

Department of Zoology

Indira Gandhi National Tribal University, Amarkantak (MP)

Ph.D Course Work

Course code	Title of the course	Credits
PZG- 101	Research Methodologies	4
PZR-102	Instrumentation and Techniques for Research	4
PZS- 103	Toxicology	3
OR		
PZS- 104	Hormones and Disease	3
OR		
PZS- 105	Neurobiology	3
OR		
PZS- 106	Genetics and Disease Biology	3
PZS- 107	Behaviour Ecology of Insect and Biocontrol	3
PZP- 103, 104, 105, 106, 107	Review of Literature/ Presentation	2
PZP- 101, 102	Practical- I& II	1+1
Total		15

PH.D. ZOOLOGY

COURSE WORK

Title of the Paper	Credits	Contact Hrs./ Week	Maximum Marks	Sessional Marks		End Semester Examination Marks	Min. Pass Marks in End Sem. Exam
				40			
				10x2 test average	20 (10 assignment+10 attendance)		
PZG- 101- Research Methodologies	4	4 hrs.	100	20	20	60	24
PZR -102- Instrumentation and Techniques for Research	4	4 hrs.	100	20	20	60	24
PZS- 103- Toxicology	3	3 hrs.	100	20	20	60	24
PZS- 104- Hormones and Disease	3	3 hrs.	100	20	20	60	24
PZS- 105- Neurobiology	3	3 hrs.	100	20	20	60	24
PZS- 106- Genetics and Disease Biology	3	3 hrs.	100	20	20	60	24
PZS- 107- Behavioural Ecology of Insects and Biocontrol	3	3 hrs.	100	20	20	60	24
PZP-103/104/105/106/107- Review of literature/ Presentation	2	2 hrs.	50	Review of literature and presentation on research theme related topic		50	20
PZP- 101- Review of Literature/ Presentation	1	1 hr	50			50	20
PZP- 101- Practical-I (Lab work/Tutorial based on PZG-101)	1	1 hr	50			50	20
PZP- 102- Practical-II (Lab work/Tutorial based on PZR-102)	1	1 hr	50				20
Total	15		450	120		330	

PZG- 101

RESEARCH METHODOLOGIES

Unit-I

An overview of research methodology

Research concept, steps involved, identification, selection and formulation of research problem, justification, hypothesis; literature collection- textual and digital resources (internet)

Unit-II

Research design, data collection and interpretation

Research design; sampling techniques, collection and documentation, presentation, analysis and interpretation of data

Scientific writing: Forms of scientific writing- Article, notes, reports, review article, monographs, dissertations, popular science articles, bibliographies,

Unit-III

Formulation of scientific communication

Outline preparation, drafting title, sub titles, tables, illustrations; Formatting tables- title, body footnotes; figures & graphs- structure, title and legends, Impact factor, citation indices, plagiarism

Unit-IV

Computer application

MS office, excel, power point, graphics (Sigma plot), statistical software (SPSS)

Elementary Biostatistics: Standard deviation/error; Correlation coefficient, types of correlation, regression equation, biological significance of correlation and regression; Test of significance, chi-square test, analysis of variance.

SUGGESTED READINGS

- Research Methodology - Methods & Techniques, CR Kothri CR (1990), Vishva Prakashan, New Delhi.
- Research Methodology & Statistical Techniques, S Gupta (1999) Deep & Deep Publications, New Delhi.
- Research Methodology for Biological Sciences, N Gurumani (2007), MJP Publishers, Chennai.
- Introduction to Biostatistics, L Forthofer (1995), Academic Press, New York.
- Biostatistical Analysis, JH Zar (2006), Prentice-Hall.
- Research Design: Qualitative, Quantitative & Mixed Method Approaches, John W. Creswell (2009), Sage Publication, USA.
- Experimental Design & Data Analysis for Biologists. PQ Gerry & JK Michael (2002), Cambridge University Press.
- Choosing & Using Statistics: A Biologists Guide, D Calvin (2003), Blackwell Publisher.

PZR- 102

INSTRUMENTATION AND TECHNIQUES FOR RESEARCH

Unit- I

Microscopic Techniques

Types of microscopes and their biological applications, Bright-field, microscope, numerical aperture, limit of resolution, types of objectives, ocular and stage micrometers, Dark-field, Phase-contrast, Differential interference contrast, Fluorescence, Confocal, Atomic force, Transmission and scanning electron microscopy

Unit- II

Cell culture techniques

Introduction to course and lab safety; Cell culture: Introduction to sterile cell culture technique. Counting viable cells and subculture into multi-well plates. Cell counting using hemocytometers. Cell attachment (adhesion) and growth. Cell attachment (adhesion) and growth. Cell staining techniques: Culturing of primary cells, preparation of human chromosome, Application of primary cell culture techniques. Isolation of chromosomal DNA, Preparation of cellular extract, isolation of nuclear extract and cytoplasmic extract

