Curriculum & Credit Framework for Post Graduate (PG) Programmes according to NEP 2020

Murshidabad Maharaja Krishnanath University, Berhampore

Curriculum components	**Course level**	**Semester**		**Total credit**
		1st Semester	**2nd Semester**	
PG Diploma	1st SEM-400 2nd SEM-500	4 core course -4x4==16 1 interdisciplinary course-4	4 core course -4x4==16 1 research Methodology-4	40
PG 2year	1st Year: 1st SEM-400 2nd SEM-500	1st Semester 4 core course -4x4==16 1 interdisciplinary course-4	2nd Semester 4 core course -4x4==16 1 research Methodology-4	40
	2nd Year: 1st SEM-500 2nd SEM-500	3rd Semester 2 core course-2x4=8 2 Discipline specific elective core course-2x4=8 Dissertation-4	4th Semester 2 core course-2x4=8 1 Discipline specific elective core course-4 Project/ dissertation-8	40
PG 1 Year	1st SEM-500 2nd SEM-500	1st Semester 2 core course-2x4=8 2 Discipline specific elective core course-2x4=8 Dissertation-4	2nd Semester 2 core course-2x4=8 1 Discipline specific elective core course-4 Project/ Dissertation-8	40

1credit=20marks

Courses of PG in Physiology under Framework of NEP 2020

SEM-I								
Course Code	Core Topics	Nature of Course	Credit of Course	Class hour/week	Evaluation			**Total**
					Internal	Semester End		
						T	**P**	
PG-PHY-CC-101	SYSTEMS PHYSIOLOGY	Core	**04**		**20**	**60**	**0**	**80**
PG-PHY-CC-102	BIOMOLECULES AND METABOLISM	Core	**04**		**20**	**60**	**0**	80
PG-PHY-CC-103	EVOLUTION AND BASIC CONCEPT OF MICROBES AND IMMUNE SYSTEM	Core	**04**		**20**	**60**	**0**	**80**
PG-PHY-CC-104	EXPERIMENTAL PHYSIOLOGY, BIOCHEMISTRY AND MICROBIOLOGY	Core	**04**		**20**	**-**	**60**	**80**
PG-PHY-IDS	BASIC HUMAN PHYSIOLOGY	Interdisciplinary Course	**04**		**20**	**-**	**60**	**80**
		Total	**20**					**400**

DETAILED STRUCTURES OF THE SYLLABUS

SEM I:

CORE COURSES

PG-PHY-CC-101: SYSTEMS PHYSIOLOGY, Credits 04 (Full Marks: 80)

Unit I:

BLOOD AND HEMODYNAMICS

Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, homeostasis

Unit II:

CARDIOVASCULAR SYSTEM

Anatomy of heart, electron microscopic structure of cardiac tissue; Electrical activity of heart, ionic basis of action potential,conduction of action potential, role of neurohormones; Fibrillation, defibrillators; Electrocardiogram (ECG)- recording principle, generation of ECG waves, electrical axis, normal and abnormal ECG; Cardiac enlargement and hypertrophy, myocardial necrosis and myocarditis, cardiac metabolism and cardiac efficiency

Unit III:

RENAL PHYSIOLOGY

Anatomy of kidney and renal blood flow, regulation of RBF and GFR; Innervation of bladder, micturition: Micturition reflex; Functions of kidney, role of kidney in the regulation of electrolytes, functions of different parts of kidney, assessment of renal functions

Unit IV:

RESPIRATORY SYSTEM

Anatomy of respiratory system, surfactant; Innervation of lungs and airways; Respiratory mechanisms: Elastic forces, lung volumes, pressure/volume relationship, O_2 and CO_2 transport; Respiratory system resistance: Physical principles of gas flow and resistance; Regulation of ventilation, abnormal ventilation; Non respiratory functions of the lung: Filtration, defense against inhaled substances

Unit V:

GASTROINTESTINAL PHYSIOLOGY

Anatomy of GI system; Regulation of GI tract functions, gastric motility; Vomiting: Physiology of vomiting and vomiting reflex; Motility of small intestine; Mechanism and cellular control of salivary and pancreatic secretion, gastric secretion, control of gastric acid secretion, hepato billiary systems and gastrointestinal functions, gastrointestinal hormones; Digestion, absorption, energy balance, BMR

Unit VI:
NERVE –MUSCLE PHYSIOLOGY
Structure and function of nerve cells, Synapse and synaptic transmission, ion channels; Neuro and gliogenesis, neuronal migration, functions of astrocytes and microglia; Segmental and intersegmental interactions: Myotatic reflex, inverse myotatic reflex, flexor reflex, crossed extensor reflex, propiospinal reflex, feedback regulation of spinal motor functions, role of descending tracts in regulation of muscle tone, posture and spinal reflexes, γ – loop, autogenic inhibition.

