

# VIDYASAGAR UNIVERSITY



**Curriculum for 3-year B.Sc. (Honours)**

## **Physiology**

**Revised Syllabus under CBCS  
(w. e. f. 2022-2023)**

**Vidyasagar University  
Midnapore 721102  
West Bengal**

# Vidyasagar University

## Curriculum for B.Sc. (Honours) in Physiology [Revised Syllabus w.e.f. 2022-23]

### SEMESTER-I

#### Course Structure

Course	Course Code	Name of the Subjects	Course Type/ Nature	Teaching Scheme in hour per week			Credit	Marks
				L	T	P		
CC1		C1T: Structural Units in Human Systems & Functional Principals	Core Course-1	4	0	4	6	75
		C1P: Histology (Practical)						
CC2		C2T: Biomolecules and Enzymes	Core Course-2	4	0	4	6	75
		C2P: Biochemistry						
GE1		TBD (from other Discipline)	Generic Elective-1	5-1-0/ 4-0-4			6	75
AECC		English	AECC (Elective)	1	1	0	2	50
<b>Semester Total</b>							<b>20</b>	<b>275</b>

L=Lecture, T=Tutorial, P=Practical, CC- Core Course, TBD - To be decided, AECC- Ability Enhancement Compulsory Course

**Generic Elective (GE) (Interdisciplinary)** from other Department [Paper will be of 6 credits]

**Semester-I**  
**Core Course (CC)**

**CC-1: Structural Units in Human Systems & Functional Principals** **Credit 06**

**C1T: Structural Units in Human Systems & Functional Principals** **Credit 04**

**Course Contents:**

**Cell Biology and Structural Units of Human Systems:**

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. Artificial membrane: liposome and its functions. Endoplasmic reticulum: EM structure and functions of smooth and rough ER. Microsomes: basic functional aspects. Golgi complex: structure, and functions. Lysosomes and its functions. EM structure and functions of nucleus. Peroxisomes and its function. Mitochondria: EM structure and its functions. Ribosomes – cytoribosomes and mitoribosomes; their structure and functions. Cytoskeleton: structure and its role in stabilization of cell shape. Microtubules and their role in cellular movements and secretions. Events of Cell cycle; Cell differentiation; Gap junction, Tight junction (structure and functions); Cell adhesion molecule (brief).

**Tissue Organization of Human Body:**

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

**Biophysical and Biochemical Principles:**

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. 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 thermodynamics, closed and open system, living body as a thermodynamic system, entropy, enthalpy, maintenance of physiological steady state. Gibbs concept of free energy.

**C1P: Histology (Practical)**

**Credit 02**

**Content:**

**Staining and Examination of fresh tissues:** Study of compound microscope. Squamous, columnar epithelium (methylene blue), corneal cell space (silver nitrate), adipose tissue (Sudan

III or IV), Specimens should be taken strictly from Goat / Rat.

**Study and Identification of supplied paraffin sections of mammalian tissues (Eosin and Hematoxylin stain).**

Trachea, lung, spleen, lymph gland, tongue, esophagus, stomach, duodenum, ileum, jejunum, large intestine, liver, kidney, salivary glands, pancreas, adrenal gland, thyroid gland, testis, ovary, uterus, spinal cord, cerebral cortex, cerebellum, skin, artery, vein.

**CC-2: Biomolecules and Enzymes**

**Credit 06**

**C2T: Biomolecules and Enzymes**

**Credit 04**

**Course Contents:**

**Chemistry of Biomolecules:**

Carbohydrates: Definition and classification.

Monosaccharides - Classification, structure, stereoisomerism, optical isomerism, optical activity, epimerism. Cyclic structures - Pyranose and furanose forms, anomers, mutarotation and its mechanism. Chemical reactions of monosaccharides (Glucose & Fructose) - Reactions with concentrated mineral acids, alkali, phenylhydrazine and their biochemical importance. 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, Sialic acids, Lectins, Blood group polysaccharides.

Lipids: Definition and classification. Fatty acids: Classification, systemic nomenclature and structure. Mono, Di- and Triglycerides. Properties of Fat and Fatty acids -Hydrolysis, Saponification, Saponification number, Iodine number. Rancidity - Acid number, Reichert-Meissl number. Cis-trans isomerism. Eicosanoids, Phospholipids, Glycolipids, Sphingolipids, Cholesterol & its ester - their structure and physiological importance. Lipoproteins - Structure, classification and physiological importance.

Amino acids and Proteins:

Amino acids: Classification, Structure, Nomenclature and Optical properties. Protonic equilibrium of amino acids - amphoteric nature, Zwitterions, Isoelectric point, titration curve of amino acids. Reactions with ninhydrin and formaldehyde.

Peptides and Proteins: Structure and properties of peptide bonds - Phi and Psi angles. Reactions with Sanger's and Edman's reagent. Biuret reaction. Different levels of protein structure - Primary, Secondary (  $\alpha$ -helix and  $\beta$ -pleated sheet), Tertiary and Quaternary. Forces stabilizing the structures (Covalent bonds, Ionic and hydrogen bonds, Van-derWaals forces and hydrophobic interactions). Denaturation and Renaturation reactions.

Purine and Pyrimidine: Structure, nomenclature and tautomerism.

Nucleic acids: Nucleosides and Nucleotides - structure. Polynucleotides. DNA double helix - Primary, Secondary and Tertiary structure. A-DNA, B-DNA and Z-DNA. RNA - Structure and types. Denaturation and annealing of DNA. Hyperchromicity, melting temperature and half  $C_{ot}$  value.

**Enzymology** – 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). 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, Enzymes in clinical diagnosis (amylase, acid and alkaline phosphatase, SGOT, SGPT, LDH and CPK).

