West Bengal State University
Department of Zoology

SYLLABUS FOR TWO-YEAR POST GRADUATE COURSE OF ZOOLOGY UNDER NEP Course Curriculum

(With effect from the session 2026-2027)

Curricular Structures of 2 Year NEP PG Programme (3+2)

1st Year of 2 year PG

Semester	Paper	Type of paper	Course Name	Credit (Theory+Practical)
Semester I (Odd)	ZOO2PCOR01M	Core	Animal Physiology and Comparative Anatomy	2+2
	ZOO2PCOR02M	Core	Cancer Biology and Toxicology	2+2
	ZOO2PCOR03M	Core	Ecology and Quantitative Biology	2+2
	ZOO2PCOR04M	Core	Infection Immunity	2+2
	ZOO2PDSE01M	Elective	List of Electives enclosed	4
	ZOO2PAEC01M	AECC	Scientific Writing and Research Ethics	2
Total Credits	**22**			
Semester II (Even)	ZOO2PCOR05M	Core	Parasitology and Microbiology	2+2
	ZOO2PCOR06M	Core	Cellular Biocghemistry and Metabolism	2+2
	ZOO2PDSE02M	Elective	List of Electives enclosed	2+2
	ZOO2 PCOR07M	Dissertation	Research Project	4
	ZOO2 PCOR08M	Dissertation	Research Project	4
Total Credits	**20**			

2nd Year of 2 year PG

Semester	Paper	Type of paper	Course Name	Credit
Semester III (Odd)	ZOO2PCOR07M	Core	Cellular Organization and Developmental Biology	2+2
	ZOO2PCOR08M	Core	Molecular Aspects of Life	2+2
	ZOO2PCOR09M	Core	Epidemiology and Public Health	2+2
	ZOO2PCOR10M	Core	Entomology and Vector Biology	2+2
	ZOO2PDSE03M	Elective	List of Electives enclosed	4
	ZOO2PSEC01M	SEC	Histopathology	2
Total Credits	**22**			
Semester IV(Even)	ZOO2PCOR11M	Core	Indian Traditional Knowledge System and AI in Biology	4
	ZOO2PCOR12M	Core	Genetics and Epigenetics	2+2
	ZOO2PCOR13M	Core	Animal Behaviour, Bipodiversity and Conservation	2+2
	ZOO2PCOR14M	Dissertation	Research Project	4
	ZOO2PCOR15M	Dissertation	Research Project	4
	ZOO2PCOR16M	Dissertation	Research Project	4
Total Credits	**24**			

List of Electives

Melissopalynology & Apiculture Lac-culture Veterinary Entomology } NG	Ornamental Fish Culture and Entrepreneurship Development Aquaculture Nutrition and Disease Management } SS
Cellular Immunology Vector Molecular Biology } CP	Biochemical Techniques DPM RNA biology, Nucleic acid-mediated inflammatory diseases and Vaccines
Public Health Entomology-CP/NG	Cell Signaling and Cancer Biology Environmental Health and Pollution Control } SB
Behavioural Endocrinology Fresh and Coastal Aquaculture } SS	Life Style and Metabolic Disorder Cell Death and Disease Zebrafish biology in Research } SB/DPM

NEP-PG Zoology, WBSU

Preamble

We are living in a golden age of biology. There is a vast domain of knowledge to teach and learn about biology especially zoology and its applications for the Welfare of society. Reading the newspaper or watching news reminds us daily that the subject of biology is woven into the fabric of our society as never before. As the discovery of biology advances, so does the number of ways that it impacts our lives. Medicine agriculture, forensics, ecology, psychology, environmental issues- these are just a few of the subjects to which zoology especially biology has made significant contributions in recent times. While the present age is rich with learning opportunities it also creates teaching and learning challenges. The present syllabus has been designed very carefully with a view not to create a suffocating condition for students under an avalanche of information/s. Focus on the most important areas of zoology has been organized within core areas like cells, genes, evolution, taxonomy and their useful applications for the welfare of society. This entire process of framing up of curriculum is a holistic product of feedback and suggestions from students, peers and corporate society.