PG-PHY-CC-102: BIOMOLECULES AND METABOLISM Credits 04 (Full Marks: 80)

Unit I:
PRINCIPLES OF BIOPHYSICS

Principles of biophysics as applied to physiology: Colloidal chemistry, pH of body fluids; Maintenance of pH within the cells, applications. **Thermodynamics-** Laws of thermodynamic, and living organism, enthalpy, entropy, efficiency, and thermodynamic system model, adiabatic process, concept of energy in biological system in the light of thermodynamics, Gibbs free energy**,** living body as a thermodynamics system. Nanoscience- Elementary concept of nanotechnology and its applications; cellular nanomachines; bio-inspired nanomaterials for a new generation of medicine; nanoscience in medicine, delivery system, and vaccine; nanoparticles in medical detection and diagnostics; synthesis of anyone inorganic or organic nanoparticles, characterization, and applications

Unit II:
CHEMISTRY OF BIOMACROMOLECULES
Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids and vitamins); Conformation of proteins and polypeptides – primary, secondary, motif, domain, tertiary, quaternary structure of proteins, reverse turns and Ramachandran plot, helix-coil transition, stability of proteins and protein folding and its problems: Role of chaperons; Bonds in biochemical reactions, conformation of nucleic acids (helix (A, B, Z), t-RNA, micro-RNA), stability of nucleic acids, typical structures of biomolecules and their physiological and clinical consequences

Unit III:
BASIC CONCEPTS IN ENZYMES
Principles of catalysis, mechanism of enzyme catalysis, kinetics versus thermodynamics; Structural basis of enzyme function: Active sites, coenzymes, allosteric activation and inhibition of the enzymes, competitive, noncompetitive and uncompetitive inhibition kinetics, covalent modification, mechanism of enzyme induction and repression, experimental methods of enzyme activities, purification and characterization of enzymes, clinical enzymology

Unit IV:
METABOLISM-I
Carbohydrate metabolism: Glycolysis, Pentosephosphate pathway and TCA cycle, Gluconeogenesis

Lipid Metabolism: β-oxidation of fatty acids; Biosynthesis of Fatty acids, Eicosanoids, Cholesterol; Metabolism of Acylglycerol, Sphingolipids and Glycolipids; Hormonal regulation of carbohydrate and lipid metabolisms

Unit V:
METABOLISM-II
Amino acid metabolism: Biosynthesis of non-essential amino acids, catabolism of proteins and amino acid pool;
Nucleotide Metabolism: Synthesis of purine and pyrimidine nucleotides;
Hormonal regulation of protein metabolism;
Metabolism of vitamins

Unit VI:
BIOENERGETICS
Mitochondrial anatomy, mitochondrial electron transport systems, thermodynamics of electron transport, sequence of electron transport; Oxidative phosphorylation, chemiosmotic theory, uncoupling of oxidative phosphorylation;
Regulation of oxidative phosphorylation and photosynthesis; Extramitochondrial electron transport chains; oxygen toxicity and superoxide dismutase.

PG-PHY-CC-103: EVOLUTION AND BASIC CONCEPT OF MICROBES AND IMMUNE SYSTEM, Credit– 04 (Full Marks:80)

Unit I:
CONCEPT OF EVOLUTION
Emergence of evolutionary thoughts: Lamarck; Darwin– concepts of variation, adaptation, struggle, fitness and natural selection; Mendelism; Spontaneity of mutations; Evolutionary synthesis.
Origin of cells and unicellular evolution: Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells; Evolution of unicellular eukaryotes; Anaerobic metabolism, photosynthesis and aerobic metabolism.

Unit II:
PALEONTOGY AND MOLECULAR EVOLUTION
Paleontology and evolutionary history: The evolutionary time scale; Eras, periods and epoch; Major events in the evolutionary time scale; Origins of unicellular and multicellular organisms; Major groups of plants and animals;Stages in primate evolution including Homo.
Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; Origin of new genes and proteins; Gene duplication and divergence

Unit III: POPULATION GENETICS

Populations, gene pool, gene frequency; Hardy-Weinberg law; Concepts and rate of change in gene frequency through natural selection, migrationand random genetic drift; Adaptive radiation and modifications; Isolating mechanisms; Speciation; Allopatricityand Sympatricity; Convergent evolution; Sexual selection; Co-evolution

Unit IV:
EVOLUTION AND BEHAVIORAL PHYSIOLOGY

Approaches and methods in study of behavior; Proximate and ultimate causation; Altruism and evolution-group selection, kin selection, reciprocal altruism; Neural basis of learning, memory, cognition, sleep and arousal; Biological clocks; development of behavior; Social communication; Social dominance;
Use of space and territoriality; Mating systems, parental investment and reproductive success; Parental care; Aggressive behavior; Habitat selection and optimality in foraging; Migration, orientation and navigation; Domestication and behavioral change

Unit V:
MICROBES

Brief history of infectious diseases, germ theory of disease; Classification of micro organisms, anatomy and physiology of major groups of microorganisms: Fungi, algae, bacteria, virus, protozoa; Reproduction of bacteria; Commensal, beneficial, parasites and pathogenic microbes; Microorganisms and human diseases, pathogenesis and pathophysiology of infectiousdiseases and their control; Food poisoning bymicrobes

