

West Bengal State University
Department of Zoology



REVISED SYLLABUS FOR TWO-YEAR
POST GRADUATE COURSE OF
ZOOLOGY

(With effect from the session 2018-2019)

	Semester	Credits	No. of Classes	Total Credits
Theory	1 st	15	210	50
	2 nd	15	210	
	3 rd	15	210	
	4 th	5	70	
Practicals	1 st	8	224	40
	2 nd	8	224	
	3 rd	8	224	
	4 th	12	336	
Aggregated				90

Preamble

This postgraduate course in Zoology has been framed keeping in mind the widening horizons of the discipline of biological sciences but at the same time not to create a suffocating condition for students under an avalanche of information/s. In order to keep up with the pace of progress in biology, topics on statistics, computation, molecular biology, immunology, biochemistry etc have been included. Nevertheless, classical zoology has also been given due weightage. The lab courses are also well framed which will give the students an opportunity to get hands-on training on latest techniques in biology. We hope that this syllabus will inspire the students for pursuing higher studies in Zoology and for becoming an entrepreneur and also enable students to get employed in research Institutes, Industries, other academic Institutes or any other concerning departments of the state and central Govt.

Syllabus-1st Semester

Theory

Course ZOOT001: Evolution and Genetics; Course coordinator

(CC- SJB)

Total Credits: 3

1. Historical backgrounds (till 1859) and early Darwinian theory of evolution (1859-1900)
2. Modernization of Darwinian concepts: Understanding of nature of inheritance from Mendel-
Population genetics approach: H-W theorem, Defining Evolution, Natural Selection, Nature

and impacts of Natural selections, Genetic Drift, Gene Flow and Mutation Rates on H-W populations. Sources of Variations

3. Debated aspects of modern evolutionary theories (introductions only): Creationists' claims, Concept of Progress, Neutral Selection, Punctuated Equilibrium, Group Selection, Critics to Adaptationist Program, Sociobiology Debate
4. Genes as the units of heredity: Mendelism, Genes are located on the chromosomes, a parallelism between the Mendelism and the behaviour of chromosomes in Meiosis - chromosomal theory of inheritance, Linkage, complementation and recombination.
5. Microbial genetics: Genetic system provided by E.coli and its bacteriophages, Advantage of using microorganism as a model genetic system, Spontaneous origin of mutation, Lederberg's and Luria-Delbruck's experiments, Mechanism of origin of spontaneous and induced mutations, Forward reverse and suppressor mutations, bacterial transformations: Griffith's and Avery's experiments; bacterial conjugation, sexes in bacteria, F Factor, plasmids and episomes, genetics of Transposable elements, Insertion of phage chromosomes in E.coli, Phage Mu as transposable elements, Transduction via phages.
6. Drosophila Genetics: linkage and linkage mapping
7. Human Genetics : Common chromosomal anomalies and resulting syndromes

Suggested Readings

Text Books:

1. Futuyama, D., Evolutionary Biology, 2nd or 3rd Edition
2. Strickberger, M., Evolution
3. Ridley, M. Evolution

Course objectives:

“Nothing makes sense in biology except in the light of evolution”- Theodosius Dobzhansky. This oft-quoted and most agreed upon statement among scientists suggest that the theory of evolution is the scientific paradigm for biology and must be taught to every student of life sciences. This Evolution and Genetics part of the course is highly updated and tailor-made to make a PG student strong in the most fundamental aspect of biological sciences.

Course ZOOT002: Biochemistry & Biophysics (CC-DPM)

Credit: 3

1. Structure of atoms, molecules and chemical bonds.

2. Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acids).
3. Stabilizing interactions (van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc.).
4. Principles of biophysical chemistry (pH, buffer, reaction kinetics, thermodynamics, colligative properties).
5. Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers.
6. Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes
7. Metabolism of carbohydrates, lipids, amino acids nucleotides.
8. Biophysical Methods: Basic Principles and Applications. Centrifugation, Spectroscopy, UV-VIS, Fluorescence, Circular Dichroism, Nuclear Magnetic Resonance Spectroscopy, Mass Spectroscopy, X-ray Crystallography, Flowcytometry (FACS) and different types of light and electron microscopy.

Suggested Reading: Lehninger

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.