SEMESTER I

1st Year of 2 year PG

ZOO2PCOR01M: Animal Physiology & Comparative Anatomy (Credits:3+1)

Theory (3 credits)

Animal Physiology

1. An overview of anatomy and physiology
2. Muscles and Muscle tissue
3. Neurophysiology
4. Cardiovascular system
5. Respiratory system
6. Physiology of chemical digestion and absorption
7. Metabolism and body temperature regulation
8. Fluid, electrolyte and acid-base balance
9. Physiology of male and female reproductive system
10. Outline of endocrine glands, mechanism of hormone action and regulation of hormone secretion
11. Hormone receptors and regulation
12. The second messenger system

Comparative Anatomy

1. Introduction to Vertebrate Morphology, Origin, and Skeletal System.
2. Integumentary and Digestive System.
3. Respiratory and Circulatory System.

4. Urinogenital and Nervous System.
5. Sensory Organs and Functional Anatomy

Practicals (1 credit):

1. Blood pressure estimation
2. TC, DC, Arneath count, Blood Group
3. Haemoglobin count
4. Blood sugar estimation
5. Preparation of hypothyroid rat model
6. Histology: Comparative microanatomy of organs across species.

Suggested Books: Elaine N Marieb, Guyton and Hall, Schmidt Nielsen, Williams, Franklyn Bolander, Greenspan and Baxter, Hadley, Kardong, Kenneth V. Vertebrates : comparative anatomy, function, evolution, Romer, A.S. - The Vertebrate Body, Young, J.Z. - The Life of Vertebrates, Waterman, A.J. - Chordate Structure and Function.

Course Objectives: The basic "Physiology & Endocrinology" is a powerful study to help the students to explore the functional logic of living systems. All organisms are made up of cells & systems. This course is designed to explore the fundamentals of body structure & its function. We hope learners will develop a deep intuition to understand the functional logic of a basic anatomy & physiology. To underscore the importance of physiology in our lives, we will address anatomy of our body parts, physiological function and disorders endocrinological system associated with health implications in the human society.

ZOO2PCOR02M: Cancer Biology & Toxicology (Total Credits:2+2)

Course Objectives: The primary goal of this course is to provide a detailed understanding of the biochemical and molecular mechanisms underlying chemical toxicity and cancer progression. Students will gain knowledge to integrate the principles of toxicokinetics and toxicodynamics to understand how xenobiotics interact with biological systems. Student shall also learn about the molecular signatures of cancer, focusing on the "Hallmarks of Cancer" and the genetic drivers of malignancy. The course will further examine the metabolic and physiological shifts in tumor cells, including metabolic reprogramming and the mechanics of metastasis along with the complex relationship between tumors and their microenvironment, including immune evasion techniques. Finally the course shall evaluate current and emerging therapeutic strategies, from traditional chemotherapy to cutting-edge immunotherapies and precision medicine.

Theory (2 credits)

1. **Introduction to Toxicology:** History and its advent as a Branch of Science, Definition and scope of toxicology, Branches of toxicology,
2. **Basic Principles of Toxicology:** Routes and Duration of exposures, Dose–Response Relationships,
3. **Toxicokinetics (ADME):** Absorption, Distribution, Metabolism / biotransformation, Excretion of xenobiotics,
4. Phase I reactions, Cytochrome P450, its nomenclature, induction, xenosensors.
5. Phase II conjugation reactions

