-2: Cell Physiology**

**PAPER CODE: UPSIMIN10001**

**PAPER LEVEL- 100**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

4. Understand the structural organization of cell, tissue and systems.
5. Acquire knowledge about intercellular communications.
6. Understand the coordination of functions between different systems

### **COURSE-1: Cell Physiology (Theory)**

**Lectures required-35**

Introduction, Cell theory, Cells- Types, Distribution, Histology and Functions. Cell Organelles- Nucleus, Mitochondria, Ribosome, Lysosome, Golgi Body, Endoplasmic reticulum, Microtubules etc. GERL system, Transport Across cell Membranes- Diffusion, osmosis, facilitated diffusion, Active transport, Endocytosis, Exocytosis, Symport, Uniport, Antiport

Plasma membrane-models, Fluid mosaic model, Membrane fluidity, receptors, Channels-Ca<sup>++</sup> channel, Voltage gated channel, Ionic flux.

Cell Signalling-Signalling molecules, types and actions of Second Messengers,

Cell Junctions-types, histology and importances,

Organs- Histology and functions of Heart, lung, liver and kidney.

Systems-histology and functions of Cardiovascular system, Digestive system, respiratory system, Nervous system, muscular system, urogenital system,

Tissues-Epithelial tissue, Connective tissue, Muscular tissue, Nervous tissue, Adipose tissue. Bone and Cartilage.

Glands, Cell Cycle, Cell Division- Mitosis, Meiosis.

### **COURSE-1: Cell Physiology (Practical)**

7. Staining and identification of squamous epithelium.
8. Staining and identification of Cornified epithelium.
9. Staining and identification of skeletal muscle fiber.
10. Staining and identification of Cardiac muscle fiber.
11. Staining and identification of Adipose tissue.
12. Staining and identification of Corneal cell space.

**(2 questions of 7.5marks each to be set=15, Viva voce=2, Lab Note Book=3)**

**SUBJECT: PHYSIOLOGY**  
**SKILL ENHANCEMENT COURSES**  
**(Related to Major)**

**COURSE-1: Homeostasis and Disease**

**PAPER CODE: UPSISEC11001**

**PAPER LEVEL- 100**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the mechanisms maintaining normal functions
2. Acquire knowledge about deviation from normal activity and development of disease
3. Acquire knowledge about the compounds fighting with disease causing agents.
4. Apply the knowledge and skill for prevention of different diseases

**COURSE-1: Homeostasis and Disease (Theory)**

**Lectures required-25**

Homeostasis- Control System, Feed Back Mechanisms-Negative and positive, Long loop and short loop feedback. Intercellular Communication, Coordination of functions

Basic idea about Health and disease, Factors controlling health and disease. Physical age and cellular age. Young and old. Antioxidants-Sources, requirements and actions, free radicals, CytP450 system, Detoxification, Bioaccumulation, Biodegradation, Undernutrition and Overnutrition. Cell Injury, Cellular aging, Apoptosis, Necrosis, Hyperplasia, Neoplasia.

Causes, Symptoms, Prevention and treatment of- Obesity, Hypertension, Fever, Gout, Allergy, Ulcer, Cancer. Cancer biomarkers

Cardiovascular system diseases- Ventricular hypertrophy, myocardial ischemia, heart failure and stroke.

Respiratory diseases- Bronchitis, Asthma, Pneumoconiosis, Common Cold, COPD.

Digestive diseases- Gastritis, Jaundice, Gall stone, Cholecystitis, Diarrhea, Dysentery, Malabsorptions.

Urogenital Diseases- Nephritis, Kidney stone, Diabetes Insipidus, Gonorrhoea, AIDS.

Nervous system diseases- Paralysis, dementia, Cerebral palsy, Epilepsy, parkinsons disease. Vertigo.