Course ZOOTO03: Molecular Biology & Microbiology (CC- SB)

Total Credits: 3

1. Demonstration of DNA as genetic material, Central Dogma, DNA replication in Prokaryotic and Eukaryotic Cells.
2. Recombination at the molecular Level: Homologous recombination, Rec system, Halliday junction, Site specific Recombination.
3. DNA damage and Repair, mutation and other kinds of damages and mechanisms of Repair.
4. Flow of genetic information: Transcription, mRNA processing, mRNA splicing and editing, folding, export and translation, ribosome function, genetic code, fidelity and control of translation.

5. Regulation of prokaryotic and eukaryotic genes.
6. Recombinant DNA Technology.
7. Structure and organization of bacteria and virus
8. Microbial Physiology: Growth yield and characteristics, strategies of cell division, stress response.
9. Sterilization techniques
10. Molecular mechanisms of commonly used antibiotics.

Suggested Readings

Text Book: **Lehninger, Lodish, Bruce Alberts**

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.

Course ZOOTO04: Cell Biology & Immunology (CC-CP)

Total Credits: 3

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, targeting, 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 apoptosis.
8. Biology of excitable (nerve or contractile cells) cells.

9. Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity.
10. B and T cell epitopes, structure and function of antibody molecules, generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions
11. MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses.
12. Primary and secondary immune modulation, the complement system.
13. Toll-like receptors, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity.

Suggested Readings: Text Book: Molecular Cell Biology By Lodish, Immunology by Kuby

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, immune system against invading pathogens and associated health implications in the human society.

Course ZOOT005: Animal Behaviour (CC- NG)

Total Credits: 3

Topics :

1. Questions asked in modern study of animal behaviour
2. Reflexes and more complex behaviours
3. Instinct and learning : characteristics and types; case study at preliminary level : foraging in honey bees, bird songs
4. Behavioural aspects of sexual dimorphism and sexual selection
5. Sociobiology: types of social structures with examples; eusociality and its evolution
6. Evolutionary aspects of human behaviour

Suggested Reading

Text Book :

Manning & Dawkins, Alcock

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.

Practicals

Course ZOOP001: Animal Behaviour & Evolution Genetics (CC- SJB)

Credits: 2

1. Behavioural repertoire, Focal animal sampling and all animal scan
2. Simulations of Natural Selections, Genetic Drift etc.
3. Pedigree analyses
4. Drosophila genetics

Course ZOOP002: Biochemistry & Biophysics (CC-DPM)

Credits: 2

1. Titration curve of acids of monoprotic and Diprotic acids using a pH meter: preparation of buffers
2. Determination of acid dissociation constant K_a and pK_a
3. Assay of enzyme activity
4. Influence of substrate concentration on the rate of enzymatic reaction
5. Effect of pH and temperature on the rate of enzyme reaction
6. Paper chromatography – Separation of amino acids and carbohydrates in a mixture
7. Thin layer chromatography of fatty acids
8. Zymography

Course ZOOP003: Cell & Molecular Biology (CC- SB)

Credits: 3

1. PBMC isolation
2. Viable cell counting
3. Organellar fraction isolation by differential centrifugation
4. Genomic DNA isolation.
5. PCR
6. DNA gel electrophoresis.
7. Protein Gel electrophoresis
8. Immunoblotting technique

Course ZOOP004: Immunology & Microbiology (CC-CP)

Credits: 2

1. Gel diffusion techniques for Antigen-antibody reaction.
2. Splenocyte isolation and viable cell counting
3. Staining techniques.
4. Basic Sterilization and aseptic techniques.
5. Plasmid DNA isolation.

2nd Semester

Theory

Course ZOOT006: Basic Maths Stats and Computer for Biologists (CC- SJB)

Total Credits: 3

1. Basic maths – logarithm, matrices, interpreting graphs, probability
2. Biostatistics- frequency distribution, central tendency, measures of dispersion, hypotheses testing, statistical tests- chi square, student's t-test.
3. Database use, analyses & simple programming

Course ZOOT007: Animal Biodiversity and Taxonomy (CC-NG)

Total Credits: 3

1. **Approaches in Taxonomy:** Morphological approach, Molecular and biochemical approaches, Numerical Taxonomy
2. **Identification:** Identification using different types of Taxonomic keys
3. **Classification:** Linnaean Hierarchical classification, Cladistic classification
4. **Nomenclature:** Rules of Nomenclature, The types and its importance
5. Evolutionary dynamics of Biodiversity and Global pattern of Biodiversity
6. History of biodiversity since the origin of human societies
7. Traditional knowledge and biodiversity
8. Values of biodiversity
9. **Biodiversity conservation:** Traditional ways, CBD, Biodiversity Act of India.