6. **Molecular Mechanisms of Toxicity:** Cellular injury mechanisms, Oxidative stress and free radicals, DNA damage and repair, Apoptosis and necrosis, Signal transduction disruption
7. **General Introduction to cancer** : etiology, world cancer statististics, the concept of multistage carcinogenesis
8. **Cell Cycle Dysregulation** and cancer: Loss of checkpoint control and the role of cyclins/CDKs.
9. **Molecular Aspects of Cancer:**, oncogenes, and tumor suppressor genes, Genomic Instability: DNA repair mechanisms,
10. **"Hallmarks of Cancer"-**road to malignancy
11. **Tumor Microenvironment (TME)**: Stroma and Signaling; The role of fibroblasts, extracellular matrix (ECM), and hypoxia-inducible factors (HIFs).
12. **Tumor Immunology**: immune evasion strategies of cancer (Immune Checkpoints like PD-1/PD-L1).
13. **Immunotherapy:** CAR-T cell therapy, monoclonal antibodies, and cancer vaccines.
14. **Clinical Oncology & Therapeutic Strategies**: Traditional Modalities; Precision radiotherapy and advanced chemotherapy; Drug Resistance

Practical Course (2 credits)

1. Measurement of serum biochemical markers of hepatotoxicity (ALT, AST, ALP) in murine/piscine models.
2. Assessment of genotoxicity: a) Micronucleus assay b) Comet assay c) DNA ladder assay
3. Asssessment of Immunotoxicity: Isolation and staining of murine peritoneal macrophages induced by xenobiotics
4. Measurement of oxidative stress: Assessment of Lipid peroxidation in different organs of murine/piscine system.
5. Measurement of antioxidant enzymes after exposure to toxicants /chemotherapeutic agents
6. Identifying the differences between normal and cancer cells
7. Maintenance of transplantable tumor cell line, development of in vivo tumors and identifying dysplastic characters.

Course Outcomes (COs): Students on successful completion of this course, students will be able to: Explain the journey of a toxicant through the body using **ADME** profiles and predict the physiological impact based on the interaction between toxicants and their target sites They will also be able to critically evaluate the roles of DNA repair failure, oncogene activation, and the loss of tumor suppressor genes in driving genomic instability and uncontrolled cell proliferation along with the capacity to explain how metabolic shifts, such as the **Warburg Effect** cell cycle checkpoints and, allow cancer cells to survive and proliferate in hostile environments. Students shall also be able to identify the molecular triggers of the **Epithelial-Mesenchymal Transition (EMT)** and map the physiological stages of angiogenesis and metastasis that lead to secondary tumor formation. A detail understanding of tumor microenvironment altered immune function shall enable the student to understand the modalities of conventional and modern therapeutics and also the reason of their failure.

Suggested Reading:

1. Casarett and Doull's Toxicology: The Basic Science of Poisons by Curtis D. Klaassen
2. The Biology of Cancer By Robert A. Weinberg

ZOO2PCOR03M: Ecology & Quantitative Biology (2+2 credits)

Theory (2 credits)

Group A: Ecology

1. Population Growth Models: Continuous and Discrete Population Growths; Exponential and Logistic Models
2. Community level interactions: Defining a Community; Lotka-Volterra equations, Niche Dynamics, Ecological Successions
3. Metapopulations: Defining metapopulations, different populations, modelling metapopulations
4. Island Biogeography: MacArthur-Wilson model

Suggested Readings:

- A Primer of Ecology by Gotelli;
- Ecology by Charles Krebs

Group B: Quantitative Biology

1. Statistic, Variables, Population, Small; Normal and Binomial distribution
2. Hypothesis Testing
3. Central Tendencies and Measures of Dispersion
4. Parametric and Non-Parametric tests; t-Test, Chi-Square, ANOVA, Kruskal-Wallis, Mann- Whitney U tests

Practical Course (2 credits)

1. Field identifications of Birds, Butterflies, Fishes and Plants.
2. Field study to quantify populations, community parameters in the fields by Quadrats, Transect Methods
3. Water parameter analyses in the fields
4. Field visits to study the management practices in any Protected Area or local community reserve

Suggested Readings: Biostatistics by Zar

The Ecology section of the course is designed to help students in understanding the ecological dynamics in endangered ecosystems. Conservation biology part would make them capable to participate in conservation activities as professionals or volunteers. This course is designed to prepare the students to be ready for such professions. Quantitative biology section of the course has been designed to remove the alleged traditional fears of biology students in numerical methods of science. The topics included are expected to help the students in designing experiments or surveys, scientific data collection and management, finally in statistical interpretations from the data, the skills demanded in so many types of professions including research. Taxonomical studies will help to identify the identity and interrelationship of the animal kingdom.

