

SYLLABUS FOR Ph.D. COURSE WORK IN PHYSIOLOGY
(For Session 2020-2022 Onwards)



DEPARTMENT OF PHYSIOLOGY
The University of Burdwan
Burdwan 713104
West Bengal

Course Structure

Semester	Course Code	Courses	Marks	Credits
I	PHSPY-101	Research Methodology	50	4
	PHSPY-102	Research & Publication Ethics	25	2
	PHSPY-103	Physiology and Allied Sciences	50	4
	PHSPY104	Term paper(s) & Seminar presentation (s)	50 (25 + 25)	4
		Total		175

SEM- I

COURSE: PHSPY- 101

Credit: 4

RESEARCH METHODOLOGY

Time: 2 hrs.

Lectures: 35

Full marks: 50

Five questions (out of eight) of 1 marks each, two questions (out of two) of 5 marks each and one question (out of two) of 10 marks each are to be answered

Computer Applications and Biostatistics: basic architecture of computer, software and programming language: machine language; assembly language; high level language; (fortran, cobol, c++, unix, basic), statistical packages, simulation & modeling of physiological problems. some utility software for life sciences research, application of computer for solving physiological problems; testing of hypothesis; probability distributions; confidence interval; errors; levels of significance, t-test, z test, nonparametric statistics, correlations, regressions, analysis of variances, chi square test, basic introduction to multivariate statistics, applications of statistical principles in physiological problems.

Molecular Biology and Recombinant DNA methods: Isolation and purification of RNA , DNA (genomic and plasmid) and proteins, different separation methods. Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels. Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors. Isolation of specific nucleic acid sequences Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors. In vitro mutagenesis and deletion techniques, gene knockout in bacterial and eukaryotic organisms. Protein sequencing methods, detection of post translational modification of proteins. DNA sequencing methods, strategies for genome sequencing. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as microarray based techniques Isolation, separation and analysis of carbohydrate and lipid molecules RFLP, RAPD and AFLP techniques

Histochemical and Immunotechniques: 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.

Biophysical Method: 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.

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.

Microscopic techniques: Visualisation of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes, different fixation and staining techniques for EM, freeze-etch and freeze fracture methods for EM, image processing methods in microscopy.

Electrophysiological methods: Single neuron recording, patch-clamp recording, ECG, Brain activity recording, lesion and stimulation of brain, pharmacological testing, PET, MRI, fMRI, CAT

Methods in field biology: Methods of estimating population density of animals and plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behaviour, habitat characterization: ground and remote sensing methods

COURSE: PHSPY- 102

Credit: 2

RESEARCH AND PUBLICATION ETHICS

Time: 1 hr.

Lectures:18

Full marks: 25

Five questions (out of eight) of 1 marks each, two questions (out of two) of 5 marks each and one question (out of two) of 10 marks each are to be answered

THEORY

Types of Research: Academic Research , Educational Research hypothesis, Characteristics and Framing of Hypothesis, Variables In Educational Research, Research schedule and Framing of Questionnaire, Importance of Literature Review in Physical Education Researches, Research methods versus methodology

Philosophy and Ethics: Introduction to Philosophy: definition, nature and scope, concept, branches; Ethics: Definition, moral philosophy, nature of moral judgments and reactions

Ethics of Research and Conduct: Ethical Principles in Scientific Research, Ethical Ethos, Intellectual honesty and research integrity, Supervisor-Student Relationship, Problems and responsibilities of researchers, interaction with research participants, Beneficence, honesty and justice, prior information and research consent, integrity of research, confidentiality and data protection

Scientific misconducts: Falsification, Fabrication and Plagiarism (FFP); Redundant publications: duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data, data reproduction and data manipulation, image manipulation and duplication, Plagiarism- Categories, Softwares for plagiarism detection and their uses

Ethics committees: types, framing of Ethical committees , duties and responsibilities, research misconduct, integrity of research, confidentiality and data protection

Publication Ethics: Definition, introduction and importance; Ethical Principles for Scholarly Publication, Best practices/standards setting initiatives and guidelines: COPE, COPE, WAME, STM, etc.; Conflicts of interest; Publication misconduct: Definition, concept, problems that lead to unethical behavior and vice versa, types; Violation of publication ethics, authorship and contributorship; Identification of publication misconduct, complaints and appeals; Predatory publishers and journals, duplicate publication / submission and Citation Manipulation, Authorship, Significance of Acknowledgement

PRACTICE

Open Access Publishing: Open access publications and initiatives; SHERPA/RoMEO online resource to check publisher copyright & self-archiving policies; Software tool to identify predatory publications developed by SPPU: UGC-CARE list of journals; Journal finder/journal suggestion tools viz. JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Publication Misconduct: **A. Group discussions**–Subject specific ethical issues, FFP, authorship; Conflicts of interest; Complaints and appeals: examples and fraud from India and abroad; **B. Software tools** – Use of plagiarism software like Turnitin, Urkund and other open source software tools

Databases and research metrics: **A. Databases**– Indexing databases; Citation databases: Web of Science, Scopus etc.; **B. Research Metrics**– Impact factor of journal as per Journal Citation Report, SNIP, SJR, IPP, CiteScore; Metrics: h-index, g-index,i-10 index, altmetrics

COURSE: PHSPY- 103

Credit: 4

PHYSIOLOGY AND ALLIED SCIENCES

Time: 2 hrs.

