

# Vidyasagar University

## Curriculum for B.Sc (Honours) in Physiology [Choice Based Credit System]

### Semester-IV

| Course                | Course Code | Name of the Subjects                                | Course Type/<br>Nature     | Teaching Scheme in hour per week |   |   | Credit    | Marks      |
|-----------------------|-------------|---|----------------------------|----------------------------------|---|---|-----------|------------|
|                       |             |   |                            | L                                | T | P |           |            |
| CC-8                  |             | C8T: Energy Balance, Metabolism and Nutrition       | Core Course - 8            | 4                                | 0 | 0 | 6         | 75         |
|                       |             | C8P: Energy Balance, Metabolism and Nutrition (Lab) |                            | 0                                | 0 | 4 |           |            |
| CC-9                  |             | C9T: Gastrointestinal Function                      | Core Course - 9            | 4                                | 0 | 0 | 6         | 75         |
|                       |             | C9P: Gastrointestinal Function (Lab)                |                            | 0                                | 0 | 4 |           |            |
| CC-10                 |             | C10T:Respiratory Physiology                         | Core Course - 10           | 4                                | 0 | 0 | 6         | 75         |
|                       |             | C10P: Respiratory Physiology(Lab)                   |                            | 0                                | 0 | 4 |           |            |
| GE-4                  |             | TBD   | Generic Elective -4        |                                  |   |   | 4/5       | 75         |
|                       |             |   |                            |                                  |   |   | 2/1       |            |
| SEC-2                 |             | TBD   | Skill Enhancement Course-2 | 1-1-0/1-0-2                      |   |   | 2         | 50         |
| <b>Semester Total</b> |             |   |                            |                                  |   |   | <b>26</b> | <b>350</b> |

**L**=Lecture, **T**= Tutorial, **P**=Practical, **CC** = Core Course, **GE**= Generic Elective, **SEC** = Skill Enhancement Course, **TBD** = to be decided

**Generic Elective (GE) (Interdisciplinary)** from other Department: Papers are to be taken from any of the following discipline: **Physics/Chemistry/Statistics/Computer Sc/Microbiology/Bio Technology/ Zoology/Botany/ Nutrition**

**Modalities of selection of Generic Electives (GE):** A student shall have to choose **04** Generic Elective (GE1 to GE4) strictly from **02** subjects / disciplines of choice taking exactly **02** courses from each subjects of disciplines. Such a student shall have to study the curriculum of Generic Elective (GE) of a subject or discipline specified for the relevant semester.

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

**CC-8: Energy Balance, Metabolism and Nutrition**

**Credits 06**

**C8T: Energy Balance, Metabolism and Nutrition**

**Credits 04**

Introduction  
Energy metabolism  
Carbohydrate metabolism  
Biological oxidation  
Protein metabolism  
Fat and cholesterol metabolism  
Integration of carbohydrate, fat and protein metabolism  
Reactive Oxygen Species  
Nutrition – Basic concepts of nutrients, nutraceutical, cosmoceutical, nutrigenomics.  
Nutrition – BMR, RQ, RDA, SDA, NPU, Biological value of proteins, vitamins and minerals. Energy in Human nutrition.

**C8P: Biochemical Estimation**

**Credits 02**

- a. Quantitative estimation of glucose and sucrose by Benedict's method.
- b. Quantitative estimation of amino nitrogen [Sorensen's formol titration method (percentage as well as total quantity to be done)].
- c. Estimation of percentage quantity of lactose in milk by Benedict's method.

**CC-9: Gastrointestinal Function**

**Credits 06**

**C9T: Gastrointestinal Function**

**Credits 04**

**1. Digestion & Absorption**

Introduction  
Carbohydrates  
Proteins & Nucleic Acids  
Lipids  
Absorption of Water & Electrolytes  
Absorption of Vitamins & Minerals

**2. Regulation of Gastrointestinal Function**

Introduction  
General Considerations  
Gastrointestinal hormones  
Mouth & Esophagus

Stomach

Exocrine Portion of the Pancreas

Liver & Biliary System

Small Intestine, Colon

Mechanism, function and regulation of mastication, deglutition, movements of alimentary canal.