Muscular diseases- hypertrophy, Atrophy, dystrophy,

**COURSE-1 Homeostasis and Disease (Practical):**

**Identification of permanent slides-** Tongue, Oesophagus, Liver, Stomach, Duodenum, Ileum, Jejunum, Large Intestine, Trachea, Lung, Lymph gland, Salivary gland, Thyroid gland, Kidney, Ovary, Testis, Ureter, Uterus, Spleen, Spinal cord, Cerebellum, cerebrum, Thymus gland, Skin.

**( 5 slides to be identified 5\*3=15), Viva voce=2, Lab note Book=3**

**COURSE-2: Clinical Biochemistry**

**PAPER CODE: UPSISEC12002**

**PAPER LEVEL- 100**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the normal range of blood constituents and their importance.
2. Acquire knowledge about the factors behind the development of diseases.
3. Apply the knowledge and skill for prevention and treatment of different diseases

**COURSE-2: Clinical Biochemistry (Theory)**

**Lectures required-25**

Pathophysiological significances of following blood constituents- Glucose, urea, Creatinine, Uric acid, Cholesterol, Acetone, Bilirubin.

Diagnostic Enzymes: Enzymes in health and diseases. Biochemical diagnosis of diseases by enzyme assays – SGOT, SGPT, CPK, cholinesterase, LDH, Acid and Alkaline phosphatase.

Organ Function Test: Liver, Renal and Pancreatic function test. Analysis of CSF. Isotopes, Autoanalyser.

Disorders of Carbohydrate Metabolism : Diabetes mellitus, glycogen storage diseases, pentosuria, galactosemia. Disorders of Lipid metabolism : Hyperlipidemia, hyperlipoproteinemia, Gaucher's disease, Tay-Sach's and Niemann-Pick disease.

Inborn Errors of Metabolism : Phenylketonuria, alkaptonuria, albinism, tyrosinosis, maple syrup urine disease, Lesch-Nyhan syndrome, Histidinemia.

Disorders of liver and kidney : Jaundice, fatty liver, Inulin and urea clearance.

Blood Disorders : Red Blood cells Disorders : Anemia, Sickle cell anemia, polycythemia vera. White Blood cells Disorders : Lymphocytopenia, Eosinophilia, Leukemia. Blood clotting Disorders : Haemophilia, Christmas Disease

**COURSE-2: Clinical Biochemistry (practical)**

Qualitative tests for the identification of physiologically important substances: Hydrochloric acid, lactic Acid, Starch, Dextrin, Glucose, Fructose, Sucrose, Lactose, Albumin, Gelatin, Peptone, Urea, Glycerol, Bile salts, Acetone. **(One sample to be identified-8marks)**

Survey report (hand-written) on disease susceptibility of a community and identification of causative factors **Or** Survey report (hand-written) on nutritional assessment of college students **(7 marks)**

**(Viva voce - 2 marks + Lab Note Book - 3 marks)**

**MULTI DISCIPLINARY COURSES UNDER PHYSIOLOGY**

**(Pool-B-in second semester)**

**Course-1: Ergonomics and Sports Medicine**

**Paper code: UPSIMDC002**

**PAPER LEVEL- 100**

**Paper type: Theory**

**Marks- 75 (Theory-60, Internal-10 and attendance-5)**

**Hour of Exam- Theory=2hrs.**

**Learning Outcomes:** At the end of the semester the students should have the ability to-

13. Accurately recognize the importance of ergogenic aids.
14. Evaluate workplace hazards which are likely to cause injuries or occupational illness
15. Apply the knowledge and skill to solve the issues related to ergonomics in industry and workplace.
16. Conduct ergonomic risk assessment.

**Course: Ergonomics and Sports Medicine (Theory)**

**Lectures required-35**

Genesis and concept of ergonomics. Ergonomic methods and techniques, Ergogenic aids, Ergonomic principles in control of Physical hazards. Occupational health, Importance of ergonomics in occupational health and well being. Job and product designing. Prevention of accidents, concept of Industrial safety. Occupational Diseases: pneumoconiosis, asbestosis, silicosis and work-related musculoskeletal disorders.

Static anthropometry, Anthropometric measurements, Application of anthropometric data in design.

