MURSHIDABAD UNIVERSITY

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Memo No.- MU(R)/1/C/43/25 **Date: 21/01/2025**

NOTIFICATION

It is notified for information of all concerned that in terms of the provision of the Murshidabad University Act, 2018, and, in existing of his powers, of the said Act, the Vice-Chancellor has, by and order dated 21.01.2025 approved the syllabi of the subject Physiology for semester wise programme of PG Course of study under this university, as laid down in the accompanying pamphlet.

Place: Berhampore
Date: 21.01.2025

Rajib Mukherjee
Registrar
Murshidabad University

Registrar
Murshidabad University

MURSHIDABAD UNIVERSITY
Estd-2021
Berhampore (W.B.)

Murshidabad University

Berhampore, Murshidabad
West Bengal-742101

Syllabus for the Master of Science in Physiology
Under Choice Based Credit System (CBCS)

(Courses effective from 2024-25 sessions)

CONTENT

POST-GRADUATE PHYSIOLOGY CBCS SYLLABUS 2024
ORIENTATION OF COURSES

SUBJECT CODE	SUBJECT	MARKS	CONTACT HRS	CREDIT
FIRST SEMESTER				
CORE COURSE PG-PHY-CC-101	**SYSTEMS PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
101.1	BLOOD AND HEMODYNAMICS	10	12	
101.2	CARDIOVASCULAR SYSTEM	10	12	
101.3	RENAL PHYSIOLOGY	10	12	
101.4	RESPIRATORY SYSTEM	10	12	
101.5	GASTROINTESTINAL PHYSIOLOGY	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY-CC-102	**CHEMISTRY OF BIOMOLECULES AND METABOLISM**	**MARKS**	**CONTACT HRS**	**CREDIT**
102.1	BIOMACROMOLECULES	10	12	
102.2	ENZYMES	10	12	
102.3	METABOLISM-I	10	12	
102.4	METABOLISM-II	10	12	
102.5	BIOENERGETICS	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY-CC-103	**EVOLUTION AND INFECTION BIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
103.1	CONCEPT OF EVOLUTION	10	12	
103.2	POPULATION GENETICS	10	12	
103.3	EVOLUTION AND BEHAVIORAL PHYSIOLOGY	10	12	
103.4	MICROBES	10	12	
103.5	IMMUNOLOGY	10	12	
Total		**50**	**60**	**04**
PG-PHY-CC-104 (P)	**PRACTICAL: EXPERIMENTAL PHYSIOLOGY**	**50**	**60**	**04**
PG-PHY-CC-105(P)	**PRACTICAL: BIOCHEMISTRY**	**50**	**60**	**04**
GRAND TOTAL		**250**	**300**	**20**

	SECOND SEMESTER			
CORE COURSE PG-PHY-CC-201	**NEUROBIOLOGY AND STRESS PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
201.1	NERVOUS SYSTEM	20	24	
201.2	SPECIAL SENSES	10	12	
201.3	MOLECULAR PHARMACOLOGY: CONCEPTS AND PRACTICE	10	12	
201.4	STRESS PHYSIOLOGY	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY-CC-202	**ADVANCED CELLULAR PHYSIOLOGY AND HUMAN GENETICS**	**MARKS**	**CONTACT HRS**	**CREDIT**
202.1	MEMBRANE AND EXPERIMENTAL APPROACHES TO STUDY CELL ORGANIZATION	10	12	
202.2	CELLULAR AND GENETIC ORGANIZATION OF ORGANELLES	10	12	
202.3	CELL TO CELL COMMUNICATION AND SIGNALING	10	12	
202.4	HUMAN GENETICS	20	24	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY-CC-203	**ENVIRONMENT, COMMUNITY HEALTH AND COMPUTATIONAL PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
203.1	CONCEPT OF ENVIRONMENTAL PHYSIOLOGY	20	24	
203.2	ENVIRONMENTAL POLLUTION, XENOBIOTICS AND ITS MANAGEMENT	10	12	
203.3	EPIDEMIOLOGY AND COMMUNITY HEALTH	10	12	
203.4	BIOSTATISTICS	10	12	
Total		**50**	**60**	**04**
	PRACTICAL			
PG-PHY- CC-204 (P)	**PRACTICAL: HISTOLOGY AND MICROBIOLOGY**	**50**	**60**	**04**
PG-PHY- CC-205 (P)	**PRACTICAL: APPLICATIONS OF COMPUTER AND BIOSTATISTICS, AND COMMUNITY HEALTH SURVEY**	**50**	**60**	**04**
GRAND TOTAL		**250**	**300**	**20**

	THIRD SEMESTER			
CORE COURSE PG-PHY- CC-301	**ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
301.1	ENDOCRINOLOGY	10	12	
301.2	NEUROENDOCRINOLGY	10	12	
301.3	CHRONOBIOLOGY	10	12	
301.4	REPRODUCTIVE PHYSIOLOGY	10	12	
301.5	STEM CELL AND DEVELOPMENTAL BIOLOGY	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY- CC-302	**SPORTS AND ERGONOMICS AND OCCUPATIONAL HEALTH**	**MARKS**	**CONTACT HRS**	**CREDIT**
302.1	EXERCISE PHYSIOLOGY AND SPORTS	10	12	
302.2	SPORTS MEDICINE AND DRUG ABUSE	10	12	
302.3	INTRODUCTION TO ERGONOMICS AND HUMAN FACTOR	10	12	
302.4	OCCUPATIONAL HEALTH AND PREVENTION OF HEALTH HAZARDS	10	12	
302.5	SPACE AND AVIATION PHYSIOLOGY	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY- CC-303	**ADVANCED MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY**	**MARKS**	**CONTAC T HRS**	**CREDIT**
303.1	ADVANCED MOLECULAR BIOLOGY	20	24	
303.2	GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY	20	24	
303.3	RADIOLABELING TECHNIQUES	10	12	
Total		**50**	**60**	**04**
PG-PHY-DSE-304	Discipline specific elective course (Theory)* Students will opt DSE offered by Parent Department	**50**	**60**	**04**
PG-PHY- GE-323	Generic Elective Course **– GE** Physiology Students will opt GE course offered by other Department	**50**	**60**	**04**
Grand Total		**250**	**300**	**20**

	FOURTH SEMESTER			
COURSE	**TOPICS**	**MARKS**	**CONTACT HRS**	**CREDIT**
CORE COURSE PG-PHY- CC-401	**RECENT TRENDS IN PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
401.1	TECHNOLOGICAL APPROACHES TO CELL AND TISSUE CULTURE	10	12	
401.2	IMMUNOTECHNOLOGY	10	12	
401.3	TECHNIQUES FOR BIOPHYSICS	10	12	
401.4	NANOTECHNOLOGY AND IT'S PHYSIOLOGICAL APPROACH	10	12	
401.5	BIOINFORMATICS IN PHYSIOLOGY	10	12	
Total		**50**	**60**	**04**
PG-PHY-CC-402 (P)	**PRACTICAL:** IMMUNOTECHNOLOGY AND APPLICATIONS OF BIOINFORMATICS	**25**	**30**	**02**
PG-PHY-DSE-403 (A, B, C and D)	Discipline specific elective course (Theory)* Students will opt DSE offered by Parent Department	**50**	**60**	**04**
PG-PHY-DSE-404(PA, PB, PC and PD)	Discipline specific elective course (Practical)*Students will opt DSE offered by Parent Department	**50**	**60**	**04**
PG-PHY-DSE-405 (PA, PB, PC and PD)	Discipline specific elective course (Project and Seminar)*Students will opt DSEC offered by Parent Department	**50**	**60**	**04**
PG-PHY- AO	Add on course– AO Physiology Students will opt AO course offered by Parent Department	**25**	**30**	**02**
Grand Total		**250**	**300**	**20**
Post-Graduation Grand Total		**1000**	**1200**	**80**

Students can choose any one from the list of Discipline Specific Elective Course (DSE)*:

A. Endocrinology and Reproductive Physiology
B. Microbiology and Immunology
C. Environmental Physiology
D. Ergonomics, Work Physiology, and Occupational Health

POST-GRADUATE PHYSIOLOGY CBCS SYLLABUS 2024

Detailed Syllabus for All Semesters

SUBJECT CODE	SUBJECT	MARKS	CONTACT HRS	CREDIT
FIRST SEMESTER				
CORE COURSE PG-PHY- CC-101	**SYSTEMS PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
101.1	BLOOD AND HEMODYNAMICS Blood corpuscles, haemopoiesis and formed elements, plasma function, blood volume, blood volume regulation, blood groups, haemoglobin, immunity, homeostasis	10	12	
101.2	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	10	12	
101.3	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	10	12	
101.4	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	10	12	

