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.)	2nd	III	**SEMESTER-III**							
			Major-3	PHYHMJ03	T: Nutritional energy and metabolism; P: Biochemistry (Practical)	4	3-0-1	15	60	75
			Major-4	PHYHMJ04	T: Cardio-respiratory & Excretory Physiology; P: Biochemical and Human Experiments (Practical)	4	3-0-1	15	60	75
			SEC	PHYSEC03	P: Occupational Health (Practical)	3	0-0-3	10	40	50
			AEC	AEC03	Communicative English -2 (***common for all programmes***)	2	2-0-0	10	40	50
			MDC	MDC03	Multidisciplinary Course -3 (***to be chosen from the list***)	3	3-0-0	10	40	50
			Minor-3 (Disc.-I)	PHYMIN03	T: Cell Biology and Cardiovascular and nerve-muscle physiology, excretory system along with Metabolism; P: Practical	4	3-0-1	15	60	75
					Semester-III Total	20				375
		IV	**SEMESTER-IV**							
			Major-5	PHYHMJ05	T: Endocrine system and Cell-Cell communication with signaling; P: Histological Staining (Practical)	4	3-0-1	15	60	75
			Major-6	PHYHMJ06	T: Reproductive System & Embryology; P: Experiments on Bio-Chemical Techniques & Embryology	4	3-0-1	15	60	75
			Major-7	PHYHMJ07	T: Neuromuscular Physiology; P: Experiment on Nerve-muscle Physiology (Practical)	4	3-0-1	15	60	75
			AEC	AEC04	MIL-2 (***common for all programmes***)	2	2-0-0	10	40	50
			Minor-4 (Disc.-II)	PHYMNI04	T: Endocrine System and Reproduction; P: Biochemistry (Practical)	4	3-0-1	15	60	75
			Summer Intern.	INT	Internship/ Apprenticeship - activities to be decided by the Colleges following the guidelines to be given later	4	0-0-4	-	-	50
					Semester-IV Total	22				400
					TOTAL of YEAR-2	42				775

MJ = Major, MI = Minor Course, SEC = Skill Enhancement Course, AEC = Ability Enhancement Course, MDC = Multidisciplinary Course, CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical, MIL = Modern Indian Language

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MAJOR (MJ)

(Total Credit – 04 (Theory - 03, Practical - 01); Total marks: 75

Major 3: Theory

Major 3T: Nutritional energy and metabolism:

- **Nutrition and Energy balance:**

Energy in Human Nutrition: Energy in Human Nutrition: Basic concept of energy and units, calorific and physiological fuel value, respiratory quotient (RQ), Recommended dietary allowances (RDA), 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 Benedict Roth apparatus and WHO/ICMR prediction equation, Factors affecting BMR, Adult consumption unit (ACU), determination of energy requirements of Indians in different age groups by doubly labelled water (DLW) method and prediction equation method. **Food pyramid:** Food guide pyramid and its nutritional importance. Space Nutrition: change of body composition, energy recommendation for space flights, space food system, types of space foods. Dietary fibers - Role of fibers in human nutrition. Calorie requirement. Vitamins and minerals. Malnutrition: Definition, Types, cause, and dietary management**. Space Nutrition:** change of body composition, energy recommendation for space flights, space food system, types of space foods.

Food and Diseases: Foodborne Diseases-Types, causes, prevention. Food toxicity: cause and dietary management. Dietary management of obese, diabetic, hypertensive, and athlete. The basic idea of PCM, marasmus, and kwashiorkor and their prevention. Iron and iodine deficiency. Physiology of starvation and obesity. Effect of food processing on nutritive values. LBW, PEM, xerophthalmia, and micronutrient disorders.