**C9P: Gastrointestinal Function Lab**

**Credits 02**

**Dale's Experimental**

1. Kymographic recording of normal movements of rat's intestine in Dale's apparatus.
2. Effects of hypoxia, acetylcholine and adrenaline on normal intestinal movements.

**CC-10: Respiratory Physiology**

**Credits 06**

**CC10T: Respiratory Physiology**

**Credits 04**

**1. Pulmonary Function**

Introduction, Properties of gases. Anatomy of the lungs. Mechanics of breathing. Gas exchange in the lungs. Pulmonary circulation. Other functions of the Respiratory System.

**2. Gas transport between the Lungs & the tissues**

Introduction. Oxygen transport. Carbon Dioxide transport. Respiratory acidosis and alkalosis

**3. Regulation of Respiration**

Introduction. Neural control of Breathing. Chemical Control of Breathing. Nonchemical influences on Respiration

**4. Respiratory adjustments in Health & Disease**

Introduction. Effects of exercise. Other forms of Hypoxia. Oxygen treatment, O<sub>2</sub> toxicity. Hypercapnia & Hypocapnia. Other respiratory abnormalities. Sleep and Respiration. Effects of increased Barometric Pressure. Artificial respiration. Respiratory failure. High altitude sickness. Lung Function Tests.

**CC10P: Respiratory Physiology Lab**

**Credits 02**

**Practical:**

**Respiratory Human Experiments**

- a. Measurement of peak expiratory flow rate
- b. Measurement of oxygen saturation by pulse oxymeter before and after exercise
- c. Measurement of forced expiratory volume (FEV) in first second.

**Skill Enhancement Course (SEC)**

**SEC-2: Computer application in Health science**

**Credits 02**

**SEC2T: Computer application in Health science**

**Credits 01**

**Course Contents:**

Importance of computer application in biological sciences and medicine. Brief history of development of computer. Generation of Computer. Classification of computer – analogue, digital, hybrid, micro, mini, mainframe and super computers. Computer hardware: Different components of computer. Computer Software – types of software - monitor program and operating system, utility program, application program. Computation of data – mean, median, mode, SD, SEM & t-value. Graphical representation of data in pie, bar and line diagram using Microsoft excel, Power Point: Preparation of body text and table by using MS word. Slide preparation for Physiological items. Presentation of study material by using power point. e-mail, internet- concepts.

Application of computer in physiology and medicine. Application of computer in physiological data analysis – M.S. Word, Excel. M.S. Excel: Basic application in physiology. Use of computer by dietitian and dietary computation.

Physiological Modeling: Concepts, Computer in physiological models. Human Brain and Computer. Computer and their use in medical field. Basics of computer assisted imaging. Computer assisted therapy in health science.

**SEC2P: Computer application in Health science**

**Credit 01**

1. Basic operation of computer: Operations of WINDOWS; data entry.
2. Graphical presentation of data. Computer tabulation of physiological data. Making charts with Ms Excel - bar diagram, line diagram, pie diagram for representing physiological data.
3. Computation of frequency and percentage distribution of different physiological parameters in different age groups, in different communities, percentage distribution of blood groups.
4. Significance of testing by 't' test with interpretation – Paired observation, standard/population mean.
5. Power point - making slide for any topic related to physiology or medicine, editing, slide show.

6. Preparation of case history of a patient and feeding of information in the hard disc.

Or

**SEC-2: Physiological Techniques and Public Health Assessments** **Credits 02**

**SEC2T: Physiological Techniques and Public Health Assessments** **Credits 01**

**Course Contents:**

Physiological Techniques:

Audiometry, Perimetry, Visual Acuity, Colour Blindness, EMG, EEG ,ECG, Nerve Conduction velocity, Autonomic Status assessment ( Valsalva maneuver), Deep breathing test, Reaction time (Choice), Stereotactic techniques.

