VIDYASAGAR UNIVERSITY

Paschim Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE (HONOURS)

MAJOR IN PHYSIOLOGY

4-YEAR UNDERGRADUATE PROGRAMME

(w.e.f. Academic Year 2023-2024)

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

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VIDYASAGAR UNIVERSITY
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: Basic Physiology-1** **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: Introduction to Physiology-I; 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 Physiology-2** **P: Practical**	**4**	**3-0-1**	**15**	**60**	**75**
			SEC	**PHYSEC02**	**P: Nutrition and Dietetics (Practical)**	**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: Introduction to Physiology-II; 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**

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

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MAJOR (MJ)

MJ-1: Basic Physiology-1 **Credits 04 (Full Marks: 75)**

MJ-1T: Basic Physiology-1 **Credits 03**

[Background history of Physiology and Medicine, Cell Biology and Structural Units of Human Systems and Tissue Organization, Brief overview of Physiological Systems, Fundamental idea of human body anatomy, Chemistry of Biomolecules]

Course contents:

Unit I: Background history of Physiology with Medicine:

Brief history of Physiology (Human) and medicine and involvement of National and International Scientists cum researchers in the field of Physiology and allied health sciences: Antonie van Leeuwenhoek, Robert Hooke, Edward Jenner, Robert Brown, Ivan Pavlov, Claude Bernard, Louis Pasteur, Camillo Golgi, Sir Charles Scott Sherrington, Sir Ronald Ross, Edme Mariotte, Ernest Henry Starling, Karl Landsteiner, Archibald Vivian Hill, Albert Szent-Györgyi, Subodh Chandra Mahalanobis, Upendra Nath Brahmachari, John Burdon Sanderson Haldane, Sacchidananda Banerjee, Professor Podili Brahmayya Sastry, Bal Krishan Anand, Autar Singh Paintal, Dr. Ajit Kumar Maiti, Dilip Mahalanabis, Sambhu Nath Dey (Among Indian), James Watson and Francis Crick, Har Gobind Khorana.

Unit II: Cell biology and structural units of human systems and tissue organization:

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, adherensjunctions, 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 III: Brief outline of physiological systems:

Basics of functional organization and physiological functions of different system. Cardiovascular system: Comparative anatomy of heart structure, myogenic heart, specialized functional tissue, cardiac cycle& output, blood pressure; Respiratory system: anatomical considerations, transport of gases, exchange of gases, Digestive system: Physiology and mechanism of digestion & absorption of different food particles; Endocrine system: Anatomical location & functions of endocrine glands, basic mechanism of hormone

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action, hormones and diseases; Nervous system: A brief outline of the organization and basic functions of the nervous system – Central and Peripheral. Fundamental concept of autonomic nervous system (ANS): Sympathetic and Parasympathetic, Physiological functions and their control mechanism. Structural organization of the different parts of brain and spinal cord. Receptors: Definition, Structure, Classification, Mode of action. Reflex action: Definition, classification, properties. Reproductive system: Structure and basic functions of reproductive organs (male and female) and reproductive processes, gametogenesis, ovulation, neuroendocrine regulation; Excretory system: Comparative physiology of excretion through kidney, urine formation, urine concentration, waste elimination.

Unit IV: Fundamental idea of human body anatomy:

Brief overview ofhuman 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.

Unit V: Chemistry of Biomolecules: Structure of atoms, molecules and chemical bonds. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (Acid, Base, pH, buffer, reaction kinetics, thermodynamics, colligative properties). Law of mass action, orders of reactions, properties of water. Definition, Types, Significance and physiological application of the following phenomena: diffusion, osmosis, dialysis, surface tension, viscosity, adsorption, absorption. Colloids: properties and significances, sol and gel, lyophilic and lyophobic sol, electro-kinetic properties; Isoelectric pH and isoelectric precipitation.

Composition, structure and function of biomolecules: Carbohydrates: Definition, classification, structure, stereoisomerism, optical isomerism, optical activity, chemical reactions of monosaccharides (Glucose & Fructose) – Reactions with concentrated mineral acids, alkali, phenylhydrazine and their biochemical importance. Disaccharides: Maltose, Lactose and Sucrose: Occurrence, Structure, bio-chemical properties and Physiological importance. Polysaccharides-Starch, Glycogen, Dextrin, Cellulose, Glycosaminoglycans, Glycoproteins, Sialic acids, lectins and its physiological importance.