- **Metabolism of Bio-molecules:**

Digestion and absorption of carbohydrates, lipids, proteins, and nucleoproteins. **Carbohydrate Metabolism:** Glycolysis, R-L cycle, TCA cycle, Gluconeogenesis, Cori cycle, Glucose-Alanine cycle. Pentose Phosphate Pathway, Glycogenesis and Glycogenolysis. Inborn errors of metabolism of glycogen, galactose. Biological Oxidation: Concept of substrate-level phosphorylation and oxidative phosphorylation, Redox Potential and redox couple. Mitochondrial Electron Transport Chain and its components. Mechanism of electron transport and ATP synthesis. Oxidative Phosphorylation, Inhibitors and uncouplers. **Protein and Amino Acids Metabolism:** Glucogenic and ketogenic amino acids and amino acid pool. Nonprotein nitrogen. Trans-amination, oxidative and non-oxidative deaminations. Ammonotelic, ureotelic and uricotelic organisms. Metabolism of glycine, sulfur-containing amino acids, tryptophan, and tyrosine. **Inborn errors of metabolism (IBM)** of tryptophan, phenylalanine, and tyrosine. One carbon metabolism, labile methyl group, and transmethylation. Synthesis of Urea and Nitric oxide. Reactive Oxygen Species: Formation of Reactive Oxygen Species and the role of Catalase, Superoxide Dismutase, Glutathione Peroxidase and Glutathione Reductase in combating oxidative stress. Role of vitamins as antioxidants. **Purine & Pyrimidine Metabolism:** Purines and Pyrimidines: Biosynthesis - de novo and salvage pathways. Catabolism (Regulation of the above-mentioned biochemical pathways/cycle not required). **Lipid Metabolism:** β-oxidation of saturated fatty acids (Palmitic acids), ω and α oxidation. Biosynthesis of saturated fatty acid (C16). Formation and sphingomyelin. Brief concept

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of cholesterol biosynthesis and its physiological significance. Metabolism of adipose tissue. Role of lipoproteins in transport and storage of lipids. **Mineral metabolism:** Sodium, potassium, chloride, calcium and phosphorus metabolism. Trace elements (iron, iodine, fluorine, selenium) - their functions and deficiencies.

Major 3: Practical:

Major 3P: Biochemistry:

- **Qualitative analysis of biochemical molecules:**

Carbohydrates- Glucose, fructose, maltose/ lactose, sucrose, starch, dextrin.
Proteins – Albumin, gelatin, peptone.
Others - glycerol, cholesterol, bile salts and pigments, acetone, HCI, lactic acid, urea, uric acid blood.

- **Quantitative analysis:**

Preparation of buffer (pH 4 to 10)
Determination of strength of NaOH, HCl, and H_2SO_4 by titration against oxalic acid.
Quantitative estimation of chloride by Mohr's method, amino nitrogen by formol titration method.

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Major 4: Theory

Major-4T: Cardio-respiratory & Excretory Physiology:

❖ Cardiovascular Physiology and Circulations:

Cardiac anatomy and structure: Basic properties of cardiac muscle: rhythmicity, refractory period, all or none law, and staircase phenomenon. **Membrane potentials:** Transmembrane potential, pacemaker potential, and cardiac tissue electrophysiology. Specialized junctional tissue of the heart and origin and propagation of cardiac impulse. Understanding of cardiac muscle as a mechanical, electrical, and functional syncytium. Heart block and basic idea about artificial pacemakers.
Blood pressure: Definition, normal values and factors regulating it, systolic, diastolic, mean arterial and pulse pressure. Measurement of blood pressure by sphygmomanometer - principle, method. Central pulse and peripheral pulse and their patterns. Venous pulse. **Heart sounds:** Origine, development, and clinical significance. **Regulation of blood pressure:** Innervations of blood vessels and vasomotor control, vasomotor reflex; role of baroreceptors and chemoreceptors, neural and humoral control. Nerve supply of the heart and its role in the regulation of the function of the heart. Role of renin-angiotensin system. Vasopressin or ADH in BP regulation. **Electrocardiography (ECG):** Origin and significance of different components of normal ECG; Different types of ECG lead; Significance of Einthoven triangle. **Cardiac valves:** Location and functions. Heart rate and its regulation. **Cardiac cycle:** Different phases and pressure changes in cardiac chambers. Frank – Starling's law of the heart. Heart sounds Their origin and significance. **Cardiac output:** Definition, normal values and factors regulating it, Determination by Fick method, dye dilution method, and isotope method. Anatomical organization. **Circulations:** Peculiarities, and significance of coronary, pulmonary, cerebral, cutaneous, hepatic, and renal circulation.

❖ Respiratory System:

Structure and anatomy of the respiratory system: Basic concepts about the respiratory tract, basic anatomy histology of lungs, respiratory muscles, and their innervations. **Mechanism and Mechanics of Respiration**: Role of different respiratory bones and accessory muscles. Lung compliance, elasticity, and elastic recoil of the lung. Role of lung surfactants. Intra-thoracic and intra-pleural pressures. **Lung volume and capacities:** Tidal volume, inspiratory and expiratory reserve volumes, residual volume, vital capacity, functional residual capacity, and maximum breathing capacity. Partial pressures and percentage of respiratory gases in expired, expired, alveolar airs and in blood.