## **C2P: Biochemistry**

**Credit 02**

### **Content:**

#### **i) Qualitative analysis of biochemical molecules:**

Carbohydrates- Glucose, fructose, maltose/ lactose, sucrose, starch, dextrin. Proteins – Albumin, gelatin, peptone;

Others - glycerol, cholesterol, bile salts & pigments, acetone, HCl, lactic acid, urea, uric acid blood.

#### **Quantitative analysis:**

a. Determination of strength of NaOH, HCl and  $H_2SO_4$  by titration against oxalic acid.

b. Preparation of buffer (pH 6-8)

c. Quantitative estimation of chloride by Mohr's method, amino nitrogen by formol titration method.

d. TLC: Chromatography: Identification of amino acid.

### **Generic Elective (GE)**

***GE-1 [Interdisciplinary for other department]***

#### **GE-1: Physiology-I**

**Credit 06**

#### **GE-1T: Physiology-I**

**Credit 04**

### **Course Contents:**

#### **Introduction to physiology and basic biophysical principles**

Study of importance of physiology. Scope of physiology in improvement of health. Distribution, characteristics and functions of different tissues.

Physiological importance of the following processes: diffusion, osmosis, dialysis, ultra filtration,

surface tension. 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.

### **Biomolecules**

Carbohydrate- Classification of monosaccharides, oligosaccharides (Lactose, Maltose and Sucrose), and polysaccharides, Pyranose and Furanose structure of monosaccharides, isomer of aldopentose and ketopentose. Reducing sugar and non-reducing sugar.

Protein- Classification of amino acids, peptide bond, disulphide bond, configuration of protein.

Lipid- Definition, saturated and unsaturated fatty acids, essential fatty acids.

### **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,

Amino acid pool-Fate & functions of amino acids in the body. Deamination, transamination.

### **Blood and Cardiovascular System**

Blood - composition, functions. Plasma Proteins: origin, functions, separation. Plasmapheresis: Formed elements of blood - their formation, functions, fate. Hemoglobin: types of compounds & derivatives. Blood volume: determination (dye & radio isotope methods), Blood coagulation: mechanism, factors affecting, anticoagulation. Blood groups. Blood transfusion & incompatible transfusion. .

Heart: Properties of cardiac muscle, origin & propagation of cardiac impulse, Events of cardiac cycle, Heart rate, Heart Sound, Heart rate control, Cardiac output: basic concept, factors affecting, ECG - normal waves, different intervals. Myocardial Infarction. Atherosclerosis, thrombosis, hypertension, heart block.

### **Respiratory System**

Functions of the respiratory passages and organs. Role of respiratory muscles in respiration. Significance of anatomical and physiological dead space, lung volumes and capacities. Exchange of respiratory gases between lung and vessels, and between tissues. Transport of O<sub>2</sub> and CO<sub>2</sub> in vessels. Hypoxia, apnea, hypercapnia, cyanosis, emphysema, cystic fibrosis. Mountain sickness, acclimatization.

### **GE-1P: Physiology-I (Practical)**

**Credit 02**

Qualitative analysis of carbohydrate-glucose, fructose, sucrose and starch, Proteins- albumin, gelatin, acetone, bile salts, glycerol, HCl and lactic acid.

Examination & staining of fresh tissue: squamous, skeletal muscle fibre by Methylene blue stain. Histological slide identification- lung, liver, pancreas, stomach, small intestine, large intestine, tongue. artery, vein, Preparation of blood film, Identification of RBC, WBC. Preparation of haemin crystals. Estimation of hemoglobin

## Suggested Readings:

1. Text book of Medical Physiology, by A.C. Guyton, John E. Hall, Eleventh edition. Elsevier Saunders.
2. Vander et al's Human Physiology: The Mechanisms of Body Function; 9th Edition Eric P. Widmaier, Hershel Raff, Kevin T. Strang The Mc Graw-Hill Companies.
3. Human Physiology, From Cells to Systems Lauralee Sherwood, Brooks/Cole.
4. Best & Taylor's Physiological Basis of Medical Practice, edited by B.R Brobeck. The William and Wilkins Co.
5. Ganong's Review of Medical Physiology, by Kim E. Barrett et al., Lange Medical Book.
6. Harper's Review of Biochemistry by R K. Murry and others. Lange Medical Book, Prentice-Hall International.
7. Lehninger Principles of Biochemistry, by, D. L. Nelson and M. M. Cox, CBS Publishers Inc.
8. Text book of Biochemistry, by E.S. West, W.R. Todd, H.S. Mason, J.T. Van Bruggen, The Macmillan Company.
9. Biochemistry, by D. Das: Academic Publishers.
10. Biophysics and Biophysical Chemistry, by D .Das, Academic Publishers.
11. Samson Wright's Applied Physiology, edited by C.A. Keele. E. Neil & N. Toets. Oxford University Press.
12. Physiology, by R.M. Berne & M.N. Levy, B.M. Koeppen, B. A. Stanton, Mosby Co.
13. Basic Histology, by L.C. Jungquire, J. Carneiro& J.A Long; Appleton & Lange.
14. Neuroscience Third Edition Edited By D. Purves, G. J. Augustine, D. Fitzpatrick, W. C. Hall, A S.I. Lamantia, J.O. Mcnamara, S. M Williams, Publishers Sinauer Associates, Inc.
15. Histology - A Text and Atlas, by M.H.Ross&E.J.Reith, The Williams and Wilkins Company.
16. Bailey's Text Book of Histology, revised by W.M. Copenhaver; The Williams and Wilkins Company.
17. Human Physiology, by R.F. Schmidt & G. Thews, Springer-Verlag.

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