Amino acids and Proteins: Classification, Structure, Nomenclature and Optical properties. Peptides and Proteins: Structure and properties of peptide bonds. Protonic equilibrium of amino acids-amphoteric nature, Zwitterions, Isoelectric point. Nucleic acids: Nucleosides and Nucleotides- structure. Polynucleotides. DNA doublehelix- Primary, Secondary and Tertiary structure.

Lipids: Definition and classification. Fatty acids: Classification, systemic nomenclature, structure and functions. Mono, Di-and Triglycerides. Properties of fat and fatty acids.

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MJ-1P: Basic Physiology-1 (Practical) **Credits 01**

1. **Histology:** Study of compound microscope, 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, Cardiac muscle, Skeletal muscle, Smooth muscle, Artery, Vein, Tongue, Uterus.
2. **Fresh tissue:** Stanning of Squamous and columnar epithelium, Adipose tissue, Striated muscle.
3. **Anatomy:** Demonstration and identifications of different bones and joints of human skeleton system through different models and chart. Anatomical position, structure &functions of human skeleton and bones with joints.

MJ-2: Basic Physiology-2 **Credits 04 (Full Marks: 75)**

MJ-2T: Basic Physiology-2 **Credits 03**

[Blood and Body Fluids and Basic Concept of Immunology, Biophysical Principle and Enzyme, Digestive System]

Course contents:

Unit I: 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 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.

Unit II: Basic concept of Immunology:
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, Tlymphocytes (helper, cytotoxic and suppressor), Natural killer cells, monocytesmacrophages. Primary and secondary lymphoid organs.

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Antigen-Antibody: Properties of immunogen, antigens and haptens. Classification, structure and functions of immunoglobqlins (IgG, IgM, IgA, IgD, IgE). Antigen antibody interaction, their physiological effects and clinical applications. Major Histocompatibility Complex: Elementary ideas about Human leucocyte antigens. Self, Non-self. Antigen processing and presentation with MHC (Class I and II). Biology of B-Iymphocyte: Elementary idea of B-Cell receptors (IgM, Igα/Igβ, CD 19, Cr2/CD21) and activation (in brief). Biology of T-lymphocyte: Elementary idea of T-Cell receptors (TCR, CD28/l52, CD40L) and. activation of T-cell (in brief): Humoral immunity: Primary and secondary immune responses. Mechanisms of humoral immunity- Cooperation of T cells B cells and macrophages for the production of specific antibody. Role of cytokines in humoral immunity. Antibody diversity (in brief). Cytokines: Types and functions. Role of cytokines in inflammatory response. Complements: Classification, components, activation of pathways (classical, alternative and lectin) and functions. Cell mediated immunity: Generation and activation CTLs; NK cells and their mechanism of killing. Acquired Immunodeficiency: AIDS, The HIV virus & infection; immunological events associated with HIV infection. Immunization: Concept about immunization, Immunizing agent- vaccine, antisera, DNA vaccine, edible vaccine. Immunization schedules - National and WHO. Hazards of immunization. Immunological techniques - Principle of Immunoassay, ELISA, RIA and Immunoelectrophoresis. Role ELISA and RIA in Hormone assay.

Unit-III: Biophysical Principle and Enzyme:

Biophysical Principle: Law of mass action, orders of reactions, properties of water. Significance and physiological application of the following phenomena: diffusion, osmosis, dialysis, surface tension, viscosity, adsorption, absorption. Colloids: properties and significances, sol and gel, lyophilic and lyophobic sol, electrokinetic properties; Isoelectric pH and isoelectric precipitation. Gibbs-Donnan membrane equilibrium and its biological importance. Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.). Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties). Acids and bases as proton donors and acceptors. Conjugate acid-base pairs; pH: definition, explanation, determination and significance; Buffers: definition, types; functions of buffers. Role of kidney, erythrocyte and lungs for maintaining body pH. Indicators and its applications. First and second laws of thermodynamis, closed and open system, living body as a thermodynamic system, entropy, enthalpy, maintenance of physiological steady state. Gibbs concept of free energy. Stablizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.), Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).