101.5	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	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY- CC-102	**CHEMISTRY OF BIOMOLECULES AND METABOLISM**	**MARKS**	**CONTACT HRS**	**CREDIT**
102.1	BIOMACROMOLECULES Principles of biophysics as applied to physiology: Colloidal chemistry, pH of body fluids; Maintenance of pH within the cells, applications. 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 theirphysiological and clinical consequences	10	12	
102.2	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	10	12	
102.3	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	10	12	

102.4	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	10	12	
102.5	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.	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY- CC-103	**EVOLUTION AND INFECTION BIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
103.1	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 andpolymers; 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 aerobicmetabolism. **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	10	12	

103.2	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; Adaptive radiation and modifications; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution	10	12	
103.3	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; Socialcommunication; 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	10	12	
103.4	MICROBES Brief history of infectious diseases, germ theory of disease; Classification of micro organisms, anatomy and physiology of major groups of micro organisms: Fungi, algae, bacteria, virus, protozoa; Reproduction of bacteria; Commensal, beneficial, parasites and pathogenic microbes; Microorganisms and human diseases, pathogenesis and pathophysiology of infectious diseases and their control; Food poisoning by microbes	10	12	
103.5	IMMUNOLOGY 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	10	12	
Total		**50**	**60**	**04**
PG-PHY- CC-104(P)	**PRACTICAL: EXPERIMENTAL PHYSIOLOGY**	**50**	**60**	**04**
	EXPERIMENTAL PHYSIOLOGY **Amphibian Experiments** a) Study of the effects of drugs and ions on the perfused heart of toad. Drugs : Graded doses of adrenaline hydrochloride (1 in 100,000 dilutions) Graded doses of acetylcholine (1 in 10,00,000 dilutions). Ions :1ml of 1% $CaCl_2$ (Ca^{++}),1ml of 1% KCl (K^{+}), 2ml of 1% NaCl (Na^{+}) (Demonstration only)			
	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 Ions : KCl (K^+), CaCl2 (Ca^{++})			
PG-PHY- CC-105 (P)	**PRACTICAL: BIOCHEMISTRY**	**50**	**60**	**04**
	BIOCHEMISTRY 1. Determination of blood sugar by Folin Wu 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 Neriand Fringe. 4. Determination of serum lipoprotein. 5. Determination of serum total lipids: by Frings and Dunn method. 6. Determination of Serum Aspartate Amino-transferase (SGOT): by Reitman and Frankel Method. 7. Determination of Serum Alanine Amino-transferase (SGPT): by Reitman and Frankel Method 8. Determination of Serum alkaline phosphatase: by the method of Stolbach and Nath. 9. Determination of Serum bilirubin (total andconjugated): by Malloy and Evelyn method. 10. Determination of serum calcium: by the method of Kramer and Tisdall and EDTA titration Method. 11. Determination of acid soluble phosphate of blood: by Fisk and Subba Row Method. 12. Protein estimation by Lowry method UV spectroscopy 13. Determination of total protein, albumin and globulin in serum: by Biuret method. 14. Fractionation and identification of serum proteins: by paper and polyacrylamide-gel Electrophoresis (PAGE). 15. Separation and identification of amino acid: by paper chromatography.			
Grand Total		**250**	**300**	**20**

	SECOND SEMESTER			
CORE COURSE PG-PHY- CC-201	**NEUROBIOLOGY AND STRESS PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
201.1	NERVOUS SYSTEM 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. Neural plasticity, higher order functions of cerebral cortex, cellular and molecular basis of learning and memory; Neural circuitry of cerebellum and functions of cerebellum; Neurophysiological basis of decerebrate rigidity and role of higher centres in the regulation of muscle tone; Vestibular apparatus and its functions. Neural circuits and feedback loops of basal ganglia, regulation of muscle tone and movements, control of eye movements, dysfunctions of basal ganglia –Parkinson's diseases, Huntington's diseases, athetosis, hemiballismus; Concept of hypothalamic functions; Neuronal basis of behaviour; Neurologicaldisorders of brain- general cellular events; Physiological basis of degenerative diseases -Alzheimer's, ALS etc; Thalamo cortical projections and its influence on evoked corticalactivity, Brain Waves, sleep-wakefulness cycle.	20	24	
201.2	SPECIAL SENSES **Taste** – Receptor organs – distribution, ultramicroscopic structures, innervation, transduction, sensory processing, taste. **Olfactory system** – Olfactory epithelium and receptors, turnover and regeneration of olfactory receptor cells; central olfactory connections, olfaction and behavior. **Vision:** Structures of retina and phototransduction, visual pathway, visual acuity, accommodation, visual cortex and cortical processing, color vision – retinal and neural mechanisms, binocular and stereoscopic perception, color blindness. **Auditory system:** Organ of corti- ultramicroscopic structure, cochlear mechanics, auditory pathway, transduction and processing; Functions of auditory system – frequency analysis and its discrimination; Pitch; Intensity processing – factors determining loudness, discrimination of loudness, adaptation of loudness, masking, auditory fatigue.	10	12	
201.3	MOLECULAR PHARMACOLOGY: CONCEPTS AND PRACTICE Biotransformation of drugs - microsomal, non-microsomal metabolism, factors influencing, pharmacogenetics;	10	12	

	Cellular and molecular basis of drug action; Molecular models of drug receptor interaction stimulus response mechanisms; Agonism and Antagonisms; Drugs and neurotoxins acting at Neuro-Muscular Junction, Ganglion-Blocking Drugs; Drug induced signal transduction mechanisms, Receptor structure and biochemistry; Transporter structure and biochemistry; Intracellular communication; The cytoskeleton Cell surface biochemistry; Intracellular trafficking; State of the art molecular pharmacological assays measurement of intracellular Ca^{2+} levels by fluorescence probes measurement of membrane potential by fluorescence probes; Scintillation proximity assay (SPA) techniques; Qualitativeevaluation of surface expression of receptors by immunofluorescence; Quantitative evaluation of surface expression by ELISA using fluorescent read out; Immunopharmacology	10	12	
201.4	STRESS PHYSIOLOGY Defining stress; Stress-responses; Heat stress; Acclimatization toheat; Thermal distress: Dehydration and heat cramps, heat exhaustion, heat stroke and prevention of thermal distress; Cold stress: Frost bites and Hypothermia. Effect of stress-inducing and anti-stress agents on the activities of catalase, peroxidases superoxide dismutases, dehydrogenases; Cardio-respiratory; Responses during high altitude acclimatization. Oxidative stress, oxidative damage and mechanisms involved. Stress and Heat Shock Proteins; Stress-induced diseases and their possible remedy by anti-stress agents; Antioxidant Defense; Classical and non-classical antioxidants, reaction mechanisms; Antioxidant enzymes and mechanisms of catalysis; Importance of antioxidants in prevention / amelioration of stress-related diseases; How cells respond to stress; Role of hypothalamo-hypophyseal-adrenal axis; Stress responsive elements and molecular pathways.	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY- CC-202	**ADVANCED CELLULAR PHYSIOLOGY AND HUMAN GENETICS**	MARKS	CONTACTHRS	CREDIT
202.1	MEMBRANE AND EXPERIMENTAL APPROACHES TO STUDY CELL ORGANIZATION Structure of model membrane, lipid bilayer and membrane proteins; Principle of membrane transport of small molecules, carrier membrane proteins and active membrane transport, ion channels and electrical properties of membranes. Experimental approaches to study cellular organization and processes: Use of pulse-chase experiments, mutants- temperature-sensitive mutants, yeast genetic mutants, dominant-negative mutants, immunoprecipitation and protein-protein interaction studies, use of drugs/ toxins/inhibitors, siRNA mediated knockdown of key proteins, Post-translational modifications and how to test for them. Regulation of cellular activities, quality control (autophagy, degradative pathways)	10	12	