O_2 and CO_2 dissociation curve and factors affecting**. The modern concept of neural and chemical regulation of respiration:** Role of respiratory centers, central and peripheral chemoreceptors. Respiratory failure, artificial respiration, and its different techniques (mouth to mouth, tank respirator method). **Respiratory disorder:** Hypoxia, asphyxia, dyspnea, asthma, cardiac and bronchial emphysema, cyanosis, dysbarism, coughing and sneezing. **Pulmonary function tests (PFT)** and its clinical significance. **Non-respiratory functions of the lung**: Airway defense, Immune system defense, and biosynthetic functions.

❖ Excretory system:

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Gross structure & functions of kidney: Microanatomical structure (including electron microscopy) and functions of a nephron and structural differences between cortical and Juxtamedullary nephrons. Juxtaglomerular apparatus. Non-excretory functions of the kidney.

Urine formation: Mechanism of urine formation, concept of ultrafiltration, glomerular filtration rate, reabsorption by passive and active tubular transport. Concept of the counter-current system, counter-current multiplier, exchanger, and mechanism of concentrated urine formation. Non-excretory functions of the kidney. Normal and abnormal constituents of urine and their clinical significance. Concept of renal threshold. Renal function tests (inulin, urea clearance tests). **Renal disease:** Renal stone formation, Polycystic Kidney Disease (PKD), Simple Kidney Cysts., Kidney Infection (Pyelonephritis), Kidney Stones. **Dialysis and artificial kidney**. Innervations of the urinary bladder and micturition, micturition reflexes, and its regulation by higher centers.

Major 4: Practical

Major-4P: Biochemical and Human Experiments:

- **Experimental Physiology:**

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

- **Biochemical analysis of Urine:** Identification of normal and abnormal constituents of urine.

- **Human experiment:**

1. Study of pulse rate and breathing rate with the change of postures.
2. Determination of diurnal variations of pulse rate, blood pressure, and respiratory rate.
3. Study of blood pressure with the change of postures.
4. Study of pulse rate as an effect of breath-holding.
5. **ECG:** Measurement of different waves of ECG

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Major 5: Theory

MJ-5T: Endocrine system and Cell-Cell communication with signaling:

- **Endocrinology:** Concept & definition of endocrine systems, glands, and hormones. Experimental and clinical methods of study of endocrine glands. General classification of hormones on a chemical basis. Concepts of hormone receptors and cell signaling. **Hormone actions:** Mechanisms and Modern Concept of hormone actions, G-protein, Cyclic AMP, cyclic GMP, IP3-DAG, Ca2+, Tyrosine Kinase, JAK-STAT pathway, and nuclear receptor-mediated action. **Hypothalamus-hypophysial axis:** Positive and negative Feedback regulation; **Hypothalamus and Pituitary:** The Hypothalamus as a neuroendocrine organ, Releasing Factors and tropic hormones of hypothalamus. Vascular and neural connections between the hypothalamus and the pituitary, role of median eminence. Histological structures, functions, and regulation of anterior, middle, and posterior lobes of the pituitary. **Hormones:** Chemistry, modes of action, and functions of growth hormone (GH), TSH, ACTH, FSH, LH, Prolactin, MSH, Vasopressin, and Oxytocin. Cushing's disease, gigantism, acromegaly, dwarfism, Simmond's disease, Frolich's syndrome, diabetes insipidus. **Thyroid Gland:** Electron microscopic structure of thyroid gland. Thyroid hormone: Chemistry, Biosynthesis, Storage and Transport. Functions of T4 (Thyroxin) and T3 (Triiodothyronine). Regulation of Thyroid hormone secretion. Cretinism. Myxedema, Grave's disease. Hashimoto's disease, iodine deficiency goiter. **Parathyroid Gland:** Histological Structure, Parathyroid hormone: Role in calcium metabolism. Relation of parathyroid hormone with bone formation and bone resorption, fragile bone and aging process, Concept of Vitamin D3 treatment. Calcitonin: its source, functions, and regulation. Hormonal control of calcium homeostasis. **Adrenal Gland: Adrenal Cortex:** histological structure, regulation of different types of hormones and functions of the adrenal cortex, Cushing's syndrome, Addison's disease, Hyperaldosteronism. **Adrenal Medulla:** Histological structure, regulation, and hormonal function of adrenal medulla. Synthesis and metabolism of catecholamine hormones. Actions of adrenaline and nor-adrenaline on different organs and their effect. Pheochromocytoma. **Pancreas gland:** Histological structure of pancreatic islets. Sources, regulation, modes of action, and functions of insulin and glucagon, Type-l and Type-II diabetes mellitus. **Gastrointestinal hormones** (Gastrin, Secretin, Cholecystokinin, VIP, and GIP)- Physiological functions. Endocrine Role of the Pineal. ANF and its functions.