Enzyme: Definition, chemical nature, classification and nomenclature. Mechanism of enzyme action - active site, specificity and enzyme-substrate complex formation. Enzyme kinetics: Hyperbolic kinetics and linear transformation (Lineweaver-Burk Plot; Eisenthal Cornish-Bowden Plot). Michaelis – Menten constant. Effect of temperature, pH and metal ions on enzyme activity. Allosteric enzyme- Definition, properties, and types; Sigmoid kinetics. Regulation of enzyme activity - Allosteric modulation; Feedback and feed forward regulations; Covalent modification; Inhibition: Reversible- competitive, noncompetitive and uncompetitive inhibition; Irreversible inhibition. Coenzyme and prosthetic groups; Activation of pro enzymes. Isoenzymes. Rate limiting enzymes. Ribozymes, Abzymes, Antizymes, Synzymes. Fundamental ideas about immobilized enzyme. Enzymes in clinical diagnosis (amylase, acid and alkaline phosphatase, SGOT, SGPT, LDH and CPK).

Unit IV: Digestive System:

Histology and functions of digestive organs - tongue, pharynx, esophagus, stomach, small intestine, large intestine, pancreas, liver, gall bladder and salivary glands. Nerve supply to the alimentary system. Mechanism, functions and regulation of mastication, deglutition, movement of the alimentary canal. Composition, functions, mechanism of secretion and control of saliva, gastric juice, pancreatic juice, bile and intestinal juice. Mechanism and control of gastric HCl secretion. Functions of gall bladder and large

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intestine. Mechanism and importance of Enterohepatic circulation of bile. Brief idea about gall stones, achlorhydria, hyperchlorhydria, peptic ulcer, Pavlov's pouch, defecation reflex, vomiting reflex.

MJ-2P: Basic Physiology-2 (Practical) **Credits 01**

1. **Blood:** Preparation of hemin crystal. Determination of coagulation time by capillary method. Bleeding time (Dukemethod), Blood grouping, Rh typing. Preparation and staining of human blood film (Leishman); Identification and measurement of WBC. Differential count of WBC, Arneth count, platelet. count, total count of RBC and WBC. Staining of reticulocyte. Estimation of hemoglobin (visual method) and cyanmethaemoglobin method. Determination of hematocrit value, calculation of red blood cell indices (MCV, MCH and MCHC). Study of bone marrow for identification of megakaryocytes.
2. **Enzyme:** Determination of enzyme (CAT,Amylase, Acid Phosphatase) from tissue sample.

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MINOR (MI)

MI – 1: Introduction to Physiology-I **Credits 04 (Full Marks: 75)**

[Blood, body fluid and Fundamental concept of immune System, Cardiovascular System, Physiology of Respiratory System]

MI – 1T: Introduction to Physiology-I **Credits 03**

Course contents:

Unit-I Blood, body fluid and immune System:

Blood, body fluid: 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 edema. Composition, properties and functions of blood, blood cell formation and related disorders, Blood groups, Blood transfusion and its hazards, Blood clotting (types), anti-clotting mechanism and blood disorders; Blood volume: Normal value, Determination of blood volume, variation and maintenance of blood volume. Effective blood volume, factors influencing blood volume, regulation ofblood volume; Erythropoiesis: Definition, steps of erythropoiesis, role of different factors on erythropoiesis; Platelets: Structure, functions. Platelet's reaction, Critical counts of Platelets. Significance of platelets counts. Haemoglobin: Structure, properties and functions of haemoglobin. Abnormal haemoglobin. Bone marrow: synthesis, functions. Blood grouping: The ABO systems, The Rhsystems, 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, Tlymphocytes (helper, cytotoxic and suppressor), Natural Killer (NK) cells, monocytes macrophages. Primary and secondary lymphoid organs. Antigen-Antibody: Properties of immunogen, antigens and haptens. Classification, structure and functions of immunoglobulins (IgG, IgM, IgA, IgD, IgE). Acquired Immunodeficiency: AIDS, The HIV virus & infection; immunological events associated with HIV infection. Immunization: Concept about immunization, Immunizing agent- vaccine, antisera, DNA vaccine, edible vaccine. Immunization schedules - National and WHO.