ZOO2PCOR04M : Infection Immunity (2+2 credits)

1. History and philosophy of immunology, Development of the concept of immunologic specificity.
2. Organs, cells, receptors and molecules that are part of the innate immune defense, Innate immune cells development, characteristics and function.
3. Antigen presentation and structure and function of antigen-presenting molecules, Structure, function and organization of major histocompatibility complex (MHC), Antigen presenting cells, Process of antigen presentation, MHC-TCR recognition.
4. T cell development and function, cytokines and their essential functions, and effects on the immune system.
5. B cell development and function, antibody formation, structure and effector function.
6. Immunization: Passive and active
7. Comprehend the overreaction by our immune system (cell-mediated effector functions, inflammation) leading to hypersensitive conditions and its consequences
8. Primary and secondary immune modulation, the complement system.

Suggested Readings

1. Kindt, T., Goldsby,R.A and Osborne, B.A. Kuby Immunology, Sixth Ed, WH Freeman and Company, New York. ISBN 13:978-1-4292-0211-4 Page 9 of 32
2. Rosen F. A. and Geha R. S. Case Studies in Immunology: A Clinical Companion, 5 th ed. New York: Garland Publishing. 2007. ISBN: 978-0-8153-4145-1.

ZOO2PDSE01M (Credits 2+2): Elective (Detailed syllabi of all the lectives are given separately)

ZOO2PAEC01M: Scientific Writing and Research Ethics (Credits: 2)

Course Objectives: The course introduces the students to the principles, ethics and structuring of document/manuscript.The primary goals of this course are: To introduce students to the fundamental pillars of academic integrity and the historical necessity of ethics in research; To familiarize students with international standards of publication ethics as defined by organizations like COPE and WAME; To provide a framework for formulating research, from initial critical thinking to the final arrangement of scientific documents; To ensure students understand the legal and ethical boundaries regarding plagiarism, copyright, and authorship; To train students in adapting their scientific findings for different formats, including research papers and popular science articles.

Theory

1. Understanding the Core Principles of Research Ethics: Pillars of Academic Integrity by *The International Center for Academic Integrity (ICAI)*, Honesty,Objectivity, Integrity, Transparency & Openness, Intellectual Property
2. History and necessity: Academic Discourse; The Publishing Process; Research Ethics; Being Active in the Academic World

3. Publication Ethics: Definitions, COPE & WAME, defining publishable ; Authorship and Contributorship, Contributors Listed in Acknowledgments, Scientific Misconduct, Intellectual Property
   Plagiarism, copyright and intellectual property

4. Scientific writing: How to Formulate Research, critical thinking and creative thing, arranging your document

5. How to write a project/research paper/popular science article

6. Referencing and Bibliography: Referencing styles are standardized methods for citing sources, e.g., APA, (Harvard), Vancouver,(IEEE), and notes-bibliography (e.g., Chicago, MHRA). Common styles include APA (social sciences), MLA (humanities), Chicago (history/arts), Vancouver (medicine), and IEEE (engineering)

Course Outcomes (COs): Upon successful completion of the course, students will be able to: Evaluate Ethical Scenarios; Apply International Standards to their writing techniques; Apply the principles of honesty, objectivity, and transparency to identify and resolve ethical dilemmas in academic discourse; Demonstrate an understanding of COPE and WAME guidelines to ensure all research outputs meet global publication ethics; Correctly attribute authorship and contributorship while navigating the complexities of copyright and intellectual property rights; Construct well-structured research papers and project proposals using advanced critical thinking and creative synthesis; Implement rigorous strategies to avoid plagiarism and scientific misconduct in their own work and peer reviews; Translate complex research data into accessible "popular science" articles for a broader, non-specialized audience.