Public Health assessment:

Nutritional status of children and adults: Growth curves (Height-for-age, Weight –for-age, weight-for-height, BMI-for-age) for detection of stunting, under weight, wasting, thinness, overweight and obesity. Somatotype for adult (Health – Carter method). Socioeconomic status assessment ( Kuppaswamy’s Socioeconomic scale)

**SEC2P: Practical**

**Credit 01**

1. Growth charts – plotting growth charts for growth monitoring.
2. Calculation of BMI of an individual and interpretation of results.
3. Prepare growth curves for stunting, under weight, wasting and obese person.
4. To map the peripheral field of vision with perimeter( Perimetry)
5. Mapping of physiological blind spot and calculation of optic disc size.
6. Determination of visual acuity by Snellen’s chart/Landolt’s chart..
7. Determination of colour blindness by Ishihara Charts.
8. Recording of auditory and visual reaction time.
9. Somatotyping of Human subjects.
10. Survey of dietary status of people in the nearby area by students, analysis of survey results and formulation of diet charts.
11. Submit a socioeconomic status assessment report.
12. To study the phenomenon of fatigue by Mosso’s ergograph.
13. Audiometry (Demonstration).
14. Recording of human electrocardiogram (ECG) (Demonstration).
15. Recording of electroencephalogram (EEG) (Demonstration).

Or

**SEC-2: Histopathological Techniques**

**Credits 02**

## **SEC2T: Histopathological Techniques**

**Credits 01**

### **Course Contents:**

#### **Unit-I**

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

#### **Unit-II:**

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.

#### **Unit-III:**

Immunological Techniques : Principles, types, application. Antibody as histological reagents, autoradioactivity. Exfoliative cytology – advantage and disadvantage, Gynaecological smear, fluid sample, thick fluid sample.

#### **Unit -IV:**

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.

## **SEC2P: Histopathological Techniques**

**Credits 01**

### **Practical:**

1. Glass wares and equipment used in histopathology lab.To prepare alcohol of different concentration. To prepare formalin from stock solution.
2. Preparation of tissue sections, To perform section cutting of paraffin embedded tissue.
3. H&E staining of tissue sections,

4. Preparation and staining of bone marrow smear,
5. Measurement of diameter of megakaryocyte,
6. Reticulocyte staining,
7. Staining of collagen in tissue sections.
8. PAP staining techniques.
9. Staining carbohydrates with PAS reaction.
10. Sudan Black staining (Demonstration)

**Or**

## **SEC-2: Sports Medicine & Nutritional Physiology**

**Credits 02**

### **SEC2T: Sports Medicine & Nutritional Physiology**

#### **Course Contents:**

**Introduction:** Concept of Sports medicine. Aims and objectives of sports medicine. Need and Scope of Sports Medicine. Role of Sports Physician, Physical Educator / Sports Coaches in Sports Medicine.

**Basic kinesiology:** Meaning and definition of Kinesiology. Importance of Kinesiology for games and sports. Kinesiological classification of muscle. Role of muscles. Joints and their Movements.

**Sports Injuries:** Introduction. Types of Sports injuries. Reasons of sports injuries. Prevention and management of Sports injuries.

**Therapeutic modalities:** Brief description of therapeutic modalities. Role of ice in treatment of sports injuries. Clinical application of heat modalities. Brief concepts of Short wave Diathermy (SWD), Whirlpool Bath, Transcutaneous Electrical Nerve Stimulation (TENS). Interferential Stimulation..

#### **Nutritional Physiology & Athlete:**

Nutritional parameters of athletics performances including intervention planning, energy production, energy nutrients, vitamins and minerals, Timing and composition of intakes. Planning and preparation of diets for younger and older athletics of various categories – age group, gender and sports type. Weight management strategies for sports persons. Planning and preparation of diets for sports persons suffering from anemia and osteoporosis.

#### **Suggested Readings:**

1. Steven Ray, Irvin Richer. Sports Medicine, Prentice Hall,1983.
2. Vinger and Roerner. Sports Injuries, PSG Publishing Co., Inc.,
3. Williams, JGP. Sports Medicine . London Edward Arnold Pub.
4. Morehouse and Rash, Sports Medicine for Trainer, WB Saunders.
5. Armstrong and Trucker, Injuries and Sports, London Scampless Press.