Unit-II: Cardiovascular System: Anatomy and histology of the heart. Properties of cardiac muscle. Origin and propagation of cardiac impulse. Properties of cardiac muscle, origin & propagation of cardiac impulse. Structure of arteries, arterioles, capillaries. Venules and veins. Heart Block, basic idea about artificial pacemaker. Cardiac valves, Heart rate and its regulations. Heart sounds. Nerves and its role in the regulation of the heart function. Frank–Starlings laws of heart. Blood Pressure- Definition, Factors affecting blood pressure; Regulation: Chemical and Neural; Cardiac output – factor affecting; Heart rate-regulation, bradicardia, tachycardia; Types of blood pressure: Hypertension and hypotension; Cardiac cycle: Events of cardiac cycle, Heart rate, Heart Sound, Heart rate control, factors affecting and regulation. Cardiac output: methods of determination (dye dilution and Fick principle), factors affecting regulation. Role of Renin- angiotensin system, Vasopressin or ADH in Blood Pressure regulations.

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Unit III: Physiology of Respiratory system: Introduction, anatomical structure and functions of the lungs. Basic concepts about respiratory tract, histology of lungs, respiratory muscles and their innervations. Mechanism of respiration; Regulation 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 O_2dissociation curve, factors affecting, clinical application; Respiratory acidosis and alkalosis; non-respiratory functions of lungs. Compliance, elasticity and elastic recoil of the lung. Role of lung surfactants. Lung compliance; Artificial respiration. Respiratory failure. High altitude sickness. Different lung volume and capacities; Lung Function Tests. Hypoxia: Types and causative factors; Oxygen treatment, O_2toxicity; Asphyxia: definition, cause, sign and symptoms.

MI – 1P: Introduction to Physiology-I (Practical) Credits 01

Course Outlines

Hematology:

a) Preparationofbloodfilmofyourownblood.StainingofthebloodfilmwithLeishman'sstain.
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, prothrombin time.

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 with the changes of postures (Standing, Supine, Sitting).
d) Study of pulse rate as an effect of breath-holding.
e) Study of pulse rate with the variation of static work load.
f) Determination of Physical Fitness Index (PFI) of an Individual by Modified Harvard Step test.

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MI-2: Introduction to Physiology-II **Credits 04 (Full Marks: 75)**

MI-2T: Introduction to Physiology-II **Credits 03**

[Cellular Physiology, Biophysical Principles, Basic concept of Biochemistry, Overview of digestive system and metabolism]

Course contents:

Unit-I: Cellular Physiology:
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 exocytosis and endocytosis. Structure functions and control of ion channels. Artificial membrane: liposome and its functions. Endoplasmic reticulum: EM structure and functions (Molecular basis) of smooth and rough ER. Microsomes: basic functional aspects. Golgi complex: structure, its storage and processing functions (Molecular basis). 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 – cytoribosomes and mitoribosomes; their structure and functions.

Unit II: Biophysical Principles:
Physiological importance of the following processes: diffusion, osmosis, dialysis, ul1rafil1ration, 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, sol and gel, lyophilic and lyophobic sol, electrokinetic properties; Isoelectric pH and isoelectric precipitation. Gibbs-Donnan membrane equilibrium and its biological importance. Acids and bases as proton donors and acceptors. Conjugate acid-base pairs; pH: definition, explanation, determination and significance; Buffers: definition, types; functions of buffers.

Unit III: Chemistry of Biomolecules:
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. Protonic equilibrium of amino acids - amphoteric nature, Zwitterions, 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, systemic nomenclature and structure. Properties of Fat and Fatty acids -Hydrolysis, Saponification, Saponification number, Iodine number.

Unit IV: Overview of digestive system and metabolism:
Different parts and functions of gastrointestinal (GI) tract. Digestive glands and their functions. Composition and functions of digestive juice including bile. Movements of the stomach & small intestine. Digestion and absorption of carbohydrates, lipids, proteins; Glycolysis, TCA cycle. Fatty acid oxidation,

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MI-2P: Introduction to Physiology-II (Practical) **Credits 01**

i. Fresh tissue experiments:
   1) Study of compound microscope.
   2) Examination & staining of fresh tissue: squamous, ciliated & columnar epithelium, skeletal muscle fibre (Rat/ Goat) by Methylene blue stain.
   3) Transitional epithelium, mesentery (Rat/ Goat) (counter stain by Methylene blue)

ii. Measurement of PH of various solutions using pH indicators and meter.

iii. Preparations and study the properties of different buffer solutions.