Sports Medicine-Nutrition for fitness and Sport. Sports physical therapy, current concept in sports medicine, Cardiopulmonary therapeutics, Emergency care, common sports injuries, sports rehabilitation. Hormone and sports, Dopping. Occupational deafness, Trauma, Muscle strain, Tendinopathy, Athletic heart syndrome.

**Note- Questions will be divided into three groups. In group-A, 4 questions of 3 mark each to be attempted out of 6 questions. In group-B, 4 questions of 6 mark each to be attempted out of 6 questions and in group-C, 2 questions of 12 marks each to be attempted out of 4 questions.**

**Internal assessment can be taken on the basis of regular class performance and/or class test and/or assignment (Ergonomic design of a study room/class room/Office/kitchen/workplace etc.) and/or group discussion and/or case study.**



**SECOND YEAR**  
**(3<sup>RD</sup> AND 4<sup>TH</sup> SEMESTER)**  
**(IMPLEMENTED FROM ACADEMIC SESSION 2024-2025)**

**SUBJECT: PHYSIOLOGY**

**MAJOR COURSES**

**COURSE-3: Haematology**

**PAPER CODE: UPSIMAJ11003**

**PAPER LEVEL- 200, PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand histology, composition and functions of blood.
2. Acquire knowledge about actions of different blood cells and plasma.
3. Understand the coordination of functions and diseases related to blood.

**COURSE-3: Haematology (Theory)**

**Lectures required-35**

Introduction, Blood-properties & composition, Bone Marrow-Classification & Functions, White Blood Cells-Types, Characters, Shape & size, Functions, Immune activities of blood, Platelets, Red Blood Cells-Biosynthesis & Factors affecting, Hemoglobin- Synthesis, Estimation, Compounds & derivatives, Fate, abnormal Hemoglobins. Blood Types-ABO, Rh & MN, Cross matching, Agglutinin & Agglutinins, Plasma proteins-Classification, Values & Functions, Plasmapheresis. Hemostasis- Coagulation factors, Mechanisms, Factors Hastening, Hemophilia, Role of Platelets in Coagulation, Blood Volume- Values, Physiological Variations, Measurements and Regulations, Lymph-Lymphatic system, Source, Composition, circulation and functions. TC, DC, ESR, MCH, MCHC, PCV, Leukemia, Leukocytosis, Leukopenia, Purpura, Arneht count, Erythroblastosis foetalis. Transfusion- Hazards, Precautions, Procedure of transfusion. Edema, Spleen-structure & function. Lymph-composition, circulation, peculiarities and functions. Arterial & Arteriolar Circulation, Capillary Circulation, Interstitial Fluid, Venous Circulation.

**COURSE-3: Haematology (Practical)**

Preparation of Haemin crystal, Bleeding time and Clotting time, Identification of blood group, Estimation of hemoglobin, Preparation and staining of blood film with *Leishman's* stain and Identification of the blood corpuscles, Differential count of WBC, Total Count of RBC, Total Count of WBC.

*(Two experiments to be set 8+7=15)*  
*(Viva voce - 2 marks + Lab Note Book - 3 Marks)*

**SUBJECT: PHYSIOLOGY**

**MAJOR COURSES**

**COURSE-4: Biochemistry of molecules and metabolism**

**PAPER CODE: UPSIMAJ11004**

**PAPER LEVEL- 200**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the structure of different biomolecules
2. Acquire knowledge about different metabolic pathways
3. Understand the regulations and energetics of the pathways

**COURSE-4: Biochemistry of molecules and metabolism (Theory)      Lectures required-38**

Classification, structure, Properties and Functions of Carbohydrates, Proteins and lipids.

Structure, types and Functions of DNAs and RNAs.

Metabolic Pathways, energetics and Regulations- glycogenesis, Glycogenolysis, Glycolysis, TCA cycle, HMP pathway, Neoglucogenesis, Cori Cycle, Glucose Alanine cycle, TCA cycle- the final common Pathway,

Beta Oxidation, Alpha Oxidation, Omega Oxidation, Ketogenesis, Fatty acid Synthesis, Cholesterol Biosynthesis, Glucogenic and Ketogenic amino acid, Pathway of serine metabolism, Deamination, Transamination, Urea cycle. Inborn error of metabolism carbohydrate, protein and lipid metabolism.