202.2	CELLULAR AND GENETIC ORGANIZATION OF ORGANELLES **Intracellular compartments and protein sorting:** The compartmentalization of cells; The transport of molecules between the nucleus and the cytosol; Transport of proteins into mitochondria and chloroplast; Transport of proteins into peroxisomes; Endoplasmic reticulum and protein sorting. **Intracellular vesicular traffic:** Transport of protein from endoplasmic reticulum through Golgi apparatus, transport of proteins from trans Golgi network to lysosomes. **Nuclear Transport** –Import and Export of protein; Export of different RNAs **Classical genetics of organelles:** Origin and evolution of mitochondria and chloroplast; Molecular genetics of mitochondria and chloroplast; Phylogenetic relationship with mitochondria and chloroplast; Nucleus and genetic organization: Nucleus and chromosomal DNA, packaging of chromosomal DNA in the chromatin fiber, telomerase.	10	12	
202.3	CELL TO CELL COMMUNICATION AND SIGNALING **Cellular communication:** General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins, neurotransmission and its regulation. **Cell signaling:** Hormones and their receptors, cell surface receptor, signaling through G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two- component signaling systems, bacterial chemotaxis and quorum sensing. **Cytoskeleton:** Microfilaments; Microtubules; Intermediate filaments; Molecular motors. **Eukaryotic Cell Cycle:** Cyclin and Cyclin-dependent Kinase; Molecular mechanisms of Checkpoint regulation	10	12	
202.4	HUMAN GENETICS Evolution of the concept of gene; Organization of human chromosomes: Normal chromosomal constitution, autosomal and sex chromosome, cytogenetic mapping, Karyotype, Karyogram, ideogram, Mendelism: The basic principles of inheritance; Mendelian principles in human genetics; Extensions of Mendelism; Extra chromosomal inheritance; The chromosome theory of heredity, genetic factors in diseases, pedigree analysis, sex determination: Sex determination in human beings, dosage compensation of X-linked genes, variation in chromosome number and structure, crossing over, linkage, chromosome mapping in eukaryotes, advanced linkage analysis (tetrad analysis) Immunogenetics: Blood Groups, histocompatibility and organ transplantations. Genetics disorders: Sickle cell anemia, hemophilia, thalassemia, cystic fibrosis, Huntington disease, color blindness, phenylketonuria, inborn errors of metabolism	20	24	
Total		**50**	**60**	**04**

CORE COURSE PG-PHY- CC-203	**ENVIRONMENT, COMMUNITY HEALTH AND COMPUTATIONAL PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDITS**

203.1	CONCEPT OF ENVIRONMENTAL PHYSIOLOGY **The Environment:** Physical environment; Biotic environment; Biotic and abiotic interactions. **Habitat and niche:** Concept of habitat and niche; niche width and overlap; Fundamental and realized niche; Resource partitioning; Character displacement. **Species interactions:** Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis; **Community ecology:** Nature of communities; Community structure and attributes; Levels of species diversity and its measurement; Edges and ecotones; **Ecological succession:** Types; Mechanisms; Changes involved in succession; Concept of climax; **Ecosystem:** Structure and function; Energy flow and mineral cycling (CNP); Primary production and decomposition; Structure and function of some Indian ecosystems: terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine); **Biogeography:** Major terrestrial biomes; Theory of island biogeography; Biogeographical zones of India. **Applied ecology:** Environmental pollution; Global environmental change; Biodiversity-status, monitoring and documentation; Major drivers of biodiversity change; Biodiversity management approaches. **Conservation biology:** Principles of conservation, major approaches to management, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves).	20	24	
203.2	ENVIRONMENTAL POLLUTION, XENOBIOTICS AND ITS MANAGEMENT Environmental air pollution, noise pollution, water pollution and its control; Environmental radiation and thermal pollution and their control; Types and pathways of metabolic reactions; Involvement of cytochrome P.450 – its isoforms and inhibitors xenobiotic metabolizing enzymes; Fate of xenobiotic metabolites; Factors influencing xenobiotic metabolism; Pharmacologic, toxic, immunologic and carcinogenic effects Clinical correlations and biomedical importance.	10	12	
203.3	EPIDEMIOLOGY AND COMMUNITY HEALTH concept of epidemiology, health and disease, Genes and environment as determinants of health and disease: Isolation, migration, immigration, amalgamation andassimilation The influence of epidemiology and biostatistics on legal and ethical issues. Epidemiologic study designs for investigating associations between risk factors and disease culminating with criteria for causal inferences. Molecular biology to community control of several burdensome diseases in India: A case example like Beta-Thalassemia in India. Community based Health care: Consanguinity Human Health in extreme situations like flood, drought, Landslides,	10	12	

	Earthquake, starvation. Malnutrition and nourishment, Compromise of Nutrition. Major Public Health Conditions and there prevention. Major water and food borne pathologicdevelopment during disaster Management and Preparedness for better living and awareness program.			
203.4	BIOSTATISTICS Testing of hypothesis: Null hypothesis, levels of significance, errors of inference, one- tail and two-tail tests; Correlation - product moment correlation, partial correlation, multiple correlations, Regression-simple and multiple linear regressions Correlations involving qualitative variables – biserial r, point biserial r, phi coefficient ; Nonparametric statistics: Chi square tests, application of chi square in testing the normality of a distribution, G test; Kendal's rank correlation coefficient Analysis of Variances: Models and types of ANOVA.	10	12	
Total		**50**	**60**	**04**
PG-PHY- CC- 204 (P)	**PRACTICAL: HISTOLOGY AND MICROBIOLOGY**	**50**	**60**	**04**
	HISTOLOGY I. Study of estrus cycle in rat : Proestrus, estrus, metestrus and diestrus II. Histological Techniques for the Preparation of Paraffin Tissue / Organ sections a) Isolation and collection of specific tissue / organ mass fromsacrificed animal. b) Fixation of tissue mass. c) Dehydration, Clearing, Embedding and Paraffin blocking of tissue masses. d) Cutting of paraffin sections by microtome and preparation ofparaffin tissue sections(s) on glass slide III. Frozen Tissue Section (For diagnostic and enzyme histo-chemistry , and non-enzymehistochemistry e.g. lipids and glycogen) IV. Staining of Paraffin Tissue / Organ Sections **i)** Histological Staining a) Hematoxylin-Eosin. b) Iron- Hematoxylins. c) Weigert's iron Hematoxylin (for connective tissue). d) Hematoxylin-eosin (for glycogen). **Histological chemistry** a) PAS method / Best's carmine method (for glycogen). b) Oil red method [for fats (degenerating myelin)].			

	c) PAS and Sudan Black B method (for Glycolipids, neutral fat and myelin). d) Feulgen and Rossenbeck Nuclear Reaction method (for DNA /deoxyribose). e) Methylgreen – pyronin method (for RNA). f) Perl's Prussian blue reaction method (for endogenous ferric iron). g) Millon reaction method (for tyrosine). h) Gomori calcium method / Azo dye coupling method (for alkaline phosphatase). Van Gieson Trichrome (for connective tissue staining). **MICROBIOLOGY** 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			
PG-PHY- CC- 205 (P)	**PRACTICAL: APPLICATIONS OF COMPUTER AND BIOSTATISTICS, AND COMMUNITY HEALTH SURVEY**	**50**	**60**	**04**
	APPLICATIONS OF COMPUTER 1. Basic operation of computer – different operations of WINDOWS; data entry, printing of programs and results 2. Operation of Ms Excel – tabulation of biological data, computation of different groups of data 3. Preparation of frequencies of a variable: by tabulation (frequency distribution table) and drawing (presentation of quantitative data by histogram, frequency curve, polygon,scatter diagram and qualitative data by bar diagram, pie diagram, pictogram etc.). 4. Statistical analysis of biological data – Mean, SD, SE, t-test 5. Calculation of correlation and regression co-efficient from physiological observations. 6. Application X^2 test to find the significance in differentphysiological observations. **BIOSTATISTICS** 1. Computation and significance of product- moment r between two continuous measurement variables. 2. Computation and significance of Kendall's rank correlation coefficient between two ordinal variables			

	3. Computation and significance of partial correlation coefficient between two variables. 4. Computation and significance of multiple correlation coefficient between a continuous measurement variable and two others continuous measurement variables. 5. Computation and significance of point biserial r between a continuous measurement variables and a genuinely dichotomous qualitative variable. 6. Computation and significance of biserial r between a continuous measurement variable and artificially dichotomized variables. 7. Testing the goodness of fit of a continuous frequency distribution with best –fitting normal distribution by Chi square test and G test. 8. Computation and significance of one- way model I analysis of variance and multiple comparison t- test and Scheffe's F test. 9. Computation of models I linear regression equation of one variable on another **COMMUNITY HEALTH SURVEY**			
Grand Total		**250**	**300**	**20**