SEMESTER II

ZOO2PCOR05M: Parasitology & Microbiology (Credits: 2+2)

Theory

Group A: Parasitology

1. Understanding of the evolution of parasitic associations.

2. Emerging parasitic diseases.

3. Understanding of the modifications (physiological, morphological, and behavioral) needed to assume a parasitic lifestyle.
4. Vector-Borne Parasites and Pathogens of Public Health Importance.
5. Zoonoses and its significance.
6. Myiasis and its evolutionary pathway.
7. Nosography of protozoans
8. Helminthology: Phylum Platyhelminthes: Class Cestoda
Phylum Platyhelminthes: Class Trematoda
Phylum Nemathelminthes: Class Nematoda

Group B: Microbiology

1. Structure and organization of bacteria and virus
2. Microbial Physiology: Growth yield and characteristics, strategies of cell division, stress response.
3. Sterilization techniques
4. Molecular mechanisms of commonly used antibiotics.

Practical Course

1. Identification & staining of relevant protozoan and helminthic parasite.
2. Microbiome Variation Study

Suggested Readings:

Foundation of Parasitology by John Janovy& Larry Roberts,
Parasitology by KD Chatterjee

Course Objectives:

The course examines the general biology, life cycles, modes of transmission, and pathogenesis of major parasites on global human health. It will enable students to explore a number of important diseases, along with the diverse protozoans, helminths, worms, and arthropods responsible for them. The course will enable students to explore a number of important diseases, along with the diverse protozoans, helminths, and arthropods responsible for them. Another portion of the course has been prepared to help understand the ability of our immune system to defend against invading pathogens or parasites in a logical fashion.

ZOO2PCOR06M: Cellular Biochemistry & Metabolism (Credits: 2+2)

Theory

1. Biochemistry Basics: Solutions, Ways Of Expressing Concentration: Molarity Molality Normality formality, part per million, volume percentage and weight percentage. Mole Fraction
2. Structure of atoms, molecules, chemical bonds. reaction kinetics, thermodynamics
3. Stabilizing interactions (van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).
4. Biochemistry of water
5. Weak Interactions in Aqueous Systems: Ionization of Water, Weak Acids, and Weak Bases, Buffering against pH Changes in Biological Systems, Water as a Reactant, Fitness of the Aqueous Environment for Living Organisms.
6. Amino acids, peptides and proteins: Structural Features, classification, as Acids and Bases, isoelectric point, peptide bond, types of peptides
7. Structure of Proteins: Primary Structure, Secondary Structure, Tertiary and Quaternary Structures, Protein Denaturation and Folding, secondary structure, domains, motif and folds)
8. Nucleotides and Nucleic Acids: Conformation of nucleic acids (helix (A, B, Z), DNA super coiling, linking number.
9. Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.

Lab Course

1. Titration curve of acids of monoprotic and Diprotic acids using a pH

meter: preparation of buffers
2. Determination of acid dissociation constant Ka and pKa
3. Assay of enzyme activity
4. Genomic DNA isolation.
5. DNA gel electrophoresis.
6. Estimation of protein by Lowry's method

Suggested Readings

1. David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry
2. Voet, D., Voet, J. G. & Pratt, C. W. Principles of Biochemistry. Wiley, 4th edition, 2013.
3. Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. Freeman, 7th edition, 2011.

Course Objectives:

Identify different classes of biomolecules and structures, explain fundamental relationships between their structure and function and describe the principal organisation of prokaryotic and eukaryotic cells. Understanding Biochemistry enables students to understanding the central theme of life and its associated mechanisms. This stream is the bridge between the physical science and its application in biological processes. Students can intermingle with the different streams of science to create unison of understanding of any topic of biology.