Unit- III

Bioinformatics and Biochemical Techniques

Basics of Computer, Introduction and Scope of Bioinformatics, Computer Networking, Archiving and retrieval of information, Search Engines
Data Bases, Access to molecular biology data bases, Sequence alignment and phylogenetic trees

Centrifugation: Basic principle, Types of rotors, Clinical, high speed and ultracentrifuge

Electrophoresis: Agarose- and polyacrylamide gel, Two-dimensional, Iso-electrofocussing

Spectroscopy: Beer-Lambert's law, molar extinction coefficient and calculation, Spectroscopy, Absorption spectrum, Colorimeter and UV-Vis, Spectrophotometer, CD, Fluorescence, NMR, Spectrofluorometry

Chromatography: Paper and thin layer chromatography, Column chromatography, Gel filtration, Ion-exchange, HPLC, FPLC, MALDI (TOF), Affinity purification

Unit- IV

Molecular Biology Techniques

Microbiology: Culture of bacterial cells, recombinant techniques, transformation, restriction, ligation and cloning

Detection, Identification, and expression of nucleic acids and proteins:

Southern and northern blotting, Western blotting, ELISA, PCR, FACS, *In situ* hybridization, FISH, RISH, immunostaining, Microarray, ELISA, FACS, DNA protein Interaction methods, EMSA, South Western, Protein-protein interaction methods, Pull down assay, Far western Blot, FRET-FREM, Yeast two hybrid system

SUGGESTED READINGS

- Principles and techniques of Biochemistry and Molecular Biology, 7th Ed: K. Wilson, J. Walker, Cambridge Univ. Press. UK
- An Introduction to Practical Biochemistry, 3rd Ed : D. T. Plummer, Tata-McGraw Hill
- Modern Experimental Biochemistry and Molecular Biology 2nd Ed: R. Boyer Benjamin/Cumin
- Physical Biochemistry, 2nd Ed: D.M. Freifelder, Freeman Press.
- Analytical Biochemistry, 3rd Ed. D. Holme, J. Peck, Tata McGraw Hill.
- Experimental Biochemistry, 3rd Ed: R. L. Switzer, L.F. Garrity, Freeman Press

PZS- 103

TOXICOLOGY

Unit- I

Introduction to Toxicology

Definition, History and scope and relationship to other branches of science, Dose response relationship

Unit -II

Classes of toxic chemicals

Air pollution, Soil and water pollutants, Food additives and contaminants, Occupational toxicants, Pesticides, Animal Toxins, Plant Toxins, Microbial Toxins, Metals, Solvents, Drugs

Unit- III

Absorption, Metabolism and Elimination of Toxicants

Mechanism of absorption, Rates of penetration, Routes of absorption, and Distribution of Toxicants, Phase -I Reaction and Phase-II metabolism of Toxicants, Elimination of Toxicants

Unit-IV

Toxicity Testing

In vitro and short term tests in eukaryotic and prokaryotic system, DNA damage and repair, Chromosomal Aberration, In vivo tests: Acute , Sub-chronic, Chronic, Teratogenicity

SUGGESTED READINGS

- Hodgston and Levi's, A Textbook of Modern Toxicology. 3ed. Willey & Sons, 2004
- Casarett & Doull's, Essentials of Toxicology, 3ed. The McGraw Hills Company-2015
- John Timbrell's Introduction to Toxicology, 3rd Edition, Taylor & Francis, 2002

PZS- 104

HORMONES & DISEASES

Unit- I

Introduction

Scope of endocrinology, Endocrine glands

Unit -II

Endocrine Glands

Pituitary gland: Introduction, Dwarfism, Gigantism, Acromegaly, Diabetes insipidus

Thyroid gland: Introduction, Goiter, Myxoedema, Cretinism

Parathyroid gland: Introduction, Osteoporosis, Tetany

Islets of Langerhans: Introduction, Diabetes mellitus

Adrenal gland: Introduction, Addison's disease, Cushing's syndrome

Unit- III

Gonads and Hormones

Testis: Origin and cause of male sterility, Azoospermia & oligozoospermia, Oligospermia, Varicocele, Cryptorchidism

Ovary: Overview of regulation of menstrual cycle, Ovarian dysfunctions (premature ovarian failure, ovarian agenesis and luteal insufficiency), Polycystic ovarian syndrome, Endometriosis

Unit- IV

Hormones and Diseases

Hormones and cancer

Hormones and stress

Obesity

SUGGESTED READINGS

- Mac E. Hadley: Endocrinology, Prentice Hall, International Edition, 2000
- Wilson and Foster, Williams Text Book of Endocrinology 8th edition, W.B .Saunders Company Philadelphia, 1972.