- **Chronobiology**: Different types of physiological rhythms- ultradian, circadian, infradian. Different zeitgebers and their relation with circadian rhythm. Biorhythms of LH, FSH, Prolactin, Estrogen, Progesterone, ACTH GH, Cortisol. Light dark cycle and regulation of penial hormone. Neural basis of the biological clock and the role of suprachiasmatic nuclei. A brief idea of jet lag.

- **Cell signaling:** Signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component systems, light signaling in plants, bacterial chemotaxis, and quorum sensing.

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Major 5: Practical

Major 5P: Histological Staining:

Basics concept of histology: Tissue preparation, section cutting, staining, and submission of five histological slides duly signed by the teacher.

General Staining: Eosin- Haematoxylin tissue staining of the following organs, GI tract, and endocrine glands: Liver, kidney, esophagus, duodenum, ileum, large intestine, lungs, spleen lymph node, ovary, testis, salivary glands, thyroid, adrenal, pancreas, spinal cord, cerebellum, the cerebrum.

Study of the oestrous cycle by different staining techniques: Special and differential staining.

Special Staining:

Gram Staining (Named after its inventor, the Danish scientist Hans Christian Gram, who developed the technique in 1884 to discriminate between two types of bacteria with similar clinical symptoms): Used for the detection of Gram-positive (Clostridium botulinum, Clostridium tetani, Staphylococcus aureus and Corynebacterium diphtheriae) or Gram-negative bacteria (Salmonella, Shigella dysenteriae, Escherichia coli and Pseudomonas aeruginosa). Also used for the detection of Actinomyces Israeli, Legionella pneumophila, Neisseria gonorrhea.

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Major 6: Theory

Major-6T: Reproductive System & Embryology

❖ **Reproductive Physiology and Embryology:**

Primary and secondary sex organs: Physiology and anatomy, secondary sex characters. Puberty and its control. **Testis:** Histological structure of testis, seminiferous tubules, and interstitial cells of Leydig. Chemical nature and functions of testosterone. **Spermatogenesis:** Mechanism of spermatogenesis, Spermiogenesis and hormonal control of testicular function. Prostate and seminal vesicle. **Ovary:** Histological structure of ovary, Graafian follicle, and Corpus luteum, chemical nature and functions of Estrogen and Progesterone. Hormonal control of ovarian functions. Formation, Maturation of Ovum. **Ovulation:** Physiological Mechanism and hormonal regulation of ovulation. Basic concepts of ovarian cysts. **Menstrual cycles**: Basic concept of menstruation and its hormonal control. **Oestrous cycle:** Different phases of the oestrous cycle and its hormonal control. **Fertilization:** Hormonal control Fertilization Transport of ovum and sperm in the female reproductive tract. Uterine implantation of fertilized ovum. **Pregnancy:** Physiology of pregnancy, changes during pregnancy and their hormonal control; Pregnancy tests (Immunological); Ectopic pregnancy. **Implantation:** Basic concept of implantation and its hormonal control. **Placenta:** Formation, structure, functions, and fate of the placenta. Placental hormones. Physiology of parturition and its hormonal control. **Lactation and Mammary Gland:** Anatomical and histological structure of mammary gland. Phases of mammary development and their hormonal control. Hormonal control of lactation and milk ejection reflex.

Embryology: Clinical concept of embryology; Cleavage, Embryogenesis, morula, blastula, gastrula, and blastocyst. Formation of trilaminar germ disc. Development of the Alimentary system, Heart, and Urogenital system. Foetal circulation and its changes after birth. Basic concept of stem cell biology.