THIRD SEMESTER				
CORE COURSE PG-PHY-CC-301	**ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
301.1	ENDOCRINOLOGY **Principles of endocrinology:** Functions of hormones, interaction of hormones, etc. **Chemistry of Hormones:** Chemical nature, synthesis, storage, release, transport and degradation of steroids, amines and peptide hormones. Cytokines and growth factors. **Mechanism of hormone actions:** Membrane bound and intercellular receptors; steroid hormone-receptor interactions; membrane bound hormone-receptor interactions; Second messenger in hormone action/signal transduction; recycling of receptors. **Hormones in immune responses:** Autoimmune endocrine disorders. Non-Conventional Endocrine Molecules in Health and Disease. **Hormonal regulation of metabolism:** Carbohydrate, protein, lipid, water, minerals/electrolyte etc. Metabolic and lifestyle disorders.	10	12	
301.2	NEUROENDOCRINOLGY **Neuroendocrinology:** Hypothalamus as neuroendocrine organ, process of neurosecretions and neurosecretory materials, synthesis, transport, release, functions and control ofneurosecretory materials. Metabolic regulation of hypothalamic function and role of tanycytes; Neuroendocrine regulation of energy metabolism, Neuroendocrine disorders.	10	12	
301.3	CHRONOBIOLOGY **Chronobiology: Rhythms in Living Organism:** Terminology and Methodology; Photoperiodisms, Influence of visible light radiationupon living organisms; **Clock and cellular mechanisms of clock:** Zeitgebers, synchronizers, Jet Lag, shift-work, Seasonal Affective Disorder (SAD); Sleep mechanisms, Sleep disorders: Human Circadian Rhythm and its mechanism of control- cellular and molecular mechanisms; The SCN, photic and non-photic entrainment pathways, neurotransmitters; Recent advances: Extra retinal illumination experiments, immediate early genes (IEG) and further developments.	10	12	
301.4	REPRODUCTIVE PHYSIOLOGY **Embryology of the gonads and the genital ducts:** Origin of primordial germ cells, differentiation of testis and ovary, germ cells and interstitial tissue. **Function of mammalian testis:** Spermatogenesis; Sertoli cells – germ cells – Leydig cells interaction; Functions of	10	12	

	sertoli cells and Leydig cells; Structure of Sperm: Histology, biochemistry and capacitation of spermatozoa. **Functions of mammalian ovary:** Folliculogenesis, ovogenesis, ovulation, luteinization and luteolysis; Biological action of gonadotropins on gonads; Feed-back control of gametogenesis and endocrine functions of gonads; Photoperiods and grade (nerve pathway of light to pineal gland, synthesis of melatonin and its influence on gonads). **Fertilization:** Molecular mechanism of fertilization; Acrosomal reaction; Chemical, mechanical and immunological method of controlling fertility; *in vitro* fertilization, preservation of gamatesand embryotransfer. **Onset of Puberty:** Reproductive cycles and its hormonal regulation. **Implantation:** Decidualization, function of placenta and foeto- placental unit, placental hormone (synthesis, control, role in foetal life and bioassay of HCG). **Parturition and Lactation:** Regulation of parturition and lactation. Reproduction and Senescence. Principle and Techniques of fertility regulation in male and female.			
301.5	STEM CELL AND DEVELOPMENTAL BIOLOGY Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation, morphogenetic gradients, cell fate and cell lineages, genomic equivalence and cytoplasmic determinants, imprinting, mutants and transgenics in the analysis of development; Gametogenesis, fertilization and early development; Morphogenesis and organogenesis; Programmed cell death, ageing and senescence; Definition and types of stem cell; Genesis and differentiation of stem cells in different organs; Placenta as a source of stem cells and its importance in stem cell research; Stem cells: Applications and future in Modern Biology and Health Sciences.	10	12	
Total		**50**	**60**	**04**
CORE COURSE PG-PHY-CC-302	**SPORTS AND ERGONOMICS AND OCCUPATIONAL HEALTH**	**MARKS**	**CONTACT HRS**	**CREDIT**
302.1	EXERCISE PHYSIOLOGY AND SPORTS Classification of physical exercise, sports, workloads etc. Hematological changes during graded muscular exercise, Oxygen consumption and O_2 pulse during graded muscular exercise. Heart rate, blood pressure, pulmonary ventilation, ventilation equivalent, VE Max, VO_2Max; Alveolar ventilation at different state of breathing. Cardio-respiratory changes in sedentary and trained persons during exercise, Lactic acid concentration and O_2 debt, Nutrition in sports and exercise, Concept of Physical fitness, Physiological effects of doping.	10	12	

302.2	SPORTS MEDICINE AND DRUG ABUSE **Physician's Interest in the Physiology of Exercise –** Historical contributions made by physicians, special qualifications of the physician – Physiologist, the sports physician, present realization of the dynamic view of the patient. **Physical Examination –** Scope of the examination, timing of the examination, interpreting the examination to the subject **Principles of safety in Physical Activity and sports –** Role of conditioning, importance of correct coaching and teaching, the use of protective equipment, following the rules, availability of emergency care. **Management of Illness and Injury sustained in Exercise Activities –** Prompt diagnosis, first –aid procedures, definitive medical care, rehabilitation procedures. **DRUG ABUSE IN SPORTS:** Introduction: Brief history – economic and social causes of drug History of Doping and Dope materials used. Classification of Drugs and Mechanism of action. Dope Methods and Mechanism of action. 10C rules, code of conduct. 10C Forbidden list of Dope materials and techniques ofidentification Drug tolerance, sensitivity and vulnerability**,** Treatment of drug abuse and viable prophylaxes. Remedial Measure and Rehabilitation	10	12	
302.3	INTRODUCTION TO ERGONOMICS AND HUMAN FACTOR Introduction to Ergonomics : Definition and application Work Study: Concept of work study, time measurement; Application of work and motion study. System Design: Concept of system design; Effect of Man, Machine and Environment in System Design; Failure of System – accident. Ergonomics and Safety: Application of Ergonomics for the development of safety; Analysis of accident; Unsafe conditions; Mechanical (engineering) control/protective devices; Personal Protective Device (PPD). Occupational health, Anthropometry: Definition of Anthropometry; Static and Dynamic Anthropometry; Application of Anthropometry in design development	10	12	
302.4	OCCUPATIONAL HEALTH AND PREVENTION OF HEALTHHAZARDS Introduction to occupational health: Concept of Bernardino Ramazzini. Prevention of hazards: Personal Protective Devices: Respiratory protective equipments : Divisions and Uses Industrial ventilation : Local Exhaust System as Engineering control Role of OSHA and NIOSH**:** Prevention and management of occupational health hazards	10	12	
302.5	SPACE AND AVIATION PHYSIOLOGY **Atmospheric requirements of Man in space:** Pressure, O_2, CO_2, Temperature and Relative humidity, Micro- contaminant level, energy requirements, water; Waste removal and/or	10	12	

	storage. **Human tolerances to stresses in space including space flight:** Acceleration, Deceleration, Weightlessness, Thermal Extreme, High 'g', Ionizing Radiation, Meteorites. **The Cabin Atmosphere (Space Craft):** Nutritional problems, Isolation and Sensory Deprivation. General Medical Emergencies.			
Total		**50**	**60**	**04**
CORE COURSE PG-PHY-CC-303	**ADVANCED MOLECULAR BIOLOGY AND RECOMBINANT DNA TECHNOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
303.1	ADVANCED MOLECULAR BIOLOGY **Genetic element and its evolution:** Fundamental aspects: law of DNA constancy and C-value paradox, eukaryotic chromosome Organization; DNA in Molecular Flux: Replication, repair, extrachromosomal replicons. **RNA synthesis and processing:** Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, structure and function of different types of RNA, RNA transport. **Protein synthesis and processing:** Genetic code, translation, effect of antibiotics on protein synthesis, translational proof-reading, translational inhibitors, Post- translational modification of proteins	20	24	
303.2	GENETIC ENGINEERING AND RECOMBINANT DNA TECHNOLOGY Isolation and purification of various RNA, DNA and proteins; different separation methods and principles of nucleic acids and proteins by gel electrophoresis; isoelectric focusing; molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems Expression of recombinant proteins using bacterial, animal and plant vectors; different PCR methods or isolation of specific DNA sequences; generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors; in vitro mutagenesis and deletion techniques; gene knock out in bacterial and eukaryotic organisms Protein sequencing methods, detection of post translational modification of proteins; DNA sequencing and strategies for genomic sequencing, methods for analysis of gene expression at RNA and protein level, large scale expression analysis, such as micro array based techniques; isolation separation and analysis of carbohydrate and lipid molecules; RFLP, RAPD and AFLP techniques.	20	24	
303.3	RADIOLABELING TECHNIQUES Detection and measurement of different types of radioisotopes normally used in biology, incorporation of radioisotopes in biological tissues and cells, molecular imaging of radioactive material, safety guidelines.	10	12	

Total		**50**	**60**	**04**
PG-PHY-DSE-304 (A, B, C and D)	DISCIPLINE SPECIFIC ELECTIVE COURSE(THEORY)* Students will opt DSEC offered by Parent Department	50	60	04
PG-PHY-GE-323	Generic Elective Course **– GE** Physiology Students will opt GE course offered by other Department	**50**	**60**	**04**
Grand Total		**250**	**300**	**20**