**COURSE-4: Biochemistry of molecules and metabolism (Practical)**

1. Photo-colorimetric estimation of blood constituents.
2. Measurement of blood glucose by Nelson-Somogyi method.
3. Measurement of blood inorganic phosphate by Fiske – Subbarow method.
4. Measurement of blood chloride.
5. Measurement of serum total protein by Biuret method.      (One experiment to be set-**10 marks** )

1. Survey report (hand-written) on awareness level about child health status of a community

**Or**

2. Survey report (hand-written) on awareness level about maternal health status of a community

**Or**

3. Case study report (hand-written) about particular diseases of a locality.      (**5 marks**)

**Students should go for field study for 2 to 3 days to the rural area or locality for collection of data**

**(Viva voce - 2 marks + Lab Note Book - 3 marks)**

**SUBJECT: PHYSIOLOGY**  
**MAJOR COURSES**  
**COURSE-5: Cardiovascular System**  
**PAPER CODE: UPSIMAJ11005**  
**PAPER LEVEL- 200, PAPER TYPE-T+P**  
**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**  
**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the structural organization of myocardial cells.
2. Acquire knowledge about cardiovascular homeostasis.
3. Understand the coordination of functions with other systems.

**COURSE-5: Cardiovascular System (Theory)**

**Lectures required-36**

**Origin of the Heartbeat & the Electrical Activity of the heart**

Introduction, Properties of heart muscle, Special Junctional tissues, Origin & Spread of Cardiac Excitation, The Electrocardiogram, Cardiac Arrhythmias, Electrocardiographic Findings in Other Cardiac & Systemic Diseases, hypertrophy and cardiac myopathy. **The Heart as a Pump:** Introduction, Mechanical Events of the Cardiac Cycle, Cardiac Output. , Heart sound, Heart rate.

**Cardiovascular regulatory Mechanisms:** Introduction, Local Regulatory Mechanisms, Substances Secreted by the Endothelium, Systemic Regulation by Hormones, Systemic Regulation by the Nervous System. Blood pressure-Types, Measurement & Regulation. **Circulation Through special Regions:** Introduction, Cerebral Circulation, Anatomic Considerations Cerebrospinal fluid, The Blood-Brain barrier, Cerebral Blood Flow, Regulation of Cerebral Circulation, Coronary Circulation , Splanchnic Circulation, Circulation of the skin. **Cardiovascular Homeostasis in Health & Disease:** Introduction, Compensation for Gravitational Effects, Exercise, Inflammation & Wound Healing, Shock, Hypertension, Heart Failure, stroke.

**COURSE-5: Cardiovascular System (Practical)**

Measurement of blood pressure before and after exercise with graphical presentation. Measurement of blood pressure before and after different grades of exercise. Determination of blood pressure at different body postures. Measurement of electrocardiographic recordings (ECG). Computation of HR, PQ interval, QRS complex, PR interval from supplied ECG recording graph. Kymographic recording of the unperfused heartbeats of toad. Study on the effects of changes in temperature, excess calcium and potassium ion concentration, acetylcholine, adrenaline on the movement of heart from supplied graph - Interpretation.

*(One experiment to be set 15) (Viva voce - 2 marks + Lab Note Book - 3 Marks)*

**Demonstration:** Kymographic recording of the movements of perfused heartbeats of toad.

**SUBJECT: PHYSIOLOGY  
MAJOR COURSES**

**COURSE-6: Respiratory System**

**PAPER CODE: UPSIMAJ11006**

**PAPER LEVEL- 200**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the structural organization of the systems.
2. Students will understand the mechanics of breathing and its regulation.
3. Learn about different diseases related to the system.