❖ **Reproductive health and Reproductive technology:**

Reproductive health: The basic and clinical concept of reproductive health. **Contraceptive:** Definition, types, and use of contraceptives. Methods of contraception: i) Sterilization ii) Hormonal iii) Intrauterine devices iv) Barrier method v) Chemical methods vi) Physiological methods vii) Coitus interruptus viii) Induced abortions. **Infertility:** Causes of Infertility in male and female; Genetic aspects of male infertility, Assisted Human Reproduction. Etiology and management of female infertility, viz. (a) PCOS (b) Endometriosis (c) Tubal factors & hydrosalpinx. **Abnormalities or Birth Defects:** A basic idea about Down's syndrome, Turner's syndrome, Klinefelter's syndrome; Environmental pollutants/chemicals- Radiation, thalidomide, vitamin A, alcohol; Developmental abnormalities- Spina bifida, neural tube defect.

Reproductive technology: Assisted Reproductive Technology (ART): Different techniques of ART - their indications and limitations. Different methods of semen preparation for artificial insemination (IUI) & ART (IVF, ICSI), Factors influencing the results of ART- recurrent implantation failure: Etiology and management; Pre-Implantation Genetic Testing (PGD & PGS).

Major 6: Practical

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Major 6P: Experiments on Bio-Chemical Techniques and Embryology:

1) **Bio-Chemical Techniques:**

- Blood calcium and blood lactate estimation.
- Estimation of triglyceride content of the blood.
- Estimation of Urine bilirubin and free fatty acids, SGOT and SGPT (transaminases) for liver function test from tissue homogenate.

2) **Embryology-related Practical:** Semen analysis & Test: Semen preparation, and, Sperm count, sperm viability test by using eosin-Y, Oocyte & embryo identification (Demonstration). Pregnancy Test: By Prega news pregnancy test kit method.

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Major 7: Theory

Major-7T: Neuromuscular Physiology:

❖ Nerve-Muscle Physiology:

Muscle Structure and Functions: Histo-anatomical structures of striated, smooth, and cardiac muscles. **Properties of muscles:** Excitability and contractility, all or none law, summation of stimuli and contractions, genesis of tetanus, the onset of fatigue, refractory period, tonicity, conductivity, extensibility, and elasticity. Muscle proteins and Sarcotubular system of Human Skeletal and Cardiac Muscle. **Mechanism of muscle contraction:** Skeletal muscle contraction and relaxation. The modern concept of muscle contraction. Isometric and isotonic contractions. Red and white muscles. Fast and slow twitch muscle fibers. Muscle length, Tension, and Velocity relationships of skeletal muscle. **Muscle groups:** antagonists and agonists. Mechanical, chemical, thermal, and electrical changes in striated muscle during contraction and relaxation. Motor unit and motor point.

Structure, properties, and Function of Neuromuscular junctions: EM structure of Neuromuscular junctions, Neuro-Muscular transmission of impulse, end-plate potential (EPP), miniature end-plate potential (MEPP). Electromyography. Single and multi-unit smooth muscle and mechanism of smooth muscle contraction and relaxation. Factors affecting smooth muscle contraction. The resting membrane potential and its origin. **The Action Potential:** Action potential components and their ionic basis. Compound action potentials. Concept of Chronaxie and Rheobase. Saltatory conduction. Myelinated and Unmyelinated nerve fibers and process of Melanogenesis. **Nerve Impulse & its Conduction:** Propagation of nerve impulse in different nerve fibers. Conduction velocity of nerve impulse concerning myelination and diameter of nerve fibers & its significance. **Properties of nerve fibers:** Excitability, Conductivity, All-or-none law, Accommodation, Adaptation, Summation, Refractory period, Indefatigability. **Synapses:** Types, EM Structure and Functions. Mechanism of Synaptic Transmission, Neurotransmission related Synaptic Potentials (EPSP, IPSP). Structure and distribution of acetylcholine and adrenaline receptors**. Injury to peripheral nerves:** Degeneration and Regeneration of peripheral nerve fibers: Changes in the nerve cell body, degeneration reaction and regeneration mechanism. Effect of different Neurotrophins on nerve growth.