	FOURTH SEMESTER			
CORE COURSE PG-PHY-CC-401	**RECENT TRENDS IN PHYSIOLOGY**	**MARKS**	**CONTACT HRS**	**CREDIT**
401.1	TECHNOLOGICAL APPROACHES TO CELL AND TISSUE CULTURE Cell separation by different techniques; *In vitro* cell culture, properties of transformed cells; Cell line, cell clone, cell fusion; Cell and tissue culture media; Gene transfer method in animal cells, transgenic biology; Tissue culture**:** Principle and its practical application, tissue transplantation technique, hybridoma technology	10	12	
401.2	IMMUNOTECHNOLOGY Antibody generation, Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy, detection of molecules in living cells, *in situ* localization by techniques such as FISH and GISH.	10	12	
401.3	TECHNIQUES FOR BIOPHYSICS Molecular analysis using UV/visible, fluorescence, circular dichroism, NMR and ESR spectroscopy; Molecular structure determination using X-ray diffraction and NMR; Molecular analysis using light scattering, different types of mass spectrometry and surface plasma resonance methods; Separating techniques- electrophoresis,chromatography.	10	12	
401.4	NANOTECHNOLOGY AND IT'S PHYSIOLOGICAL APPROACH 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 An overview of scanned probe microscopy and analysis including scanning tunneling microscopy (STM), atomic force microscopy (AFM), and scanning transmission electron microscopy (STEM). Basic idea about the devices to study the molecular interactions that drive the release of chemical messengers; Concept of red-emitting quantum dots and quantum dot-tagged cancer cells; Concept of surface polymerization to generate patterned arrays for binding of biomolecules	10	12	
401.5	BIOINFORMATICS IN PHYSIOLOGY Principles of Genome bioinformatics; Fundamental and applied aspects of genomics and proteomics; Systems biology; The description of biological networks and protein and metabolic gene network modeling; Genomics and its application to health and agriculture, including gene therapy; Emphasis in both topological aspects of networks and their dynamical behavior; Concept of OME and OMics; Techniques applied for OMICS study; Softwares and analysis	10	12	
Total		**50**	**60**	**04**

PG-PHY-CC-402 (P)	**PRACTICAL:** IMMUNOTECHNOLOGY 1. Study of hemagglutination and precipitation reaction (ODD, SRID). 2. Demonstration of ELISA. 3. Separation of human lymphocytes, monocytes and neutrophils from whole blood 4. Agarose Gel electrophoresis 5. Separation of serum proteins by polyacrylamide gel electrophoresis. APPLICATIONS OF BIOINFORMATICS: 1.NCBI blast analysis 2.Analysis of DNA and Protein sequences, development of phylogenetic tree using BioEdit, MEGA, Clustal Omega Softwares and analysis	25	30	02
PG-PHY-DSE-403 (A, B, C and D)	DISCIPLINE SPECIFIC ELECTIVE COURSE(THEORY)* Students will opt DSEC offered by Parent Department	50	60	04
PG-PHY-DSE-404 (PA, PB, PC and PD)	DISCIPLINE SPECIFIC ELECTIVE COURSE(PRACTICAL)* Students will opt DSEC offered by Parent Department	50	60	04
PG-PHY-DSE-405 (PA, PB, PC and PD)	DISCIPLINE SPECIFIC ELECTIVE COURSE(PROJECT AND SEMINAR)* Students will opt DSEC offered by Parent Department	50	60	04
PG-PHY- AO	Add on Course– AO Physiology Students will opt AO course offered by Parent Department	**25**	**30**	**02**
Grand Total		**250**	**300**	**20**
Post Graduate Grand Total		**1000**	**1200**	**80**
	LIST of DISCIPLINE SPECIFIC ELECTIVE COURSES(DSEC): • Endocrinology and Reproductive Physiology • Microbiology and Immunology • Environmental Physiology • Occupational Health, Ergonomics and Work Physiology			

COURSE OFFERED BY PHYSIOLOGY DEPARTMENT FOR STUDENTS OF OTHER DEPARTMENTS

Paper: System Physiology
Paper Code: PG-PHY- GE-323

[one paper for 50 marks in 3rd Semester as draft syllabus for Generic Elective course offered by the Dept. of Physiology; each module carry 10 marks; 5x10 = 50 marks; Credit - 04]

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, electrical axis, normal and abnormal ECG, generation of ECG waves.

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.

Detailed Syllabus of Add on course (AO)

COURSE OFFERED BY PHYSIOLOGY DEPARTMENT FOR STUDENTS OF PHYSIOLOGY DEPARTMENTS

Paper: Public Health
Paper Code: PG-PHY- AO

[One paper for 25 marks in 4th Semester as draft syllabus for AO course offered by the Dept. of Physiology; Marks-25; Credit - 02]

Public Health Survey: Epidemiological and community health based field survey/study (including preparation of survey sheet; methodology; project report writing etc.)

DETAILED SYLLABUS

OF
DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)

COURSE OFFERED BY PHYSIOLOGY DEPARTMENT FOR STUDENTS OF PHYSIOLOGY DEPARTMENTS

Paper: PG-PHY-DSE -304 (A, B, C and D), PG-PHY-DSE-403 (A, B, C and D), PG-PHY-DSE - 404 (PA, PB, PC and PD), PG-PHY-DSE-405 (PA, PB, PC and PD)

ENDOCRINOLOGY AND REPRODUCTIVE PHYSIOLOGY				
PG-PHY-DSE-304 (A)	**THEORETICAL: MOLECULAR ENDOCRINOLOGY**	**Marks**	**Contact Hrs**	**Credit**
304.1**ER**	Discovery of hormones as chemical signals for control and regulation of physiology processes. Techniques for quantitation of hormones; RIA, immunoradiomertic assays (IRNA), immonochemilumetric assays (ICMAS),radioreceptor assays, functional hormone bioassays; Statistical procedure for immunoassay data-deduction, design and development of hormone assays	10	12	
304.2**ER**	Structure of peptide and protein hormones; Purification and characterization of hormones; Structural-functional relationship in different hormones. Phylogenic analysis of hormone structure and function, pharmokinetics of hormones	10	12	
304.3**ER**	Genetic control of hormone formation: Subcellular structure of cells that secrete protein hormones, storage and secretion of hormones – molecular mechanism ofregulation; Structure of a gene encoding a polypeptide hormone; Regulation of gene expression: Transcriptional and post transcriptional mechanisms of hormone biosynthesis and secretion; Hormonal genes and hormone regulated genes in the context of biosynthesis; Inhibitors of biosynthesis and their use; Metabolism of hormones by target and non-target tissues.	10	12	
304.4**ER**	Discovery of receptors in target tissues; Biochemistry and molecular biology of steroid receptors, hormonal control of gene expression, RNA synthesis, RNA stability and steroid hormone action. Hormones that act at the cell surface: Mechanism of hormonal action and signal attenuation; Signal discrimination, signal transduction and signal amplification in hormone regulated physiological processes;Receptor antagonists and their applications.	10	12	
304.5**ER**	Autoimmunity and endocrine disorders – generation of specificity, recognition of antigens, tolerance of self antigens, mechanism of autoimmunity, genetics of autoimmunity, non-endocrine function of endocrine molecules, non- conventional endocrine molecules in health and disease; Endocrine disruption.	10	12	
Total		**50**	**60**	**04**
PG-PHY-DSE-403 (A)	**THEORETICAL: NEUROENDOCRINOLOGY/ REPRODUCTIVE PHYSIOLOGY**			
403.1**ER**	Neuroendocrinology – neuronal control of glandular secretion;	10	12	