**COURSE-6: Respiratory System (Theory)**

**Lectures required-34**

1. **Pulmonary Function:** Introduction, Properties of Gases, Anatomy of the Lungs, Alveolar cell types, Alveolar macrophages, Mechanics of breathing, Other Functions of the Respiratory System. Cough and sneeze reflex.
2. **Gas Transport Between the Lungs & the Tissues:** Introduction, Gas Exchange in the lungs, Oxygen Transport, Carbon Dioxide Transport, Oxygen dissociation curve, Respiratory acidosis and alkalosis.
3. **Regulation of Respiration:** Introduction, Neural control of Breathing, Hering Breuer reflex, Chemical Control of Breathing, Nonchemical Influences on Respiration.
4. **Respiratory Adjustments in Health & Disease :** Introduction, Effects of Exercise, Hypoxia, Cyanosis, Kaysers disease, Oxygen Treatment, Hypercapnia & Hypocapnia, Asthma, Bronchitis, Pneumonia, Other Respiratory Abnormalities,

Effects of Increased and decreased Barometric Pressure, Artificial Respiration. Pulmonary Circulation,

**Course 6- respiratory system (Practical)**

1. Measurement of peak expiratory flow rate.
2. Measurement of oxygen saturation by pulse oxymeter before and after exercise
3. Measurement of forced expiratory volume (FEV) in first second and first 10 second.
4. Pneumographic recording of effects of hyperventilation, breath-holding and talking on respiratory movements.
5. Measurement of Respiratory rate under sitting, lying and standing posture.
6. Measurement of respiratory rate and under different grades of exercise.
7. Measurement of Pulse respiratory ratio under resting condition and under different grades of exercise.

*(One experiment to be set 10)*

**Measurement of physiological data like BMI, muscle mass, body fat, visceral fat, BMR etc, as much as applicable. Students need to collect at least 5 parameters from 10 subjects and prepare a report.**

**(Report-5marks, Viva voce - 2 marks + Lab Note Book - 3 Marks)**

**SUBJECT: PHYSIOLOGY**  
**MAJOR COURSES**  
**COURSE-7: Gastrointestinal System**

**PAPER CODE: UPSIMAJ11007**

**PAPER LEVEL- 200**

**PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand histology, composition and functions of the system.
2. Acquire knowledge about actions of different glands and enzymes.
3. Understand the coordination of functions and diseases related to Gastrointestinal system.

**COURSE-7: Gastrointestinal System (Theory)**

**Lectures Required-35**

1. **Anatomy & Histology:** Organs- Mouth; tongue, oesophagus liver, stomach, intestine, Deglutition, Defecation.
2. **Digestion & Absorption**  
Introduction, Carbohydrates, Proteins & Nucleic Acids, Lipids. Digestion & Absorption, Absorption of Vitamins & Minerals
3. **Regulation of Gastrointestinal Function**  
Introduction, General Considerations, Gastrointestinal hormones, & Exocrine Portion of the Pancreas, Liver & Biliary System, Small Intestine, Colon.
4. **Digestive Juices-** composition, Secretion, functions & regulation of secretion of Saliva, Bile, Gastric juice, Pancreatic juice and Intestinal juice. HCL secretion& regulation.  
Black & white bile, Gastritis, Pancreatitis, Jaundice, Cholecystitis. Gall stone, Endoscopy. Malabsorption.

**COURSE-7: Gastrointestinal System (practical)**

Quantitative estimation of glucose and sucrose by Benedict's method (percentage as well as total quantity)].

Quantitative estimation of amino nitrogen by Sorensens formol titration method (percentage as well as total quantity).

Estimation of percentage quantity of lactose in milk by Benedict's method.

Introduction on Dale's Apparatus and preparation of Ringer Lock solution.

Kymographic recording of normal movements of rat's intestine in Dale's Apparatus.