**Generic Elective (GE)**  
**[Interdisciplinary for other department]**

**GE-4: Nerve -Muscle Physiology, Nervous system and Sensory Physiology      Credits 06**

**GE4T: Nerve -Muscle Physiology, Nervous system and Sensory Physiology      Credits 04**

**Course Contents:**

**A. Nerve - Muscle Physiology**

**1. Excitable Tissue: Nerve** Introduction, Nerve Cells, Excitation & Conduction, Measurement of Electrical Events, Ionic Basis of Excitation & Conduction, Properties of Mixed Nerves, Nerve Fiber Types. Neurotrophin. Regeneration and Degeneration of nerve fibers.

**2. Excitable Tissue: Muscle:** Introduction, Skeletal Muscle: Morphology, Electrical Phenomena & Ionic Fluxes, Contractile Responses, Properties. Cardiac Muscle: Morphology, Electrical Properties, Mechanical Properties Pacemaker Tissue, Smooth Muscle: Morphology.

**3. Synapse and Neuro muscular Junction:** Introduction, Synaptic Transmission: Functional Anatomy, Electrical Events at Synapses, Inhibition & Facilitation at Synapses, Chemical Transmission of synaptic activity. Neurotransmitter. EPSP,IPSP.

**Neuro muscular Junction:** Introduction, structure, transmission of impulse. Electromyography.

**4. Initiation of Impulses in Sense Organs** Introduction, Sense Organs & Receptors, The Senses, Electrical & Ionic Events in Receptors, “Coding” of Sensory Information.

**B. Nervous system**

**1. Reflexes** Introduction, Monosynaptic Reflexes: The Stretch Reflex, Polysynaptic Reflexes: The Withdrawal Reflex, General Properties of Reflexes.

**2. Cutaneous, Deep & Visceral Sensation** Introduction, Pathways Touch, Proprioception, Temperature, Pain.

**3. Arousal Mechanisms, Sleep, & the Electrical Activity of the Brain** The Reticular Formation & the Reticular Activating System, The Thalamus & the Cerebral Cortex: structure & functions. The Electroencephalogram, Physiological Basis of the EEG & Sleep, Interpretation of abnormal EEG pattern.

**4. Control of Posture & Movement** Introduction, General Principles, Basal Ganglia & Cerebellum: Structure & functions. Movement disorders.

**5. The Autonomic Nervous System** Introduction, Anatomic Organization of Autonomic Outflow, Chemical Transmission at autonomic Junctions.

**6. Central Regulation of Visceral Function** Introduction, Hypothalamus: Anatomic Considerations, Hypothalamic Function, Relation to Autonomic Function, Relation to Sleep, Hunger, Thirst, Control of Posterior Pituitary Secretion, Control of Anterior pituitary Secretion, Temperature Regulation, fever.

**7. Neural Basis of Instinctual Behavior & Emotions** Introduction, Limbic system: Anatomic Considerations, Functions - Sexual Behavior, Fear & Rage, Motivation,

### C. Special sense

**Vision:** Anatomic Considerations, The Image-Forming Mechanism (accommodation and visual acuity), The Photoreceptor Mechanism: Genesis of Electrical Responses, Visual Pathways and effects of lesions of these pathways, Color Vision, Errors in visual process.

**Hearing & Equilibrium:** Introduction, Anatomic considerations, Hair cells, Mechanism of hearing, Vestibular function.

**Smell & Taste:** Introduction, Smell: Receptors & Pathways. Taste: Receptor Organs & Pathways.

### GE4P: Histological Study and Experiments of Nerve and Muscle

Credit 02

#### Practical:

1. Isolation and Staining of nerve fibers with node(s) of Ranvier (AgNO<sub>3</sub>) and muscle fibers (Haematoxylin and Eosin).
2. Measurement of grip strength.
3. Determination of visual acuity by Snellen's chart / Landolt's C chart.
4. Determination of colour blindness by Ishihara chart.