PZS- 105

NEUROBIOLOGY

Unit- I

Organization of the Nervous System

Brain structure, Cerebrospinal fluid, Cells and connection of the nervous system, Neurons, Glial cells, Synapses, Neural network, Blood-brain barrier, Neurotransmitters and Neuropeptides

Unit -II

Learning and Memory

Types, Molecular basis

Unit -III

Brain and Behavior

Motivation, Sleep, Brain aging

Unit -IV

Neuropathology

Strokes, Epilepsy, Alzheimer's disease, Huntington's disease, Parkinson's disease

Brain Imaging, Techniques to identify diseases

SUGGESTED READINGS

- Longstaff: Neuroscience, Viva Books Pvt. Ltd., 2002
- Shepherd: Neurobiology, Oxford Univ. Press
- Ganong: Review of Medical Physiology (21st Ed.), Lange Medical Publ., 2003
- Guyton & Hall: Textbook of Medical Physiology (10th Ed.), WB Saunders, 2001.

PZS- 106

GENETICS AND DISEASE BIOLOGY

Unit -I

Population Genetics

Hardy-Weinberg Law (statement and derivation of equation, application of law to human Population); Evolutionary forces upsetting H-W equilibrium; Genetic Drift (mechanism, founder's effect, bottleneck phenomenon)

Unit -II

Genetic Polymorphism

Natural selection (concept of fitness, selection coefficient, genetic load, types of selection, density-dependent selection, heterozygous superiority, kin selection, adaptive resemblances, sexual selection

Chromosomal polymorphism, Allozyme polymorphism

Unit -III

Epidemiology

Concept, Application, Disease origin, Progression, Risk Assessment, Application of Bayes' Theorem, Probability of an Outbreak, Expected Duration of an Epidemic, Allele Frequency in Population

Unit- IV

Disease modeling

Disease modeling in Epidemiology, Demographic Stochasticity, Seasonal Forcing, Contact Rates, Exposed periods, Herd Immunity, The Inter-epidemic Period, Epidemic Approach to the Endemic Equilibrium, Case study

SUGGESTED READINGS

- Anderson RM & May RM. Infectious Diseases of Humans. Dynamics and Control. Oxford Science Pubs.
- Clayton D, Hills M. Statistical Models in Epidemiology. Oxford University Press
- Giesecke, J. Modern Infectious Disease Epidemiology. Edward Arnold 2nd edition
- Kelsey JL, Whittemore AS, Evans AS, Thompson WD. Methods in Observational Epidemiology. Oxford Univ Press (2 nd Edition)

BEHAVIOURAL ECOLOGY OF INSECTS AND BIOCONTROL

Unit-I

Introduction to Insects

Origin of and evolution of insects, Phylogeny of insect orders, Naming and describing insects, Classification and identifying characters of Apterygota, Exopterygota and Endopterygota

Insect anatomy and physiology

Insect body plan, Integument, Respiration, Digestive system, excretory system, Circulatory System and Thermoregulation, Reproductive system, Sound and light producing organs

Unit-II

Insect embryology and Endocrinology

Insect eggs, embryonic development, Viviparity, Polyembryony, Parthenogenesis, Pedogenesis and metamorphosis, Types of larva and pupae, Molting and diapauses physiology, Types of hormones in insects and their functions

Insect Ecology

Dynamics of insect life systems, Insect life tables and its application, Effects of environment in insect development, Regulation of insect populations, insect as ecological indicator: insect outbreak, insect monitoring and forecasting, Insect communities in aquatic and terrestrial systems, Patterns of insect distribution, Global patterns of insects richness, body weight, range size, species richness, sex ratio and abundance, biogeography of insect, Effect of global change in insects distribution and range shift, Global change and insect diversity and Morphological, physiological, anatomical and reproductive adaptation of insects, Prey-predator dynamic and species interactions

Unit-III

Insect Behavior

Sexual selection, Basic responses and patterns of behavior, nervous system and behavior, hormones and behavior, genetic control of behavior, behavioral periodicity and clocks, oriental navigation and homing. Host selection and feeding behavior, defence behavior, foraging behavior, resting behavior, communication behavior, epigamic behavior, mating and reproductive behavior, parental care, presocial behavior, eusocial behavior, leadership behavior

Unit-IV

Biocontrol of Pests: IPM, Classical, Inoculative, Inundative, Conservative/Augmentative, Biocontrol agents, Limitations of Biocontrol, Mistakes and Misunderstanding about biocontrol, Future of Biocontrol.

Research Methodology for Insects

Tools and techniques of insect collection & preservation, Research design (lab & field), Insect collection & sampling techniques, General techniques for insects rearing, Biostatics tools

Suggesting Books:

1. Chapman, R.F. 1998. The insects structure and function 4th edition. Cambridge University Press.
2. Fox, R.M. and Fox, J.W. 1966. Introduction to comparative entomology. Reinhold Publishing Corporation, New York.
3. Walter, G.H. 2008. Insect Pest Management and Ecological Research. Cambridge University. Press. 400 pp.
4. Atkins, M.D. 1980. Introduction to Insect Behaviour. MacMillan Publishing Co. Inc. New York.