	hypothalamic-pituitary unit; Regulation of secretion of tuberohypophysial hormones; Feedback concept in neuroendocrinology: Neuroendocrine control of pituitary hormones; Pineal gland; Circumventricular organs, neuroendocrine disorders, neuro-endocrine-immune interaction; Neurone as target cells for hormone action, neuronal modification of hormone metabolism and regulation of neuronal function – effect of ion channels, electrical events			
403.2**ER**	Sex determination and differentiation – mechanism of determination and sexual differentiation – differentiation of gonads and differentiation of genital tract; Male reproductive system: an overview of male reproductive physiology. Male sterility, Azoospermia, Oligozoospermia, Asthenzoospermia, varicocele, genetic basis of male infertility.	10	12	
403.3**ER**	Female reproductive system: An overview of female reproductive physiology; Puberty, folliculogenesis, ovulation, lutenization, lutelysis, follicular atresia.	10	12	
403.4**ER**	Fertilization, capacitation, acrosomic reaction, sperm-egg fusion, activation of eggs, prevention of polyspermy, implantation, parturition and lactation; Contraception leading to prevention of fertilization – surgical, hormonal and immuno contraception.	10	12	
403.5**ER**	Reproductive senescence: male and female designing experiments for the study of breeding and fertility – breeding of laboratory animals; Principle and techniques of animal cloning	10	12	
Total		50	60	04
PG-PHY-DSE-404 (PA)	**PRACTICAL**	50	60	04
	I. Surgical Techniques 1. Thyroidectomy 2. Adrenalectomy 3. Ovariectomy 4. Castration 5. Pancreatectomy 6. Cryptorchidism II. Histological biochemical technique 1. Study of estrous cycle after unilateral and bilateral ovariectomy with and without estrogen treatment 2. Compensatory hypertrophy of adrenal and thyroid gland after unilateral adrenal and thyroidectomy 3. Compensatory hypertrophy of testis after unilateral castration 4. Studies on thyroid gland in hypo and hyperthyroid condition 5. DNA and chromosomal studies in endocrine disorders 6. Basic studies on Immunocytochemistry in hypo and hyper active conditions of endocrine glands 7. Studies of certain enzymes of TCA cycle and steroidogenic pathway in adrenal glands 8. Sperm count and motility and effect of some antifertility agents			
	Biochemical techniques I 1. Estimation of Ascorbic acid, Cholesterol, Blood Glucose, and Glycogen levels under experimental conditions 2. Determination of serum sodium in experimental			

	condition. 3. Chromatographic separation of amino acids/ peptides. Biochemical techniques II 1. Bioassay of oxytocin on rat's uterine contraction 2. Bioassay of adrenaline on rat's intestinal contraction 3. Bioassay of adrenaline on blood pressure of cat Assay of any one hormone by RIA/ELISA for which facility exists			
PG-PHY-DSE-405 (PA)	**PROJECT AND SEMINAR**	50	60	04
MICROBIOLOGY AND IMMUNOLOGY				
PG-PHY-DSE -304 (B)	**THEORETICAL: MICROBES AND MICROBIAL GENETICS**	50	60	04
304.1 **M**	**Microbial Infection (bacteria, viruses and parasites) and Phage genetics** Host-parasite interaction: Recognition and entry processes of different pathogens like bacteria and parasites into animal and plant host cells. Entry, replication and egress of DNA and RNA viruses. Lytic and lysogenic cycles of bacteriophage; Virulent and Temperate phage, Prophage; Study of plaque morphology; mapping of phage chromosome by phage crosses.	10	12	
304.2 **M**	**Bacterial Genetics and Transfer of genetic material** Growth yield and characteristics, strategies of cell division; Chromosome and plasmids; Genetic recombination, methods of genetic transfers – transformation, conjugation and transduction; Molecular mechanism of crossing over, gene conversion, chromosome mapping, the yeast genetics, repetitive DNA, satellite DNAs, DNA renaturation kinetics, stress response	10	12	
304.3 **M**	**Regulation of Gene Expression and Operons** DNA binding motifs, the regulation of expression of phages, viruses, prokaryotic and eukaryotic genes; Role of chromatin in gene expression and gene silencing; RNA in regulation of gene expression: Attenuation, anti- sense RNA, RNAi, micro RNA, concept of operons: *lac* operon, *trp* operon, arabinose operon	10	12	
304.4 **M**	**Antimicrobials and Transposable Genetic Elements** Antibacterial, Antifungal, Antiviral agents; Molecular and genetic basis of antibiotic action and resistance; Discovery of transposable elements, transposable elements in bact and eukaryotes, genetic significance; Mutation and genetic analysis; Homologous non-homologous recombination including transposition, evolutionary significance of transposable elements, role of transposable elements in the dissemination of antibiotic resistance	10	12	
304.5 **M**	**Advanced Microbiology and Biotechnology** Bacterial photosynthesis, biogeochemical cycling of sulfur and nitrogen; Bioremediation and phytoremediation; Microbes in decomposition and recycling processes, symbiotic and asymbiotic N_2-fixation; Applications of biofermenter and biofertilizer ; Microbial technology: Fermentation technology, production of ethanol, penicillin and other antibiotics,	10	12	

	microbial-insecticides, enzymes, amino acids etc. and application in industry: Use of microorganisms in pollution control (hydrocarbons, oils, heavy metals), biopolymers, biosensors, biopesticides and biofuels; Linkage, mapping of genes by interrupted mating; Microbes and recombinant DNA technology, practical application in various life processes, study of virulence;			
PG-PHY-DSE -403 (B)	**THEORETICAL: IMMUNOLOGY**	50	60	04
403.1**I**	**Immune system** Innate immune response, adaptive immune response, B and T cell activation, complement pathway, inflammation, role of interleukins, adhesion molecules, leukocyte recruitment, hypersensitivity, immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections, congenital and acquired immunodeficiencies	10	12	
403.2 **I**	**Molecular Basis of Autoimmune Disease** Clonal selection hypothesis and problem of immunological tolerance, clonal and peripheral tolerance mechanisms, experimental approaches to study of T-cell tolerance, breakdown of tolerance and autoimmune disease	10	12	
403.3 **I**	**Tumor and Transplantation Immunology** Oncogene and cancer induction, tumor antigens, signals for cell cycle regulation, cell death, survival and apoptosis in the immune system, immunotherapy; Distribution, structure, function and genetic control of MHC, glycoproteins; HLA typing; Mechanisms of graft rejection; Basic concept of bone marrow transplantation; Foetus as an allograft and survival of foetus against maternal graft rejection mechanisms	10	12	
403.4 **I**	**The Biotechnological Approach to Vaccine Development** Genetic attenuation of pathogens, attenuated pathogens as vectors for heterogeneous antigens, genetic attenuation of bacterial toxins, DNA vaccination, trans-cutaneous immunization, expression of microbial pathogens in plants (edible vaccines), transgenic and knock-out mice, application of transgenic animals	10	12	
403.5 **I**	**Immunological Methods** Ouchterlony double diffusion (ODD), single radial immune diffusion (SRID); Detection of molecules using ELISA, RIA, western blot, immunoprecipitation, flow cytometry and immunofluorescence microscopy, detection of molecules in living cells, monoclonal antibodies, antibody engineering	10	12	
PG-PHY-DSE -404 (PB)	**PRACTICAL**	50	60	04
	Experiments on Microbiology 1. Isolation and enumeration of a pure culture from mixed bacterial culture by i) Streaking, ii) pour plate, iii) Spread plate techniques. 2. Isolation of fungi and bacteria from natural sources. 3. Isolation of spore forming, lactose fermenting bacteria from natural sources. 4. Study of lytic and lysogenic cycle of bacteriophage by plaque assay			

	5. Determination of antibiotic susceptibility and minimum inhibitory concentration (MIC) of an antibiotic 6. Isolation of genomic DNA from bacterial cell, isolation and agarose gel electrophoresis of a plasmid DNA from bacteria (Demonstration only). 7. Characterization of organism by Urease, hemolysin, protease, gilatinase production ability. 8. Studies on enzyme kinetics and determination of Michelis – Menten constant (Km.). 9. Demonstration of PCR			
	Experiments on Immunology 6. Preparation of antiserum against BSA as soluble antigen and determination of antibody titer. 7. Study of antigen-antibody reaction by agglutination, hemagglutination and precipitation reaction (ODD, SRID). 8. Demonstration of ELISA. 9. Study of cell mediated immune response by delayed type of hypersensitivity reaction. 10. Separation of human lymphocytes, monocytes and neutrophils from whole blood 11. Isolation of murine splenic and peritoneal macrophages; Assessment of murine macrophage functions: Phagocytosis, bacterial killing, bactericidal enzyme (Lysozyme) release, tests for intracellular killing, respiratory burst response. 12. Western blot (demonstration only). 13. Separation of serum proteins by polyacrylamide gel electrophoresis.			
PG-PHY-DSE -405 (PB)	**PROJECT AND SEMINAR**	50	60	04
ENVIRONMENTAL PHYSIOLOGY				
PG-PHY-DSE -304 (C)	**THEORETICAL**	50	60L	04
304.1 **EP**	**Human and Environment** Definition and types: Natural, domesticated, fabricated, and social. Components of human environment. Biological and Physiological environment. Basic concept on changes in the environment caused by human.	10	12	
304.2 **EP**	**Human population and its Physiological Control** Position of human in biological environment. Evolution and features of modern man. Human population : Definition, population growth rate, factors controlling population growth rate, World distribution of population, growth curves, survival curves of human, family planning- hormonal and immunological. Population genetics and society	10	12	
304.3 **EP**	**Principles of Ecosystem** Ecosystem: Definition and anatomy, habitat, niche, ecological equivalents, food chain,food webs, flow of matter and energy. Terestrial biomes: Taiga, tundra, tropical rain forest, savanna,	10	12	