ZOO2PDSE02M (Credits: 2+2) (Detailed syllabi of all the electives are given separately)

ZOO2PCOR07M& ZOO2PCOR08M: Project Work/Dissertation (4 credits each)

Includes project on an original problem under the supervision of any faculty from WBSU or from other Institute of National and International repute.

SEMESTER III

One year PG Programme after completion of Four-Year UG Programme (4+1) and 2nd 2nf Year of 2 year PG

ZOO2PCOR07M: Cellular Organization & Developmental Biology (Credits: 2+2)

Theory (2 credits)

Group A: Cell Biology

1. Evolution of cell
2. Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.
3. Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.
4. Transport of Ions and Molecules across cell membranes: Passive diffusion, facilitated diffusion, uniporters, symporters, antiporters , Ion channels, ATP-powered pumps,
5. Extracellular matrix and Cell junctions and cell-cell signaling.
6. Cell Function: Dynamic movements, trafficking, targetting, sorting and localization of macromolecules and signal transduction in the living cells.

7. Cell cycle: Molecular genetics of cell cycle control, cdc mutants, Loss of cell cycle control and cancer, programmed cell death and apopotosis.
8. Biology of excitable (nerve or contractile cells) cells.

Group B: Developmental Biology

1. Basic concepts of development: Potency, induction, competence, differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells.
2. Gametogenesis, fertilization and early development: Production of gametes, cell surface molecules in sperm-egg recognition in animals; embryo sac development; zygote formation, cleavage, blastula formation, gastrulation and formation of germ layers in animals.
3. Morphogenesis and organogenesis in animals: Axes and pattern formation in Drosophila, amphibian and chick; organogenesis-vulva formation in Caenorhabditiselegans, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons.
4. Programmed cell death, aging and senescence

Suggested Reading:

1. Molecular Cell Biology By Lodish,
2. Cell by Cooper
3. Molecular Biology of the Cell by Bruce Alberts
4. Developmental Biology by Scott F. Gilbert

Course Objectives:

The cell is a powerful case study to help us explore the functional logic of living systems. All organisms are made up of cells. This course is designed to explore the fundamentals of cell biology. We hope learners will develop a deep intuition to understand the functional logic of a cell. To underscore the importance of cell biology in our lives, we will address questions of cellular disorders, and associated health implications in the human society.

Developmental biology studies the mechanisms involved in growth and development of complex organisms. In many ways the basic understandings of developmental biology provide an invaluable foundation for other aspects of biology as well as medicine, especially as many health issues can be related back to early developmental defects during embryogenesis. This course aims to provide a broad, comprehensive look at embryology with special emphasis on vertebrate models, focusing on both classical experiments and modern molecular and genetic techniques.

Lab course (2 credits)

1. Viable cell counting.
2. Staining mammalian and piscine cells with Giema/Leishman stain
3. Organellar fraction isolation by differential centrifugation
4. Assessment of cell size, cell granularity and cell cycle analysis by Flowcytometer
5. PBMC/ Splenocyte isolation and study of different cell types under microscope
6. Studying the different embryonic stages in zebrafish development

ZOO2PCOR08M -Molecular Aspects of Life (Credits: 2+2)

Theory (2credits)

1. DNA replication, repair and recombination (Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons, DNA damage and repair mechanisms, homologous and site-specific recombination).
2. RNA synthesis and processing (transcription factors and machinery, formation ofinitiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, andpolyadenylation, structure and function of different types of RNA, RNA transport).
3. Protein synthesis and processing (Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, and translational proofreading, translational inhibitors, Post- translational modification of proteins).
4. Control of gene expression at transcription and translation level (regulating the expression of phages, viruses, prokaryotic and eukaryotic genes, role of chromatin in gene expression and gene silencing).

Suggested Readings

Text Book: David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry, Molecular Cell Biology Lodish, Molecular Biology of the Cell by Bruce Albert.

Course Objectives:

The course aims to equip students with a basic knowledge of the structural and functional aspects of biological macromolecules, viz., DNA, RNA and proteins. After completion of the course, the students can apply this knowledge in their fields of research and higher education. Basic concepts on microbiology and antibiotics for general information (useful for day-to-day life) and further advanced knowledge on the topic.