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SKILL ENHANCEMENT COURSE (SEC)

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

Course Outline:

Concept of Clinical Haematology:
Anemia and its classification. Laboratory investigation and management of anemia. Iron deficiency anemia, megaloblastic anemia, pernicious anemia- pathogenesis and laboratory investigation. Reticulocytes. Aplastic anemia- laboratory diagnosis. Bone marrow examination. Aspiration techniques. Hemoglobin - abnormal hemoglobin. Hemolytic anemia and its laboratory investigation. Haemoglobinopathies. Hemoglobin electrophoresis. Sickle cell anemia, Thalassemialaboratory diagnosis. Blast cell. Causes and significances of leucocytosis, leucopenia, neutrophilia, eosinophilia, basophilia, monocytosis, lymphocytosis, neutropenia, lymphopenia. Toxic granulation. Leukemia and its classification. HIV on blood cell parameters. LE cells and its significances. Blood parasites. Hemostasis and Coagulation: Platelet development. Qualitative and quantitative disorders of platelets. Secondary hemostasis. Hemophilia, Willebrand diseases. Disorder of fibrinogen. Fibrinolysis. Bleeding and coagulation disorders. Blood groups: Immunological basis of identification of ABO and RH blood groups. Biochemical basis of ABO system and Bombay phenotyping. Others blood groups: Kell, Kidd, Duffy, etc. Blood transfusion. Blood banking. Definition determination and significance of TC, DC, ESR, Arnth count, PCV, MCV, MHC, MCHC. bleeding time, clotting time, prothrombin time.

Practical:
1. General blood film preparation by Leishman stain,
2. Differential leucocyte count, RBC, WBC count and platelet count.
3. Determination of haemoglobin by various methods
4. Determination of ESR, PCV, MCV, MCH, MCHC and red cell indices.
5. Staining of bone marrow
6. Determination of blood groups.
7. Demonstration of thrombin time.
8. Demonstration of malarial parasite identification.

SEC 2P: Nutrition and Dietetics (Practical) Credits 03 (Full Marks: 50)

Course Outline:

Concept of Nutrition and Dietetics:
Basic concept: Nutrition, Nutrients, Nutraceutical, Cosmeceutical, Nutrigenomics. Nutritional Evaluation of Carbohydrates: Glycemic Index (GI), Classification of dietary fibers with potential of health benefit, Resistance starch. Nutritional Evaluation of Proteins: Essential and Non-essential amino acids, Protein Efficiency ratio (PER), nitrogen balance, Net protein utilization (NPU), Biological value of protein, protein spares, Nutritive value of major food groups (basic concepts). Vitamins: Water soluble vitamins (Vit-B complex, Vit-C, Folic acid) and fat-soluble vitamins (Vit-A, D, E and K): source, brief chemistry, dietary requirements, functions, deficiency, hyper-vitaminosis, and antioxidant. Energy in Human Nutrition: Basic concept of energy and units, calorific and physiological fuel value, respiratory quotient (RQ), Total energy expenditure (TEE), Basal metabolic rates (BMR) and Resting energy expenditure (REE), Specific dynamic action (SDA), physical activity ratio (PAR), Determination of BMR by

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Benedict Roth apparatus. Factors affecting BMR. Adult consumption unit (ACU). Formulation of balance diet chart for college students, pregnant and lactating mothers and athletes.

Practical:

- **Diet Survey:** Nutritional assessment as per ICMR specification (Steps- Introduction, Diet History, Methodology, Dietary Survey on the status of dietary intake in the surrounding area through visits or Field visit at different high-altitude area or sea level surrounding community populations, Clinical Examinations, Remarks, Recommendation and Conclusion. Each student has to prepare and submit the report preferably regarding the diet survey or field.
- **Research Institute visit** for exploring the research idea in future of the students.

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