❖ Nervous System-I:

Anatomical and functional Organization: A brief outline of the organization and basic functions of the nervous system – central and peripheral. **Structure and functions of Brain:** Gross neuroanatomy of the brain, structural organization of the different parts of the brain. **Receptors:** Definition, Structure, Classification, Mode of action. Role of blockers and stimulators (Drugs included in pharmacology). **Reflex action**: Definition, classification, properties, reflex arc**. Cerebral cortex:** histological structure, connections, and functions. Organization of the limbic system and its functions.

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Major 7: Practical

Major-7P: Experiment on Nerve-muscle Physiology:

Skeletal muscle: Study and use of kymograph, induction coils, key and tuning fork in Gastrocnemius sciatic preparation. Kymographic recording of isotonic simple muscle twitch. Effects of temperature, summation, and load (after-load) on muscle contraction.

Cardiac muscle: Kymographic recording of the heartbeat of the toad. Preparation of amphibian Ringer solution. Kymographic recording of the perfused heartbeat of a toad. Study of the effects of acetylcholine and excess calcium ion on perfused heart (Demonstrations).

Test for supplied CSF: Globulin (Pandy test), total protein, glucose **(Demonstration).**

Reflex analysis: Examination of planter reflex, knee jerk reflex.

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MINOR (MI)

Total Credit – 04 (Theory - 03, Practical - 01); Total marks: 75

Minor (MI) 3: Theory (Discipline-I)

Minor-3T: Cell Biology and Cardiovascular and nerve-muscle physiology, excretory system along with Metabolism

- **Cell Biology and Cell Communication:** 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.

- **Cardio-Vascular Physiology and Circulation:** Basic properties of cardiac muscle: rhythmicity, refractory period, all or none law, and staircase phenomenon. Transmembrane potential, pacemaker potential and electrophysiology of cardiac tissue. Specialized junctional tissue of the heart and origin and propagation of cardiac impulse. Understanding of cardiac muscle as a mechanical, electrical and functional syncytium. Heart block and basic idea about artificial pacemakers. **Cardiac circulation:** Peculiarities of coronary circulations- Nature of blood supply, blood drainage, blood flow and significance. **Electrocardiography (ECG):** Origin and significance of different components of normal ECG; Different types of ECG lead; Einthoven triangle.

- **Nerve-Muscle Physiology & Nervous system: Muscle structure and Functions:** Histo-anatomical structures of striated, smooth, and cardiac muscles. **Properties of muscles:** Excitability and contractility, all or none law, summation of stimuli and contractions, the genesis of tetanus, the onset of fatigue, refractory period, tonicity, conductivity, extensibility, and elasticity. **The Action Potential:** Action potential components and their ionic basis. Compound action potentials. **Nerve Impulse & its Conduction:** Propagation of nerve impulse in different nerve fibers. Conduction velocity of nerve impulse concerning myelination and diameter of nerve fibers. **Properties of nerve fibers:** Excitability, Conductivity, All-or-none law, Accommodation, Adaptation, Summation, Refractory period, Indefatigability. **Synapses:** Types and EM Structure Function. Mechanism of Synaptic Transmission of the Impulse. IPSP & EPSP

- **Renal Physiology: Gross structure & functions of kidney**: Microanatomical structure (including electron microscopy) and functions of a nephron and structural differences between cortical and Juxtamedullary nephrons. Juxtaglomerular apparatus. Non-excretory functions of the kidney. **Urine formation:** Mechanism of urine formation, concept of ultrafiltration, glomerular filtration rate, reabsorption by passive and active tubular transport. Concept of counter-current system, counter-current multiplier, exchanger, and mechanism of concentrated urine formation.

- **Basic concept of the digestive system and metabolism:** Brief idea about the anatomy and histology of the digestive system and organs (Stomach, Pancreas, Liver, Large and Small

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intestine). Digestion and absorption mechanism of carbohydrates, lipids, proteins, and nucleoproteins.

Minor (MI) 3: Practical

Minor-3P: Experiment on muscles and urine analysis:

Skeletal Muscle: Study and use of kymograph, induction coils, key, and tuning fork in Gastrocnemius sciatic preparation. Kymographic recording of isotonic simple muscle twitch. Effects of load (after-load) on skeletal muscle contraction. Demonstrations of effects of temperature, summation on skeletal muscle contraction **(Optional).**

Smooth Muscle: Preparation of physiological solutions like Dale's fluid, Normal saline etc. Experiments on the isolated intestine of the rat: Normal movement of the isolated intestine, b) Effect of hypoxia, c) Effect of drugs like substances i) Acetylcholine ii) Adrenaline.