	and deserts. Marine biomes. Biogeochemical cycle: Carbon cycle- major sinks for CO_2; N_2 -cycle: biological fixations(Half cell reaction), denitrifications.			
304.4 **EP**	**Natural Resources** Air: Components, human interactions: Respiration, concept of atmosphere, atmospheric division, stratopheric ozone layer and its importance. Water: Fresh water- sources and uses, acquifers, oceans and rivers as beneficialresources to mankind. Top soil: Definition, components, types, origin and importance. Minerals: Nature and types, mineral resources of India. Living resources: Biodiversity – plants and animal resources and their use, wild life,medicinal plants, petrocrops.	10	12	
304.5 **EP**	**Energy Resources** Conventional: Non-renewable- coal, petroleum, natural gas; Renewable- hydel power, atomic energy; Fission and fusion atomic technologies. Non-conventional: Renewable- solar energy, wind energy, geothermal energy, tidalenergy, OTEC. Biofuels. Petrocrops.	10	12	
PG-PHY-DSE -403 (C)	**THEORETICAL**	50	60L	04
403.1 **EP**	**Physiological Toxicology** Principle of toxicology: Toxins, mode of action of toxins, factors affecting toxicity: Dose and duration, dose- response curve, LD_{50}, LOD_{50}, threshold level, NOEL; biological effects; Acute and chronic- mutation, cancer, birth defects (teratogenicity). Bio-accumulation and biomagnifications of xenobiotics. Health hazards of pesticides, dioxin, PCB and PAH. Occupational health hazards: Pneumoconiosis, asbestosis, silicosis. Reproductive toxins. Nerve gases: examples and health hazards	10	12	
403.2 **EP**	**Environmental and Public Health** Definition: Hygiene, health and public health. Air, water, food borne diseases: Causes, symptoms, and control. Food additives and adulterants: Definition, examples and human health hazards. Vector borne epidemic diseases: Malaria and plague- etiology and control.	10	12	
403.3 **EP**	**Environmental pollution and human health hazards** Air Pollution: Definition, sources, air pollutants, effects of air pollution on human health, indoor air pollution, environmental tobacco smokes (ETS) and human health hazards, phenomenon of photochemical smog, acid rain; Ozone layer depletion- causes and human health hazards, concepts of ozone hole; Enhanced green house effects and globalwarming; Consequences of global warming on human environment. Water Pollution: Definition, types, health hazards, water pollutants, eutrophication, biochemical oxygen demand (BOD), thermal pollution, chemical pollution- Minamata and	10	12	

	Itai- Itai disaster, oil pollution, plastic pollution, concept of safe drinking water standards,biomagnifications of xenobiotics in aquatic food chains. Soil Pollution: Causes, health hazards, solid waste managments- bioremediation, phytoremediation. Sound Pollution: Definition, concept of noise, sources of sound pollution, effects of sound pollution on human health, noise index (noise standards). Radionuclide Pollution: Radiation types sources, 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. Legal and technological control measures for pollution.			
403.4 **EP**	**Environmental Management** Environmental ethics. GIS, remote sensing to monitor environmental degradation. Sustainable use of natural resources: water, topsoil, minerals, living resources. Conservation of topsoil, ground water and wild lives; Rain water harvesting; sanctuary,national park; Biosphere reserve; Wildlife (conservation) act 1992. Environmental conflicts.	10	12	
403.5 **EP**	**ENVIRONMENTAL ISSUES : Current concerns** Greenhouse gases and global warming, Ozone depletion and its impact onglobal climate, Temperature inversion. Impact on community of global warming, Outbreak of new diseases due toclimate change phenomenon. Environmental safety-Oil Spills. Natural disasters. Bhopal, Chernobyl.	10	12	
PG-PHY-DSE -404 (PC)	**PRACTICAL**	50	60	04
	Bio- chemical Experiments Estimation of serum calcium by Kramer and Tisdall method of the animals exposed by ETS,and smoker and non-smoker hum Estimation of blood glucose by Nelson Somogy method after chronic exposure of the animalsby tobacco smoke/smokers and non- smokers. Estimation of SGOT and SGPT values. Measurement of Dissolved oxygen (DO) and Biochemical Oxygen Demand (BOD) in watersamples. Measurements of chloride in water samples by Silver nitrate method. Measurements of nitrate in water sample by PDA method. Biochemical identification of food additives in some common food Kymographic recording of the effects of Hg, Pb, and As compounds; and food additives(Metanil yellow, Rhodamin B, and TOCP) on i. The contraction of perfused heart of toad. ii. The contraction (isometric) of isolated Gastrocnemius muscle of toad. iii. The motility of intestinal movements of rats in Dale's bath.			

PG-PHY-DSE -405 (PC)	**PROJECT AND SEMINAR**	50	60	04
OCCUPATIONAL HEALTH, ERGONOMICS ANDWORK PHYSIOLOGY				
PG-PHY-DSE -304 (D)	**THEORETICAL**	50	60L	04
304.1OEW	**INTRODUCTION TO ERGONOMICS and PRINCIPLES OF TECHNIQUES USED IN ERGONOMICS** **Introduction To Ergonomics: Definition, Origin, Development, Benefits** Historical background, development of ergonomics; Definition and scope of ergonomics; Aims, objectives and benefits of ergonomics; The role of the ergonomist; Fitting the job to the person vs. fitting the person to the job. Principles of instrumentation in Ergonomics and WorkPhysiology. Principles of measurement of temperature, dB, etc.; Force Measurement: push-pull force gauges and dynamometers, torque gauges, hand dynamometers, muscle strength measurement systems; Radio and Infra-red telemetry, Heart rate monitors; Cardio-respiratory test systems;	10	12	
	EMG and Physiological Data Acquisition Systems; Nerve conduction velocity – measurement and interpretation. Motion Analysis and Improvement, Motion Capture Systems andMovement Analysis, Pressure Mapping; Eye movement recording; 3-D imaging; Calibration. Questionnaires, interviews in assessment Measurement of human performance, Methods in IndustrialErgonomics Computer application for management and statistical treatmentof ergonomics and work physiology related data; Computer programming (BASIC / FORTRAN); Image editing, Spreadsheet analysis, Graphs and charts, Presentations. Computerized systems, Mathematical and digital human modeling			
304.2OEW	**ANTHROPOMETRY AND PRINCIPLES OF DESIGN FOR HUMAN BENEFIT** Physical dimensions of the human body as a working machine, static and dynamic body measurements, size and motion relationship; Application of anthropometry in the design of seats, furniture,clothing, consumer products, etc., Percentiles; Body segment data – length, weight, mass centre, etc.; Somatotyping, measurement of body composition, body fat, lean body mass, and their relation to human performance in sports and industry. **A.** Design Design characteristics of controls (shape, size, color, layout)and effect on performance;	10	12	

	Design characteristics of visual, auditory and other displays, quantitative and qualitative information, multiple displays and layout; Compatibility and population stereotypes; Warnings, signs and labels; Continuous control/tracking, simulators, control roomergonomics; Designing for special populations; Work-station evaluation, designing an efficient and ergonomic work station. **B.** Cognitive Ergonomics Cognitive Ergonomics - information processing, memory, situation awareness, attention			
304.3OEW	BIOENERGETICS and BIOMECHNICS in ERGONOMICS **A.** Biochemistry and bioenergetics of muscular contraction and relaxation, fuel for muscular work; 1. Aerobic work, classification of workloads, maximum aerobic power; Anaerobic work, oxygen debt, lactic acid production, maximum anaerobic power; 2. Measurement of Maximal Physical Work Capacity using graded sub-maximal and maximal dynamic exercise; 3. Effect of different factors (age, sex, body build, nutrition, smoking, etc.) on performance; 4. Absolute and Relative Cardiac Cost, Energy cost of different activities; Work demand and individual capacity, Relative AerobicStrain, Occupational Work Capacity (OWC) Acceptable Work Load (AWL); 6. Fitness for health and work; 7. Fatigue – mechanism of development, measurement, and prevention. B. Anatomical and biomechanical considerations of the human musculo-skeletal system; 1. Angular motion of limbs, goniometry, range of motion; 2. Muscle strength evaluation; 3. Power and precision grips, power assisted controls; 4. Forces and moments at L5/S1 level, physiology of back pain; 5. Static and dynamic multi-link biomechanical models in 2D and3D. Analysis of motion and gait using force platforms and digital motion capture and analysis systems.	10	12	
304.4OEW	OCCUPATIONAL ERGONOMICS ***A. System Analysis*** Man as a system component, allocation of functions; Job /Task analysis, Methods of job/task analysis; Human error, methods of estimating human error, HumanReliability analysis. ***B. Musculo- Skeletal Disorders*** Work Related Upper Limb Disorders (WRULD), Work Related Upper Extremity Musculo Skeletal	10	12	