Unit VI:
IMMUNE SYSTEM

Innate and adaptive immunity, Antigens, Antigenicity and Immunogenicity; Structure and classification of Antibody Molecules; Humoral and cell- mediated immune responses, primary and secondary immune Responses; Cytokines, chemokines and complement system

PG-PHY-CC-P-104: PRACTICAL: EXPERIMENTAL PHYSIOLOGY, BIOCHEMISTRY AND MICROBIOLOGY Credit– 04 (Full Marks: 80)

Unit I:
EXPERIMENTAL PHYSIOLOGY

Mammalian Experiments

a) Study of the effects of Drugs and Ions on the motility of isolated mammalian intestine (rat): by Dale's method :Drugs : Acetylcholine and Adrenaline
b) Amphibian Experiments (Demonstration)
c) a) Study of the effects of drugs and ions on the perfused heart of toad.
d) Drugs :
e) Graded doses of adrenaline hydrochloride (1 in 100,000 dilutions)
f) Graded doses of acetylcholine (1 in 10,00,000 dilutions).

g) Ions :1ml of 1% $CaCl_2$ (Ca^{++}),1ml of 1% KCl (K^+), 2ml of 1% NaCl (Na^+)
h) Ions : KCl (K^+), CaCl2 (Ca^{++})

Unit II: Biochemistry

1. Determination of blood sugar (true): by (i) modified Nelson and Somogyi; and (ii) Hagedorn and Jenson Method.
2. Determination of total cholesterol in whole blood or serum: by the method of Nath and Ghosh.
3. Determination of serum triglyceride: by the method of Neri and Fringe.
4. Determination of serum lipoprotein.
5. Determination of serum total lipids: by Frings and Dunn method.
6. Determination of Serum alkaline phosphatase: by the method of Stolbach and Nath.
7. Determination of Serum bilirubin (total and conjugated): by Malloy and Evelyn method.
8. Determination of serum calcium: by the method of Kramer and Tisdall and EDTA titration Method.
9. Determination of acid soluble phosphate of blood: by Fisk and Subba Row Method.
10. Protein estimation by Lowry method using UV spectroscopy
11. Fractionation and identification of serum proteins: by paper and polyacrylamide-gel Electrophoresis (PAGE).
12. Separation and identification of amino acid: by paper chromatography.

Unit III:

a) Study of morphology by staining: Gram staining, spore staining, mold and yeast staining
b) Isolation and enumeration of a pure culture from mixed bacterial culture by i) Streaking, ii) Pour plate, iii) Spread plate techniques.
c) Determination of bacterial growth curve by O.D and detection of oxygen concentrations at different phases

Unit IV:

(a) Blood group determination
(b) Immunodiffusion (Ouchterlony Double Diffusion and Single radial Immunodiffusion)

Unit- IV: Respiratory Physiology

a) Measurement of peak expiratory flow rate.
b) Measurement of forced expiratory volume (FEV) in first second.

Unit- V: Cardiovascular System

a) ECG
b) Measurement of blood pressure

INTERDISCIPLINARY COURSE

PG-PHY-IDS: BASIC PHYSIOLOGY, Credit– 04 (Full Marks: 80)

1. **Blood and Circulation** - Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, function of haemoglobin in adult and embryonic life, immunity, haemostasis.

2. **Cardiovascular System:** Comparative anatomy of heart structure, myogenic heart, specialized tissue, cardiac cycle, heart as a pump, blood pressure, neural and chemical regulation of all above, ECG – its principle and significance, electricalaxis, normal and abnormal ECG, generation of ECGwaves.

3. **Pulmonary Physiology:** Respiratory pigments, transport of gases, exchange of gases, waste elimination, neural and chemical regulation of respiration.

4. **Excretory System** - Comparative physiology of excretion, kidney, urine formation, waste elimination, micturition, regulation of water balance, blood volume, blood pressure, electrolyte balance, acid-base balance.

5. **Nerve and Muscle Physiology:** Structure, classification and functions of neurons and neuroglias, resting membrane potential, action potential, propagation of nerve impulse in different types of nerve fibers; Structure of synapse and synaptic transmission; Structure of skeletal, smooth and cardiac muscles, contractile elements; Mechanism of skeletal and smooth muscle contraction and relaxation: Excitation-contraction coupling; Isometric and isotonic contractions – muscle length, chemical and thermal changes during contraction and relaxation.

6. **Sports, Ergonomics and Exercise Physiology:**
   Importance of regular exercise in health and wellbeing. Basic concept of Bioenergetics, Energy sources during exercise (Phosphagen, Anaerobic system and Aerobic system); Cardio-respiratory responses during different grades of exercise; Concept of excess post exercise oxygen consumption (EPOC), physiology of fatigue and recovery; Training: Principles of physical training; Effect of overtraining and detraining. Introduction to Ergonomics: Definition and application; System Design: Concept of system design; Effect of Man, Machine and Environment in System Design; Failure of System – accident. Definition of Anthropometry; Static and Dynamic Anthropometry.