Cardiac Muscle: Kymographic recording of the perfused heartbeat of a toad. Preparation of amphibian Ringer solution. Study of the effects of acetylcholine and excess calcium ion on perfused heart (**Demonstrations**).

Biochemical analysis of urine: Identification of normal and abnormal constituents of urine.

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Minor (MI) 4: Theory (Discipline-II)

Total Credit – 04 (Theory - 03, Practical - 01); Total marks: 75.

❖ Minor 4T: Endocrine system and Reproduction:

Endocrinology:
Concept & definition of endocrine systems, glands, and hormones. General classification of hormones on a chemical basis. **Hormone actions:** Mechanisms and Modern Concept of hormone actions, G-protein, Cyclic AMP, cyclic GMP, IP3-DAG, Ca2+, **Hypothalamo-hypophysial axis:** Positive and negative Feedback regulation; **Hypothalamus and Pituitary:** Hypothalamus as a neuroendocrine organ, Releasing Factors, Tropic hormones of hypothalamus. **Hormones:** Chemistry, modes of action, and functions of growth hormone (GH), TSH, ACTH, FSH, LH, Prolactin, MSH, Vasopressin, and Oxytocin. Endocrine gland: Pancreas, Adrenal, Thyroid structure, functions, and deficiencies.

Reproductive Physiology:
Primary and secondary sex organs: Physiology and anatomy, secondary sex characters. Puberty and its control. **Testis:** Histological structure of testis, seminiferous tubules, and interstitial cells of Leydig. **Spermatogenesis:** Mechanism of spermatogenesis, Spermiogenesis and hormonal control of testicular function. Prostate and seminal vesicle. **Ovary:** Histological structure of ovary, Graafian follicle, and Corpus luteum, chemical nature and functions of Estrogen and Progesterone. **Menstrual cycles**: Basic concept of menstruation and its hormonal control. **Fertilization:** Hormonal control Fertilization Transport of ovum and sperm in the female reproductive tract. Uterine implantation of fertilized ovum. **Pregnancy:** Physiology of pregnancy, changes during pregnancy and their hormonal control; Pregnancy tests (Immunological); Ectopic pregnancy. **Placenta:** Formation, structure, functions, and fate of the placenta. Placental hormones. **Lactation and Mammary Gland:** Anatomical and histological structure of mammary gland. Phases of mammary development, lactation, and their hormonal control. **Contraceptive:** Definition, types, and use of contraceptives.

Minor (MI) 4: Practical

Major 4P: Biochemistry:

- **Qualitative analysis of biochemical molecules:**

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

- **Bio-Chemical Techniques:**
  - Blood calcium and blood lactate estimation.
  - Estimation of triglyceride content of blood.

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SKILL ENHANCEMENT COURSE (SEC)

SEC 3P: Occupational Health (Practical) **Credits 03 (Full Marks: 50)**

Course Outline:

Occupational health: Basic Concept- The occupational medical history, worker's compensations, disability prevention and management. Occupational health risk. **Occupational Injury:** Musculoskeletal injury, peripheral nervous injury, eye injuries, facial injuries, hearing loss, injury caused by physical hazards, Ergonomics and the prevention of occupational injuries. **Occupational exposures:** Metals, chemicals, solvents, gasses & airborne toxicants, pesticides. **Occupational illness:** Brief idea on: Clinical toxicology & immunology, cardiovascular toxicology, liver, renal & neurotoxicology. Occupational hematology, infection, skin disorders & lung disease. Reproductive toxicology**. Occupational Diseases:** Human diseases associated with occupational exposure. Brief idea on pneumoconiosis, asbestosis, silicosis, farmer's lung and work-related musculoskeletal disorders. **Program management:** Occupational stress, substance abuse & employee assistance programs. Occupational safety, industrial hygiene, biological monitoring. Prevention of accidents. Concept of industrial safety.

Practical:

- Measurement of working heart rate by ten beats methods.
- Determination of cardiac cost of specific work.
- Measurement of blood pressure before and after different grades of exercise.
- Measurement of some common anthropometric parameters. Calculation of BSA and BMI from anthropometric data.
- Measurement of WBGT indices.
- Measurement of noise level by noise level meter.
- Assessment of illumination.
- Determination of strength by hand grip dynamometer.

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