	Disorders (WRUEMSD), Cumulative Trauma Disorder (CTD); Repetitive Stress Injuries (RSI); Body components at risk, Anatomical and biomechanical aspects of causation, Occupational and Non-Occupational factors, specific disorders; Standardised Questionnaires, Prevention. ***C. Manual Material Handling*** Manual material handling, lifting and carrying loads; Personal and job risk factors, Intra Abdominal Pressure (IAP);NIOSH guidelines and equation; Back braces / belts; Design of material handling tasks, Assist devices, "Zero lift"programmes. *Posture* Biomechanics of the sitting posture; Pressure distribution, postural sway; Observational and descriptive methods, measurement of post discomfort.			
304.5OEW	**PSYCHO-PHYSIOLOGY OF WORK** Occupational Stress - causes, effects and preventive measures; Learning time, learning curve, problems of Ageing and compensatory measures; Inspection / sustained alertness (vigilance) tasks – industrial inspection, radar operators, locomotive drivers; Mental fatigue and loading, Simple and Choice Reaction Time, Critical FlickerFusion Frequency, Sinus Arrhythmia, Secondary Task; Rating of Perceived Exertion (RPE), BORG Scale; Virtual environments; Human visual, auditory, tactile, and vestibular sense organs and sensory perception; Auditory System: Sound detection, transmission; Visual ergonomics, visual acuity and color vision, lighting levels, contrast and glare, reflections and flicker, effect of color monochromatic light on industrial performance, lighting standards	10	12	
PG-PHY-DSE - 403(D)	**THEORETICAL**	50	60L	04
403.1 OEW	**OCCUPATIONAL PHYSIOLOGY AND DISEASES** Physical and chemical aspects of work environment Thermal work environment - heat balance, measurement, indices, body temperature regulation and acclimatization, clothing, subjective assessments - thermal comfort and discomfort, heat disorders, thermal protective suiting. Work environmental Noise – Continuous noise, impulse noise, Continuous equivalent levels (Leq), weighting networks (dBA), standards, exchange rate, audiometry, Noise Induced Hearing Loss (NIHL), Hearing Conservation Programmes (HCP), distraction, annoyance and emergency signals, effect of noise on performance, Non-auditory effects of noise exposure. Vibration - Whole Body vibration, Hand Arm vibration, vibration criteria (Reduced Comfort, Fatigue and Decreased Proficiency, Exposure Limit), effects of vibration on the human body, vibration units weighting networks, vibration standards, measurement and control. Ionising and Non-Ionising Radiations in the work environment. long-term and short-term effects, genetic and somatic effects; maximum exposure standards andmethods of control. Chemical aspects of the work environment - dust, fumes, vapours,	10	12	

	gases, etc., work rate Maximum Allowable Concentration (MAC), Threshold Limit Value (TLV) and Short Term Exposure Limit (STEL), synergism, effect of OCCUPATIONAL DISEASES**:** Occupational lung and other diseases (asbestosis, byssinosis, silicosis, etc.)			
403.2 OEW	**PERFORMANCE IN ADVERSE CONDITIONS** Physiology in High Altitude, Space, Aquatic, Desert and Arctic conditions. Effects of high and low barometric pressures, physiological adaptation of high altitude dwellers, physiology of mountaineering, High Altitude Pulmonary Oedema (HAPO); Effects of acceleration and deceleration, positive and negative G forces, weightlessness and performance, gravitational cues; Physiology of deep-sea diving, problems of pressurization and decompression, Caisson disease and its prevention; phenomena of sensory deprivation; Heat and water regulation, nutrition and performance in desert and arctic climates; Protection against climatic extremes.	10	12	
403.3 OEW	**ERGONOMICS FOR SAFETY, LOSS PREVENTION** Safety and Ergonomics Accident: definition, types, impact, theories ;Ergonomics in Use of PPE Ergonomics in prevention and management of accidents, Case Studies Ergonomics in Risk Mitigation and Hazard control	10	12	
403.4 OEW	**PRINCIPLES OF MANGEMENT AND TECHNOLOGY INERGONOMICS** **A. Ergonomics in management of human resources** Selection, placement, training of HR; Motivation of HR Job evaluation, analysis, design, enrichment, rotation; Work-rest schedules, rationalization; Cost Benefit analysis Shift work – zeitgebers, circadian rhythms, effects, alternate shift systems, off-shore and on-shore patterns. **B. Work study: Principles of Industrial, Production andReliability Engineering in Ergonomics** Method Study, Work Measurement Process chart, Double handedProcess chart	10	12	
403.5 OEW	**NATIONAL , INTERNATIONAL REGULATIONS ANDSTANDARDSRELATED TO ERGONOMICS AND OCCUPATIONAL HEALTH** ILO WHO conventions Factories Act and Rules made the reunderEnvironment (Protection) Act and Rules Workmen Compensation Act Ergonomics related ISO standards; Occupational Health and Safety Management System	10	12	

	Standards(OHSAS), ergonomics requirements in OHSAS			
PG-PHY-DSE -404 (PD)	**PRACTICAL**	50	60	04
	1. Experiments on the principles of instrumentation for measurements of different parameters. 2. Determination of body dimensions by anthropometric equipment. "Workshop" on the design of seat, work space, etc. Determination of body composition. 3. Experiments with the actions of muscles, use of goniometer, dynamometer, etc.; location of motor points; velocity off nerve impulse. 4. Ergonomic evaluation of the design of different control knobs, hand tools (screw drivers, pliers,scissors), etc. 5. Experiments on taking different physiological responses (heart rate, blood pressure, respiratory rate, pulmonary ventilation, oxygen consumption, sweat rate, oral, aural, rectal and skin temperatures) during graded work on step test, bicycle ergometer, treadmill tests, etc. – Use of gas analysis apparatus, aerobic and anaerobic power – oxygen debt;			
PG-PHY-DSE -405 (PD)	**PROJECT AND SEMINAR**	50	60	04

BOOK LIST

Name of Books	Name of the Authors
Molecular biology of The Cell	Alberts
Text Book of Endocrinology	Williams
Molecular biology of The Gene	Watson
Cell and molecular Biology	Karps
Principles of Biochemistry	Lehninger
Biochemistry	Voet and Voet
Principles of genetics	Snustad
Developmental Biology	Gilbert
Physiology of Reproduction	Ernst Knobil and Jimmy D.Neill
Immunology	Kuby
Microbiology	Prescott`s
Occupational Biomechanics	Don B.Chaffin, Gunnar B.J.Andersson, Bemard J.Martin
iGenetics A Molecular Approach	Peter J.Russell
Lewin`s GENES	Jocelyn E.Krebs, Elliott S.Goldstein, Stephen T.Kelpatrick
Principles of Toxicology (Environmental and industrial application)	Stephen M. Roberts, Robert C.James, Phillip L.Williams
Handbook of Human Factors and Ergonomics	Gavriel Salvendy
Bioinformatics	Arthur M.Lesk
Introduction to Bioinformatics	Anna Tramontano
Bioinformatics principles and application	Zhumur Ghosh, Bibekanand Mallick
Bioinformatics A Practical Guide to the analysis of genes and proteins	Andreas D.Baxevanis, B.F.Franus ouellette
Essential Bioinfarmatics	Jin Xiong
Bioinformatics Data bases Tools and Algorithms	Orpita Basu andSimminder Kaur Thukral
Yen and Jaffe`s Reproductive Endocrinology	Strauss and Barbieri
Exercise Physiology	William D.Mcardle, Frank I.Katch, Victor L.Katch
Evolution	Monroc M Strickberger
Molecular Biotechnology (principles and Application of Recombinant DNA)	Bernard R. Glick, Cheryl L.Patten
Physiology Berne and Levy	Bruce M. Koeppen, Bruce A.Stanton
Life: The Science of Biology	David Hillis, H. Craig Heller, Sally D. Hacker, Dave Hall, David Sadava, Marta Laskowski,
Fundamental of toxicology	Dr. Kamaleshwar Pandey, Dr. JP Shula, Dr. SP Trivedi
Environmental science	Y K Singh
Animal behavior	John Alcock
Animal behaviour	Dr. Reena Mathur

Brock Biology Of Microorganisms	Madigan Michael T. (Author), Martinko John M. (Author), Bender Kelly S. (Author)

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