VIDYASAGAR UNIVERSITY

Midnapore, West Bengal

PROPOSED CURRICULUM & SYLLABUS (DRAFT) OF

BACHELOR OF SCIENCE WITH PHYSIOLOGY

(MULTIDISCIPLINARY STUDIES)

3-YEAR UNDERGRADUATE PROGRAMME

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

Based on

Curriculum & Credit Framework for Undergraduate Programmes

(CCFUP), 2023 & NEP, 2020

VIDYASAGAR UNIVERSITY
BACHELOR OF SCIENCE IN LIFE SCIENCES with PHYSIOLOGY
(*Under CCFUP, 2023*)

Level	YR.	SEM	Course Type	Course Code	Course Title	Credit	L-T-P	Marks		
								CA	ESE	TOTAL
B.Sc. in Life Sc. with Physiology	3rd	V	**SEMESTER-V**							
			Major-A4	PHYPMJ04	T: Nervous system with thermoregulation of the body and sensory physiology; P: Practical *(To be studied by students taken* Physiology *as Discipline- A)*	4	3-0-1	15	60	75
			Major-A5	PHYPMJ05	T: Exercise Physiology with Ergonomics and Sports Physiology; P: Practical *(To be studied by students taken* Physiology *as Discipline- A)*	4	3-0-1	15	60	75
			Major-A6	PHYPMJ06	T: Microbiology and Immunology; P: Practical *(To be studied by students taken* Physiology. *as Discipline- A)*	4	3-0-1	15	60	75
			Major (Elective) -1	PHYMJE-02	Environmental and Sensory Physiology OR Maternal-Child Health *(To be studied by students taken* Physiology *as Discipline- A)*	4	3-0-1/ 3-1-0	15	60	75
			Minor-5 (Disc.-C5)	PHYMIN05	T: Sensory physiology and basic ideas of microbiology*; P:* Practical *(To be studied by students taken* Physiology *as Discipline- C)*	4	3-0-1	15	60	75
					Semester-V Total	20				375
		VI	**SEMESTER-VI**							
			Major-B4		*To be decided(Same as Major- A4 for* Physiology *taken as Discipline-B)*	4	3-0-1	15	60	75
			Major-B4		*To be decided(Same as Major–A5 for* Physiology *taken as Discipline-B)*	4	3-0-1	15	60	75
			Major-B4		*To be decided(Same as Major–A6 for* Physiology *taken as Discipline-B)*	4	3-0-1	15	60	75
			Major (Elective) -2	PHYMJE-02	Basic concept of genetics and molecular biology OR Wildlife Conservation & Management *(To be studied by students taken* Physiology *as Discipline- A)*	4	3-0-1/ 3-1-0	15	60	75
			Minor -6 (Disc.-C6)	PHYMIN06	T: Ecology, Ethology & Wildlife Biology; P: Practical *(To be studied by students taken* Physiology *as Discipline- C)*	4	3-0-1	15	60	75
					Semester-VI Total	20				375
					TOTAL of YEAR-3	40	-	-	-	700
			Eligible to be awarded Bachelor of Science in Multidisciplinary Studies with Physiology *on Exit*			126	**Marks (Year: I+II+III)**			2325

MJP = Major Programme (Multidisciplinary), MI = Minor, A/B = Choice of Major Discipline; C= Choice of Minor Discipline; CA= Continuous Assessment, ESE= End Semester Examination, T = Theory, P= Practical, L-T-P = Lecture-Tutorial-Practical

MAJOR (MJ)

Major A/B 4: Theory

(Credits 03; Marks: 40)

Major-A/B4 T: Nervous system with thermoregulation of the body and sensory physiology:

Nervous System: Ascending and descending tracts: Origin, courses, termination and functions. Lower motor neuron and upper motor neuron. Structure and function of the vestibular apparatus. Postural reflexes, Muscle spindle, muscle tone and its regulation. Decerebrate and decorticate rigidity. Structure, connections and functions of the cerebellum. Nuclei, connections and functions of the thalamus and hypothalamus. **Basal ganglia and reticular formation:** structure, connections and functions. Emotion. Origin and components of EEG. Physiological basis of different types of sleep. Sleep-wakefulness cycle. Higher functions of the nervous system: memory, conditioning and learning. Speech and aphasias. Physiology of pain. **CSF:** formation, circulation, and functions. **Autonomic nervous system (ANS) & Peripheral nervous system (PNS):** Organization, outflow, ganglia, centres, and functions. Chemical transmission in the autonomic nervous system: Nicotinic and muscarinic acetylcholine receptors, alpha and beta adreno-receptors, and their agonists and antagonists. Central control of the autonomic nervous system for the regulation of internal body homeostasis. **Spinal Cord:** Structure and functions of the spinal cord with special reference to functional changes after hemi-section and complete section of the spinal cord, Brown-Séquard syndrome.

Skin and body temperature regulation:

Histological structure of skin. Organization of the sweat gland. Composition and functions of sweat. Regulation of sweat secretion. Insensible and sensible perspiration. Composition and functions of sebum. Triple response. Normal body temperature. Channels of heat loss and the heat gain process of heat production and heat loss. Regulation of body temperature: higher centres and mechanisms of regulation. Hypothermia and hyperthermia. Physiological basis of fever.

Major A/B 4: Practical

(Credits 01; Marks: 20)

Major-A/B4 P: Analytical biochemistry:

- Estimation of free and total acidity in supplied gastric juice.
- Estimation of lactose and calcium from milk.
- Determination of total carbohydrate by the phenol-sulphuric acid method from cereals.
- Estimation of free amino acids by the ninhydrin method and total protein by the quantitative biuret reagent method from pulses.
- Determination of acid value and iodine number of fat.

Major A/B5: Theory

(Credits 03; Marks: 40)

Major-A/B5 T: Exercise Physiology with Ergonomics and Sports Physiology:

Work Physiology and Ergonomics: Physical work: definition and units of measurement. Concepts and classification of physiological work-static, dynamic, positive, negative and isokinetic work. The difference between work and sports. **Energetics of work:** Concept of Aerobic and anaerobic energy production; Energy expenditure in different activities; source of energy- aerobic and anaerobic metabolism; Cardiovascular and respiratory responses during graded work. Aerobic and anaerobic capacity. Maximal aerobic power, factors affecting and methods of measurement. Concept of excess post-exercise oxygen consumption. Concept of fatigue. **Anthropometry:** common instruments for anthropometric measurements. Application of anthropometry in nutrition and ergonomics. **Tests for physical work capacity:** Measurement with bicycle ergometer, treadmill mill and Harvard step test**. Physiology of Strength Performance:** Types of muscle fibres; Muscle hypertrophy and hyperplasia.

Ergonomics: An elementary idea of ergogenic aids. Human factors and fundamentals of ergonomics. Basic concepts of ergonomics and their application in industry to increase individual and group productivity. Ergonomics design methodology and checkpoints for design development. Human body: Structural anatomy and functions; Body posture and supportive devices. Vertical and horizontal work surface. Cognitive aspects and mental workload; Work-rest cycle. Industrial safety; Human error and risk perception.

Sports Physiology: Physical training- General principles and different methods. Nutrition in sports - nutrients and calorie requirements for different kinds of sports. Nutrition in sports - nutrients and calorie requirements for different kinds of sports. Basic concepts of Sports Psychology, Role of sports in emotion, and social factors. **Sports Training:** History, Importance, Aim and objectives of sports training; Characteristics of sports training; biological process in training; Components of physical fitness (motor abilities)– endurance, strength, speed, flexibility, coordination, agility. **Principles of training:** Overload, specificity, progression and reversibility; Meaning and concept of Training load; Adaptation and Recovery. **Sports Application:** Application in competitive sports, recreational sports, and medical rehabilitation; Human energy transfer in rest and exercise

Major-A/B5: Practical

(Credits 01; Marks: 20)

Major A/B5 P: Human experiments & Anthropometric measurements:

Blood Pressure measurement: Measurement of arterial blood pressure at rest, after exercise and at different postural conditions by a Sphygmomanometer. Harvard step test and determination of physical fitness. Measurement of breathing rate before and after exercise. Determination of VO_2 max by Queen's College method. Study of the effect of graded exercise (by Bicycle ergometer/Treadmill) on heart rate. Pneumographic effects of talking, laughing, coughing, exercise, hyperventilation and breath holding. Determination of muscular efficiency by Mosso'sergograph. Spirometric measurement of vital capacity. Determination of hand and foot reaction time.