*(One experiment to be set 15) (Viva voce - 2 marks + Lab Note Book - 3 Marks)*

**SUBJECT: PHYSIOLOGY  
MAJOR COURSES**

**COURSE-8: Nutrition and Dietetics**

**PAPER CODE: UPSIMAJ11008**

**PAPER LEVEL- 200, PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**COURSE-8: Nutrition and Dietetics (Theory)      Lectures Required-35**

Introduction. Fuel value, Composition and nutritional value of common Indian foodstuffs, rice, wheat, pulses, egg, meat, fish and milk, vegetables & fruits.

Importances of carbohydrate, protein and fat. Balance diet, Balanced diet chart, . Concept of ACU. Principles of formulation of balanced diets for growing child, adult man and woman, pregnant and lactating woman. Caloric requirement, Dietary fibre, Protein energy malnutrition, Food groups, Malnutrition, BMR, RQ, RDA, SDA, NPU, Biological value of proteins,

Vitamins- A,D,E,K, B complex, C, - Sources, Daily requirements, actions, deficiency symptoms, Hypervitaminosis and Hypovitaminosis

Minerals- Sources, functions & Deficiency symptoms. Clinical implications.

Basic idea on PCM, marasmus, kwashiorkor and their prevention. Iron and iodine deficiency.

Diet, concepts & principles of diet survey. Diet prescription, acid & alkaline foods.

Principles of diet therapy, therapeutic diet, RDA & nutraceuticals. Diet management of obese, diabetic, hypertensive person and athlete. Diet prescription for Peptic ulcer, liver diseases, Gout and high fever patients.

**COURSE-8: Nutrition and Dietetics (Practical)**

**Excursion cum survey on diet of one specific community & Preparation of project report**

A complete project report (hand written) has to be prepared on the basis of survey work of a locality (10 families each) by the students- Report should have Introduction, Review of literature, Materials& Methods, Results, Discussion and Conclusion covering BMI, Dietary intake, Nutritional intake, Nutritional requirement, Energy deficiency/excess, vitamin deficiency/excess, mineral deficiency/excess, malnutrition, disease susceptibility and Formulation of balanced diet chart for the school going children, college students, pregnant woman & Lactating women based on the availability in the study area.

OR

A comparative analysis may be made in dietary habits of two different seasons of same locality/ community to identify the amount of nutrient intake and their effects in body and Formulation of balanced diet chart for the school going children, college students, pregnant woman & Lactating women based on the availability in the study area.

**(Report should be presented in Powerpoint presentation of 5-7 minutes) 20Marks (report-10, Presentation-8, Viva-2)**

**SUBJECT: PHYSIOLOGY**  
**SKILL ENHANCEMENT COURSES (Related to Major)**  
**COURSE-3: Haematological techniques**  
**PAPER CODE: UPSISEC13003**  
**PAPER LEVEL- 200; PAPER TYPE-T+P**  
**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**  
**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** At the end of the semester the students will-

1. Understand the principles and methods of different techniques.
2. Acquire knowledge about deviation from normal activity and development of disease.
3. Acquire knowledge about the compounds fighting with disease causing agents.
4. Apply the knowledge and skill for prevention of different diseases

**COURSE-3: Haematological techniques (Theory)**

**Lectures required-25**

Introduction of histopathology: cellular physiology and Pathology. Evolution of histology. Quality control in histopathology. Histological laboratory organization, care & maintenance of equipments used in histopathology laboratory. Fixation and fixatives: Types and mechanism Microtome, its type. Staining theory: Stains and dyes, dye types. mordant, accelerators. silver impregnations. Haematoxylin and Eosin staining, Mounting and mounting media, Tissue processing and its steps. Decalcification. Embedding media - types and properties. Cryotomy, cryostat, impregnation techniques, frozen sections and staining for emergency diagnosis. Histochemistry: General consideration, limitation to histochemistry. PAS reactions, Sudan Black, Perchloric acid/ Napthaquinone reaction(PAN). Histochemistry of Nuclie acids, proteins and enzymes – basic concept, process, and quantitation of enzyme activity. Histochemistry of Pigments. Immunological Techniques : Principles, types, application. Antibody as histological reagents, autoradioactivity. Exfoliative cytology – advantage and disadvantage, Gynaecological smear, fluid sample, thick fluid sample. Cytogenetics & Molecular Techniques: Cytogenetics , chromosomal studies. Karyotyping, growth of cells in tissue cultures. DNA hybridization techniques. Microscopy : Light Microscopy – types, procedure, tissue preparations, photomicrography. Electron Microscopy : Types, Principle, tissue preparation & techniques.