Lab Course (2 credit)

1. Genomic DNA isolation.
2. DNA gel electrophoresis.
3. Protein Gel Electrophoresis

ZOO2PCOR09M - Public Health Epidemiology

(Credits: 4)

ZOO2PCOR10M - Entomology and Vector Biology(Credits: 2+2)

1. Classifications of Insects with salient identifying characters (till Order level)
2. Important insect structures and functions (flight, vision, reproductive structures, sensory structures)
3. Concept of Applied Entomology
4. Economically Beneficial Insects and their cultures: Bees and Apiculture, Lac and Lac Culture, Silk Moths and Sericulture
5. Insect Pests: Agricultural Pests (Rice, wheat, vegetable pests)
6. Insecticides: Chemical and Biological Controls, Insecticide resistance and mechanism of resistance, IPM (Integrated Pest Management)
7. Vector Biology of Plasmodium sp, Japanese Encephalitis, Dengue, Leishmaniasis
8. Methods of Vector Control
9. Forensic entomology

Practical

1. Identification of insect pests and different species of honey bees, mosquitoes, sandfly, lac insects, silkworms
2. Identification of pollen plants from corbicular pollen
3. Study of any crop pest- ecology, behaviour, life history strategies and control
4. Identification of different stages of Lac-insects and their host plants
5. Methods of insecticide application
6. Determination of LC50 and LD50
7. Study of the ecology, behaviours and life history strategies of major vector mosquitoes /sand flies

Suggested Readings:

1.Insects by R.F. Chapman

2.Agricultural pests of South-East Asia and their management – A.S Atwal &G.S. Dhallwal

3.An Introduction to Sericulture- by J Ganga; SulachanaChetty

4.Bees & Beekeeping in India by D.P. Abrol

5.Lac-culture in India- N. Ghorai, International Books and periodical supply service, New Delhi

6.Medical Entomology – A.K. Hati

7.Medical Entomology- Bruce F. Eldridge, John D. Edman, Kluwer Academic Publishers

Course Objectives:

The mission of this course ranges from basic aspects of arthropod ecology, morphology, parasitology, physiology and systematics to applied subjects in apiculture, agricultural, medical and veterinary pest management.

ZOO2PDSE03M (Credits 2+2): Elective

ZOO2PSEC01M - Histopathology (Credits: 2)

1. Theory and principles of different staining procedures in Histopathology.
2. Histochemistry.
3. Immunohistochemistry.
4. Study on Histophysiology of – Liver, Spleen, Kidney, Cardiac Muscle, Ovary, Gut.
5. Preparation of various fixatives & Stain solution.
6. Decalcification of calcified tissue before sectioning.
7. Special staining techniques.
8. Processing of tissue for routine paraffin sections and other methods of embedding.
9. Histochemical identification from processed tissue section.
10. Preparation of biopsy report of – Liver, Spleen, Kidney, Cardiac Muscle, Ovary & Gut.

Course Objectives and Scope of Employability

The skill gained through this course in histopathology will introduce students to microscopic features of tissues and organs, giving them the opportunity to compare and contrast the normal with the abnormal in various disease states. Students will use logical and systematic thinking to solve problems with this diagnostic technique and procedure. This course will give students an edge to pursue career in various histopathological laboratories, diagnostic centres or paramedical institutions.

Suggested Reading:

Junqueira's Basic Histology: Text and Atlas, Book by Anthony L. Mescher and L.C.U. Junqueira. McGraw-Hill Education / Medical.

SEMESTER IV

ZOO2PCOR11M - Indian Traditional Knowledge System and AI in Biology (4 credits)

ZOO2PCOR12M - Genetics and Epigenetics (Credits

2+2)

Course objectives

In this course, students will learn about various aspects of gene regulation which go beyond basic Mendelian genetics. Students will learn to appreciate the fact that despite having the same genetic content, our cells differentiate and perform different functions. Even though we will revisit the fundamentals of basic genetics, the main emphasis of this course will be on epigenetic mechanisms and regulation. The course objective is to develop a general understanding of epigenetics and its role in various facets of biology, from general cell regulation to disease types.