#### Demonstration:

Study of Kymograph, Induction coil, Key and other instruments used to study mechanical responses of skeletal muscle.

Kymographic recording of mechanical responses of gastrocnemius muscle to a single stimulus and two successive stimuli.

Kymographic recording of the effects of variations of temperature and load (after-load) on single muscle twitch.

Calculation of work done by the muscle.

Determination of nerve conduction velocity.

Neurological experiments:

Experiments on superficial (plantar) and deep (knee jerk) reflex.

Reaction time by stick drop test.

Short term memory test (shape, picture word).

Two point discrimination test.

Principles of fixation and staining, Staining and identification of fixed endocrine glands and nervous tissue.

Or

**GE-4: Excretory System & Body Temperature Regulation**

**Credits 06**

**GE4T: Excretory System & Body Temperature Regulation**

**Credits 04**

**Course Contents:**

**Renal Function & Micturition:**

Introduction, Juxta Glomerular Apparatus, Function of Malpighian corpuscles and renal tubule, counter-current mechanism, Water Excretion, Acidification of the Urine & Bicarbonate Excretion, Regulation of Na<sup>+</sup> & Cl<sup>-</sup> Excretion, Renal Circulation, Disorders of Renal Functions, Filling of the Bladder, Emptying of the Bladder, Non-excretory function of kidney. Diuretics.

**Skin and Body temperature regulation:**

Histological structure of skin. Colour of the skin. Organization of sweat gland. Composition and function of the sweat. Regulation of sweat secretion. Insensible and sensible perspiration. Composition and function of sebum. Triple response.

Normal body temperature. Channels of heat loss and heat gain process. Regulation of body temperature: Higher centre and mechanism of regulation. Hypothermia and Hyperthermia. Physiological basis of fever. Cold stress. Insulating effects. Acclimatization to colds.

**GE4P: Excretory System & Body temperature regulation (Lab)**

**Credits 02**

## Practical

1. Identification of normal constituents of urine.
2. Identification of abnormal constituents of urine.
3. Tests for Urinary deposits.
4. Estimation of albumin in urine.
5. Detection of specific gravity of urine.
6. Quantitative estimation of Urea in Urine.
7. Recording of Body Temperature.
8. To study the response of the skin to blunt injury (triple response)(Demonstration).

Or

**GE-4: Environmental pollution and Human health**

**Credits 06**

**GE4T: Environmental pollution and Human health**

**Credits 04**

### Course Contents:

**Environment & Health** : Definition concepts, components. Major environmental health problems in industrialized and developing countries. Occupational Health. Occupational diseases. Occupational safety.

**Environmental Pollution and its impacts on Human health** : **Air Pollution:** definition, sources, air pollutants, effects of air pollution on human health, concept of ozone hole, green house effects and global warming. **Water Pollution:** definition, types, health hazards, water pollutants, biochemical oxygen demand (BOD), thermal pollution, concept of safe drinking water standards. **Soil Pollution:** causes, health hazards, solid waste management - bioremediation, phytoremediation. **Sound Pollution:** definition, concept of noise, source of sound pollution, effects of sound pollution on human health, noise index (noise standards). **Radionuclide Pollution:** ionizing radiations, effects of ionizing radiation on human health, permissible doses. **Arsenic Pollution:** sources, sources of arsenic in ground water, drinking water standard for arsenic (WHO, USEPA), health effects of chronic arsenic poisoning.

Source, health problems and preventions of Bio- medical waste & e-waste.

**Environment and Health impacts assessment** – Concept, Steps and application.

**GE4P: Environmental pollution and human health**

**Credits 02**

**I. Physiological ( experimental) Experiments:**

Kymographic recordind of the effects of Hg, Pb and As compounds on: The contraction of perfused heart of toad. The intestinal movements of rats in Dale's bath.

**II. Histo-chemical Experiments:** Histochemical studies: chronic effects of food additives and arsenic compounds on liver, kidney, intestine, brain, muscle and lung tissues in rat.