**COURSE-3: Haematological techniques (Practical):**

Glass wares and equipment used in histopathology lab. To prepare alcohol of different concentration. To prepare formalin from stock solution. Preparation of tissue sections, To perform section cutting of paraffin embedded tissue. H&E staining of tissue sections, Preparation and staining of bone marrow smear, Measurement of diameter of megakaryocyte, Reticulocyte staining, Staining of collagen in tissue sections. PAP staining techniques. Staining carbohydrates with PAS reaction. Sudan Black staining (Demonstration) . (*One experiment to be set 15*) (*Viva voce - 2 marks + Lab Note Book - 3 Marks.*)

## **SUBJECT: PHYSIOLOGY**

### **MINOR COURSES**

#### **COURSE-3: Blood and Body Fluids**

**PAPER CODE: UPSIMIN10003**

**PAPER LEVEL- 200; PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** By the end of this course, the students should be able to understand the principles of hematology, both blood physiology, functions, and disorders and explain the pathophysiology of common haematological disorders, discuss the anatomy, functional organization and characteristics of the hematopoietic system. The students would also be able to interpret diagnostic test results and erroneous test results and able to fix them.

#### **COURSE-3: Blood and Body Fluids (Theory)**

**Lectures required-35**

Blood : Properties of blood, composition, character, properties and functions of blood. Plasma proteins : Origin, separation and functions. Plasmapheresis. Erythrocytes : Morphology, fate and functions. Erythropoiesis : Definition, steps of erythropoiesis, Role of different factors on erythropoiesis. Haemoglobin : Functions, derivatives. Abnormal haemoglobin. Anaemia : Different types, Clinical significances. Leucopoiesis. Leucocytes : Morphology and functions. Phagocytosis, Inflammation. Leukaemia. Platelets: Structure, functions. Significance of platelets counts. Coagulation of blood: Mechanism of blood coagulation, factors affecting blood coagulations, Anticoagulants. Bleeding disorders, Coagulation time, bleeding time, prothrombin time. Blood groups : The ABO systems, The Rh systems, Importance of blood groups, Immunological basis of identification of ABO and Rh blood groups. Crossmatching, Donor and Recipient. Blood transfusion: Precaution and hazards of blood transfusions. The Rh system and pregnancy, Erythroblastosis foetalis. Blood volume: Normal value. Determination of blood volume. Factors influencing blood volume, regulation of blood volume. Body fluids: Intracellular and extracellular compartment of body fluids. Lymph and tissue fluids - Composition, function and fate of lymph and tissue fluids.

#### **COURSE-3: Blood and Body Fluids (Practical)**

Preparation of blood film of your own blood. Staining of the blood film with Leishman's stain. Identification of different types of blood corpuscles. Determination of TC of RBC and WBC by haemocytometer. Differential count of WBC. Determination of ESR of human blood. Estimation of haemoglobin by haemoglobinometer. Preparation of haemin crystals. Determination of Blood groups. Determination of clotting time, bleeding time, prothrombin time.

**(1 question to be set=15, Viva voce=2, Lab Note Book=3)**



**SUBJECT: PHYSIOLOGY  
MINOR COURSES**

**COURSE-4: Blood and Body Fluids**

**PAPER CODE: UPSIMIN10004**

**PAPER LEVEL- 200 ; PAPER TYPE-T+P**

**FULL MARKS =75 (Theory=40, Practical=20, Internal=10, Attendance=5)**

**Hour of Exam- Theory=2hrs, Practical=2hrs**

**Learning Outcomes:** By the end of this course, the students should be able to understand the principles of hematology, both blood physiology, functions, and disorders and explain the pathophysiology of common haematological disorders, discuss the anatomy, functional organization and characteristics of the hematopoietic system. The students would also be able to interpret diagnostic test results and erroneous test results and able to fix them.