Anthropometric parameters: Weight, stature, eye height, shoulder height, elbow height, bi-acromian breadth, head breadth, head circumference and neck circumference. Mid upper arm circumference, chest circumference, waist circumference, hip circumference, waist-hip ratio, BMI, and BSA.

Major A/B6: Theory

(Credits 03; Marks: 40)

Major-A/B6 T: Microbiology and Immunology

Microbiology: Organization of a prokaryotic cell. Classification of bacteria based on morphology, staining characteristics, biochemical tests and 16S rRNA test for identification. Nutritional requirements of bacteria, nutritional types, and culture media. **Sterilization**: Types, principles and importance. Pasteurization and its application. Concept of pure culture and different methods of pure culture technique. **Bacterial growth:** Growth curve and physical conditions for growth, Bacterial metabolism: fermentation (ethanol, lactic acid, acetic acid), glyoxylate cycle, Entner-Doudoroff pathway, phosphoketolase pathway. **Bacterial genetics:** Elementary idea of transformation, conjugation and transduction. **Control of bacterial growth:** concept of antiseptics, disinfectants, antibiotics, probiotics and prebiotics. Elementary idea of bacteriostatic, bactericidal and bacteriolytic agents. **Food microbiology**: Brief ideas about food spoilage (fish, meat, milk, vegetables) and its prevention. Bioremediation, Bio-fertiliser, Metal-leaching. Elementary knowledge of fungi, algae, protozoa, and viruses.

Immunology: Basic concept of Immunology: Overview of Immune System - properties of the immune system; types of immunity: innate immunity, acquired immunity, active and passive immunity. First and second line defence. **Innate immunity:** Mechanical barrier against pathogens, biochemical organisms, Physiological barrier-antibacterial and antifungal substances in external body secretions, bactericidal action of HCl. Mechanism of chemotaxis, phagocytosis of lysozyme and reactive oxygen species. **Immuno-competent Cells-** Structure and functions of Neutrophil, B-lymphocytes, T-lymphocytes (helper, cytotoxic and suppressor), Natural killer cells, monocytes, and macrophages. Primary and secondary lymphoid organs**.** Classification, structure and functions of immunoglobulins (IgG, IgM, IgA, IgD, IgE). **Antigen-Antibody:** Properties of immunogen, antigens and haptens. Antigen-antibody interaction, its physiological effects and clinical applications. **Major Histocompatibility Complex (MHC):** Elementary ideas about Human leucocyte antigens. Self, non-self. Antigen processing and presentation with MHC (Class I and II). **Biology of B-Lymphocyte:** Elementary idea of B-Cell receptors (IgM, Igα/Igβ, CD19, 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 of CTLs, NK cells and their mechanism of killing. Acquired Immunodeficiency: AIDS, the HIV & infection; immunological events associated with HIV infection. **Toll-like receptor (TLR):** Role of Toll-like receptor (TLR) in immune functions. Hypersensitivity reactions: Mechanism of different types of hypersensitivity reactions and their physiological effects. Transplantation immunology: **Types of graft;** Immunological basis of graft rejection; Autoimmunity: Immunological features of autoimmune diseases.

Major-A/B6: Practical

(Credits 01; Marks: 20)

Major-A/B6 P: Immuno-histochemistry:

- Separation of different types of blood cells by Histopaque (gradients), identification of (a) B-cells by resetting (b) T-cells by resetting (c) Macrophages, polymorphonuclear cells.
- Measurement of the diameter of WBC and megakaryocytes.
- Gram stain, spore stain, fungi stain and Negative staining.
- Qualitative assay of Catalase and amylase in bacterial culture.