Lectures: 35

Full marks: 50

Five questions (out of eight) of 1 marks each, two questions (out of two) of 5 marks each and one question (out of two) of 10 marks each are to be answered

Cellular & Molecular Physiology, Immune Biology: Cell to cell communication and cell signalling, check points and regulation of cell cycle, cancer, protein folding and higher order structures, Ramachandran plot, protein sequencing, proteomics, enzyme kinetics, enzyme regulation technical approach to the study of enzyme activities; purification and characterization of enzymes; clinical enzymology, diagnostic and therapeutic uses of enzymes, genome size, C-value paradox, catenation and decatenation of DNA, regulation of transcription and translation, DNA sequencing, amplification, epigenetics, genomics and applications, thermodynamics and energetics, redox potential and Electron transport chain, Molecular basis of hormonal signalling, hormone assay, Immune system and antigen presentation, antibody diversity, cellular and molecular interaction during induction of immune responses, immunodiagnosics, immunity to infectious diseases, hypersensitivity vaccine development, immune response to inflammatory reaction and role of interleukins

Biotechnology: Fermentation technology, production of ethanol, penicillin and other antibiotics, microbial-insecticides, enzymes, amino acids etc. and application in industry. Use of microorganisms in pollution control. Enzyme biotechnology: Immobilized enzymes and its application in industry. Principles of protein engineering. Biotechnology as applied to Immunology

Human genetics: Organisation of human chromosomes; Inheritance; Genes in the Kinds and in the individuals: Genetic variations, genetic factors in diseases, Pedigree analysis; Immunogenetics; Genes in Development and Differentiation; Population Genetics; Hardy-Weinberg equilibrium, mutation, selection, drift, gene flow, inbreeding, genetic diversity, races; Genetics disorders: Sickle cell anaemia, hemophilia, thalassemia, cystic fibrosis, Huntington disease, Colour blindness, Phenylketonuria; Cancer Genetics; Molecular diagnosis of genetic disorders: Use of RE, RFLP, Oligonucleotide probes, DNA-probes, DNA blotting, etc. DNA fingerprinting and SNP analysis, Genetic screening and genetic counselling; The Human genome project (HGP): Implications and future prospects.

Biopotentials and Electrophysiology: Bioelectric potential generation in excitable cells - muscle, nerve, heart and brain, properties of various ion channels, gating current, electrodes, single ion channel study, bioelectrodes and clamping techniques, EEG, ECG, EMG, echocardiography, visual evoked potential, auditory, olfactory and gustatory potentials.

Hemodynamics and Homeostasis: Principles and application of hemodynamics, blood vascular resistance, turbulence, blood pressure, role of platelets in blood homeostasis, complement system, neural and chemical regulation of blood pressure

Cardiovascular and Respiratory Physiology: Laws of Heart, electrical axis of heart, heart sound in cardiac cycle, cardiorespiratory and vasomotor centres, reflex regulation of heart and respiratory system, Mechanics of breathing, compliance, hysteresis, airway resistance, gas exchange, ventilation perfusion ratio and its significance, cardiovascular diseases and their pathophysiology, hypoxia, artificial respiration, neonatal heart and lungs, Respiratory distress syndrome; Sudden infant death

Nervous system, Biorhythm and Special Senses: Modern techniques for studying nervous mechanisms including neuroimaging. neuronal migration. Neural Plasticity. Higher order functions of Cerebral Cortex, Dominant Cortex, Laterality. Cognition, Learning and Memory-cellular and Molecular basis, Regulation of tone, posture and equilibrium, Modern concept of hypothalamic functions. Neurological disorders of brain- general cellular events; Mechanism development of degenerative diseases - Alzheimer's, Parkinson's Disease, ALS etc. Thalamo cortical projections and its influence on evoked cortical activity, wakefulness. Biorhythm generation and regulation, clock genes, disorders of biological clock Perception of vision, audition, gustation and olfaction, accommodation, colour vision, role of brain in- coding of colour, pitch, taste and odour discrimination

Alimentation and Excretion: Regulation of GI secretion and function, Gut-brain connection and role of hormones in gastric function, diseased conditions and their management (Ulcer, Malabsorption and Diarrhoea), cancer of the GI Tract. Structure and functional relationship of nephron, renal regulation of sodium-ion-exchange, body fluid volume. Neural and Endocrine control of renal functions; Non-excretory functions- renin-angiotensin system, erythropoietin system, biosynthesis of dihydroxychole calciferols, guanidinoacetate and prostaglandins; Pathophysiological aspects and renal failures

Reproductive Physiology: Blood testis barrier and role in spermatogenesis, immune endocrine interactions of testis in health and venereal diseases, sperm metabolism, immune endocrine interaction in pregnancy, hormones of lactation, ovarian reserve and in vitro fertilisation

Ergonomics, Exercise & Work Physiology: Ergonomics and its contemporary application in industrial sectors. Ergonomics and Cognition, Assessment of physiological and mental stress; Evaluation of physiological fatigue during overload job in extreme environment, Design Ergonomics, Human error and its relation with psychological condition during operation; Decision making and cognitive ability; Cost-effective study and improvement of individual productivity, VE Max, VO₂Max; Alveolar ventilation at different state of breathing. Lactic acid concentration and O₂ debt. Nutrition in sports and exercise, Physician's Interest in the Physiology of Exercise; Dynamic Physical Examination; Principles of safety in Physical Activity and sports; Management of Illness and Injury sustained in Exercise Activities; Rehabilitation procedures.

COURSE: PHSPY- 104

TERM PAPER

Credit: 4

Full marks: 50

Term paper submission:

25

Seminar presentation and interaction:

25 (15+10)