Course Contents

Theory

1. Introduction: Genetics vs. Epigenetics.
2. Fundamentals of regulation of gene expression
3. Mendelian inheritance and laws
4. Molecular Genetics: DNA structure and replication, Central dogma: transcription and translation,Genetic code.
5. Chromatin organization-Nucleosome solenoid model.
6. Histone modificationand their role in gene regulation.
7. DNA methylation and demethylation mechanisms
8. Non-coding RNAs in gene regulation
9. Genomic imprinting and X-chromosome inactivation
10. Epigenetic control of embryonic development
11. Factors influencing epigenetic modifications: Diet, Metabolism, stress, Aging, etc.
12. Epigenetic dysregulation in human diseases

Practicals

- Isolation of DNA from animal cell
- Isolation of nuclei (as a source for studies on structure of chromatin) from rat/mouse liver density gradient centrifugation.
- Identification of inactivated X chromosomes as barr body from the given sample
- Preparation and study of metaphase chromosomes from mouse bone marrow/grass hopper testes/onion root tip
- Studying the role of environmental factors on epigenetic marks in zebrafish

Reference and Textbooks

- Gardner, E.J., Simmons, M.J., Snustad, D.P. (2008). Principles of Genetics. VIII Edition. Wiley India.
- Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc.
- Handbook of Epigenetics: The New Molecular and Medical Genetics/Edited by Trygve O. Tollefsbol, Edition 2.
- Epigenetics/Edited by C. David Allis, Marie-Laure Caparros, Thomas Jenuwein, Danny Reinberg; Associate Editor, Monica Lachner, Edition 2.
- Histone variants ancient wrap artists of the epigenome. Talbert P. B. and Henikoff, S. Nat. Rev. Mol. Cell Biol., 2010 doi:10.1038/nrm2861.

Outcome

Basic knowledge on Epigenetics will promote the students for research activities and encourage them for higher studies

ZOO2PCOR12M: Animal Behaviour, Biodiversity & Conservation (Credits: 2+2)

Group A: Animal Behaviour

1. Evolutionary approach in Behavioural studies
2. Critical perspectives of Imprinting and learning behaviours
3. Reviewing Bee-Dance language
4. Sexual selections- modern perspectives
5. Social Behaviours in insects and primates from evolutionary perspectives
6. Human Behaviours- Critical evolutionary analyses

Suggested Reading

Animal Behaviour by Lee Dugatkin

Group B: Conservation Biology

1. Threats to Biological Diversity
2. Conservations at the Population and Species Levels
3. Conserving Biological Communities, Regional Unique Biodiversity
4. Man-Wildlife conflicts and Development vs Conservation
5. Traditional Ethics and Role of Local Communities in Conservation

Suggested Readings:

1. Conservation Biology: A Primer for South Asia by Bawa, Primack and Oommen; Univ. Press. Kolkata

Lab Course

1. Study of Social Behaviour in Crows / Street dogs
2. Study of facial expressions and other behaviours in humans
3. Study of feeding behaviour in Butterflies/Fishes

Course Objectives:

Studies of animal behaviours brought one of the only two Nobles for Zoology so far. Emerging fast from its psychological capsules, since then, study of animal behaviours in evolutionary approach has become one of the most attractive fields in biology. In a country of high biodiversity like India, students can flourish in research careers in this low-cost demanding field much more easily than any high cost equip dependent fields of biology. The course is hence designed and offered.

ZOO2PCOR14M, ZOO2PCOR15M & ZOO2PCOR16M: Project Work/Dissertation (4 credits each)

Includes project on an original problem under the supervision of any faculty from WBSU or from other Institute of National/International repute.