Major Elective

(To be studied by students taken Physiology as Discipline- A)

Major Elective (MJE)-2:

(Credits 04; FM: 75)

MJE-2T: Environmental and Sensory Physiology (Theory): Credits 03

Environmental Physiology: Environment- Its physiological aspects. Effects of exposure to hot and cold environments. Acclimatization to hot and cold environments. Heat disorders and their preventive measures. Effects of hypobaric and hyperbaric environments. Mountain sickness. Acclimatization to high altitudes. **Preventive measures** against hypobaric and hyperbaric effects. Physiological effects and preventive measures against G force, noise, vibration and radiation. Environmental pollution; global environmental change; biodiversity status, monitoring and documentation; major drivers of biodiversity change; biodiversity management approaches. **Types of pollutants** (primary, secondary and tertiary), sources, mechanisms of action and effects of metabolic pollutants, neurotoxins, mutagens, carcinogens, and teratogens. **Heavy metal toxicity**: Lead (Pb), Mercury (Hg), Cadmium (Cd), and Arsenic (As) toxicity. Air and water pollution - sources, effects and control. Brief idea about biotransformation, bioaccumulation, biomagnification and health hazards of pesticides. An elementary idea about xenobiotics and their effects.

Sensory Physiology:

General and special sensation: Classification of general and special senses and their receptors. Muller's law of specific nerve energies. Weber-Fechner law. Mechanism of transduction of stimuli from sensory receptors. Adaptation of receptors: phasic and tonic adaptations. **General Sense:** Classification, distribution, function and neural pathway of touch, pressure, pain, thermal and kinesthetic sensation. **Olfaction and Gustation:** Structure and functions of the receptor organs, nerve pathways, and centres. Physiology of taste and smell. Olfactometer. **Audition:** Sound waves, decibels, structure and functional significance of auditory apparatus – external, middle, and internal ears. Structure of the organ of Corti. Mechanism of hearing and its modern theories. Discrimination of sound frequency and loudness. Auditory pathway and centres. **Vision:** Anatomy and structures of the eyeball. The structure of the lens. Errors of refraction and their corrections. Contact Lens. Pupillary reflexes, light reflex, near response. Argyll Robertson pupil. Histological details of the retina. Photopic and Scotopic vision. Chemical and electrical changes in the retina on exposure to light. Visual Pathway and effects of lesion. Colour visions and their modern concept. Colour blindness. Visual field, Perimetry. Visual acuity and its measurement. Factors affecting Visual Acuity. Binocular vision and depth perception.

MJE-2P: Measurement of environmental parameters (Practical): Credits 01

- Measurement of environmental temperature - dry bulb and wet bulb, relative humidity, air velocity.
- Determination of O_2, CO_2, BOD and COD. Determination of total alkalinity, Ca, Mg and chlorine in water by the titration method.
- Measurement of noise by a Sound level meter.
- Determination of light intensity (at library, laboratory & classroom) by lux meter.
- Heat stress indices.

OR

Major Elective (MJE)-2

(Credits 04; FM: 75)

MJE-02T: Maternal and Child Care Health (Theory): Credits 04

Nutritional needs during pregnancy, common disorders of pregnancy (Anaemia, HIV infection, Pregnancy-induced hypertension), and the relationship between maternal diet and birth outcome. **Maternal health and nutritional status**, maternal mortality and issues relating to maternal health. **Nutritional needs** of nursing mothers and infants, determinants of birth weight and consequences of low birth weight. **Mammary Gland:** Anatomy, histology, development, and its hormonal control. **Lactation:** Breastfeeding biology and its hormonal regulation, Breastfeeding support and counselling, nutritional significance of colostrum. Infant and young child feeding and care. Assessment of malnutrition among the children, Micronutrient deficiency in preschool children. **Reproductive and Child Health (RCH):** Antenatal, Intranatal and Postnatal care of mother, Neonatal and infant care, Feeding of infants, Immunization, Pre-school children care**,** Growth and development of children, Adolescent health**,** Indicators of **Reproductive and Child Health (RCH)** Programme and services, Demography and Population Control, National Family Welfare Programme. **Health Programs:** Integrative Child Development Services **(ICDS),** Mid-day-meal **(MDM)** program, Clinical Management- Severe Acute Malnutrition **(CM-SAM),** State-level Nutrition programs, Special Nutrition Programme **(SNP),** Balvadi Nutrition Programme **(BNP).**