**COURSE-4: Blood and Body Fluids (Theory)**

**Lectures required-35**

Blood : Properties of blood, composition, character, properties and functions of blood. Plasma proteins : Origin, separation and functions. Plasmapheresis. Erythrocytes : Morphology, fate and functions. Erythropoiesis : Definition, steps of erythropoiesis, Role of different factors on erythropoiesis. Haemoglobin : Functions, derivatives. Abnormal haemoglobin. Anaemia : Different types, Clinical significances. Leucopoiesis. Leucocytes : Morphology and functions. Phagocytosis, Inflammation. Leukaemia. Platelets: Structure, functions. Significance of platelets counts. Coagulation of blood: Mechanism of blood coagulation, factors affecting blood coagulations, Anticoagulants. Bleeding disorders, Coagulation time, bleeding time, prothrombin time. Blood groups : The ABO systems, The Rh systems, Importance of blood groups, Immunological basis of identification of ABO and Rh blood groups. Crossmatching, Donor and Recipient. Blood transfusion: Precaution and hazards of blood transfusions. The Rh system and pregnancy, Erythroblastosis foetalis. Blood volume: Normal value. Determination of blood volume. Factors influencing blood volume, regulation of blood volume. Body fluids: Intracellular and extracellular compartment of body fluids. Lymph and tissue fluids - Composition, function and fate of lymph and tissue fluids.

**COURSE-4: Blood and Body Fluids (Practical)**

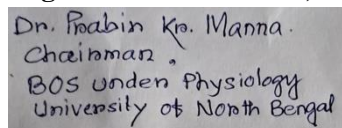
Preparation of blood film of your own blood. Staining of the blood film with Leishman's stain. Identification of different types of blood corpuscles. Determination of TC of RBC and WBC by haemocytometer. Differential count of WBC. Determination of ESR of human blood. Estimation of haemoglobin by haemoglobinometer. Preparation of haemin crystals. Determination of Blood groups. Determination of clotting time, bleeding time, prothrombin time.

**(1 question to be set=15, Viva voce=2, Lab Note Book=3)**

### Recommended Text and Reference Books for Physiology Major and Minor

1. Best and Taylor's Physiological basis of Medical Practices, by B.K. Brobecks. The William and Wilkins Co.
2. Review of Medical Physiology, by W.F. Ganong, Lange Medical Book. Pretices- Hall International. Mc Graw Hill.
3. Harper's illustrated Biochemistry, by R.K. Murray and others. Lange Medical Book, International edition, Mc Graw Hill.
4. Text book of Medical Physiology, by A.C. Guyton. W.B. Saunders Co.
5. Lehninger's Principles of Biochemistry, by D.L. Nelson and M.M. Cox, Worth Publishers Inc.
6. Text book of Biochemistry, by E.S. West; W.R.Todd; H.S. Mason; J.T Van Bruggen. The Macmillan Company.
7. Biochemistry, by D Das. Academic Publishers.
8. Biophysics and Biophysical Chemistry, by D.Das. Academic Publishers.
9. Physiology, by R.M. Berne and M.N. Levy, C.V Mosby Co.
10. The Physiological Basis of Physical Education and Athletics, by W.D. McArdle, F. Katch and V.L Katch. Williams and Wilkins.
11. The Text Book of Work Physiology by P.O. Astrand and K. Rodhal. McGraw-Hill Books Co.
12. Human factors in Engineering and Design, by E.O. McCormick and M. Sanders. Tata McGraw Hill.
13. Sports Physiology, by E.L. Fox, Saunders College Publishing Holt-Saunders.
14. Ross and Wilson Anatomy and Physiology in Health and Illness, by A. Waugh and A. Grant. International Edition, Churchill Livigstone Elesvier.

#### Signature of Chairman,



Dr. Prabin K. Manna  
Chairman  
BOS Under Physiology  
University of North Bengal