Major Elective (MJE)-3: Theory

(Credits 04; FM: 75)

MJE-3T: Basic concept of genetics and molecular biology (Theory): Credits 03

Basic ideas about genetics: Basic concepts of gene, allele, multiple alleles, pseudoallele, and complementation tests. **Extensions of Mendelian principles:** Codominance, incomplete dominance, gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, sex linkage, sex limited and sex influenced characters. **Elementary idea about regulation of gene expression**: operon concept, lac operon, lytic and lysogenic cycle of phage. Chromosomal aberrations and gene mutations (agents and types). Idea about the Human Genome Project. Concept of oncogenes, tumour suppressor genes, and properties of cancer cells. **Extra chromosomal inheritance:** Inheritance of Mitochondrial and chloroplast genes, maternal inheritance. **Human genetics:** Linkage and Crossing over: Karyotypes. **Population genetics**: Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; genetic shift.

Molecular biology:

Nucleic acid structure: Nucleotides and nucleic acids, DNA structure, different forms of DNA, unusual DNA structure, different types of RNA, RNA structure. **Nucleic acid chemistry:** Denaturation and renaturation, hybridization, nonenzymatic transformation (Mutation) – spontaneous and induced, point **Chromosome structure:** Concept of nucleosome, molecular organization, chromosomal proteins, and the different levels of chromatin organization. Double helical structure and Watson-Crick model of DNA. **Basic concept of DNA replication:** Meselson and Stahl Experiment, DNA Polymerases, Ligases, and other regulatory proteins. Brief idea of DNA damage and repair. Structure of different RNA molecules and mechanism of transcription of RNA (prokaryotic). **Gene expression:** Knowledge about gene expression at RNA and protein levels, including large-scale expression, such as microarray-based techniques. **Post-translational modification:** Protein folding and protein trafficking.

MJE-3P: Estimation of genetic materials (Practical): Credits 01

- Isolation and purification of RNA (Orcinol), DNA (DPA), (genomic and plasmid) and estimation of DNA, RNA (Demonstration).
- Analysis of RNA, DNA and proteins by one and two-dimensional gel electrophoresis, and Isoelectric focusing gels (Demonstration).
- Measurement of total protein by suitable methods.
- Chromosome Staining and Karyotyping.

OR

Major Elective (MJE)-2: Theory

(Credits 04; FM: 75)

MJE-03T: Lifestyle, Health and Diseases: Credits 04

Concept of lifestyle: Definition and components of lifestyle, factors affecting lifestyle, lifestyle and health, lifestyle management. General concept of stress and distress. Concept of risk, risk factors, risk groups; **lifestyle and diseases:** Coronary Heart Disease (CHD), cancer, diabetes mellitus, obesity, hypertension, back pain. Lifestyle modification and management of lifestyle-related diseases. Physical activity and health benefits, physiological effects of exercise. A balanced diet and health promotion. **Concept of health and disease:** Definition of health (WHO), dimensions and determinants of health, physical, mental and psycho-social health. Concept and Principles of public health, Public Health in a global perspective, Public Health problems in India. **Disease:** Definition, Epidemiological triad, Risk factors, Concepts of disease, control, and prevention, and causative factors. **Nutrition-Related Health:** History of the development of the health care delivery system in India. Nutritional Problems: Anaemia, LBW**,** PEM**,** Xerophthalmia, Nutritional anaemia**,** IDD, Endemic fluorosis. **Characteristics and Key Components:** Three-tier health care delivery system- Primary health centre, Subcentre, CHV, Urban health infrastructure, Healthcare professionals, resources and actions. **Functions of a Healthcare System:** Public health, addressing health issues, and vaccination.

MINOR (MI)

(To be studied by students taken Physiology as Discipline- C)

MI-5/C5: Same as Minor-5 (PHYMIN05) of Physiology (Hons.) programme **Credits 04**
Full Marks: 75

MI-6/C6: Same as Minor-6 (PHYMIN06) of Physiology (Hons.) programme **Credits 04**
Full Marks: 75