Course ZOOT008: Toxicology & Oncology (CC- SB)

Total credits: 3

- 1) General principles of Toxicology
- 2) The absorption, distribution, metabolism and excretion of Xenobiotics: Toxicokinetics

- 3) Interaction of toxicants with their target site: Toxicodynamics
- 4) Toxins and toxicants
- 5) Environmental Toxicology & Ecotoxicology
- 6) General Introduction to Oncology
- 7) Genetic and epigenetic factors
- 8) Carcinogenesis: the concept of multistage mutations
- 9) Carcinogens and Pathways to cancer
- 10) Cell cycle disruption and cancer
- 11) Oncogenes
- 12) Tumour suppressors
- 13) Growth Factors and Signal Transduction in Cancer
- 14) Concept of Cancer stem cells
- 15) Modern therapeutics

Course ZOOT009: Parasitology and Histopathology (CC-CP)

Total credits: 3

1. Life history, Pathogenicity, Clinical features and Control measures/Prophylaxis of parasites of human importance.
2. Understanding of the modifications (physiological, morphological, and behavioral) needed to assume a parasitic lifestyle: Host parasitic interaction with respect to Malaria and Leishmaniasis.
3. Understanding of the evolution of parasitic associations.
4. Emerging parasitic diseases with special references to protozoan parasite.
5. Vectors and its importance in transmission of parasites.
6. Zoonoses and its significance.
7. Myiasis and its evolutionary pathway.
8. Nosography of helminthes and protozoans.
9. Theory and principles of different staining procedures in Histopathology.
10. Histochemistry.
11. Immunohistochemistry.
12. Study on Histophysiology of – Liver, Spleen, Kidney, Cardiac Muscle, Ovary, Gut.

Course ZOOT010: Ecology, Field biology & Conservation (CC-NG)

Total Credits: 3

1. Organizations at population levels: growth modes, population regulations.
2. Organizations at Community level: conceptualizing an ecological community.
3. Studying the community composition -species diversity, succession.
4. Nature and dynamics of competition, predations and cooperations.
5. Basic principles of conservation biology: metapopulations, island biogeographic, theory, concept of resilience.
6. Concept and dynamics of ecosystems
7. Designing of PAs, Man-Animal conflicts in PAs, Traditions of conservations, Case studies on conservation of Indian wildlife : Red Panda, Great One-horn Rhino and Lion-

Tailed Macaque, Tiger and Elephant, Conservation of Biodiversity : status, laws and activities

Suggested Reading

Text Book :

Ecology : Charles Krebs,

Field Biology : Smith, E.A.

Conservation : Schonowald-Cox

Practicals

Course ZOOP005: Quantitative applications in Ecology & Field Biology (CC-SJB)

Total Credits: 2

1. Transects, Quadrat, Point count, pitfall sampling techniques (preferably in natural habitats)
2. Tree architecture and Vegetation characterisation techniques (preferably in natural habitats)
3. Computer database preparation, quantitative analyses and statistical interpretation of ecological data

Course ZOOP006: Animal Biodiversity and Taxonomy (CC- NG)

Total Credits: 2

1. Framing up of keys (based on sampled animals in nature)
2. Application of cladistics
3. Field surveys to document biodiversity-Quantitative and Qualitative Methods (to be demonstrated in fields, preferably in a biodiversity rich natural habitat)

Course ZOOP007: Parasitology and Histopathology (CC- CP)

Total Credits: 2

1. Identification & staining of relevant protozoan and helminthic parasite.
2. Preparation of various fixatives & Stain solution.
3. Decalcification of calcified tissue before sectioning.
4. Special staining techniques.
5. Processing of tissue for routine paraffin sections and other methods of embedding.
6. Histochemical identification from processed tissue section.
7. Preparation of biopsy report of – Liver, Spleen, Kidney, Cardiac Muscle, Ovary & Gut.

Course ZOOP008: Toxicology & Oncology (CC- SB/DPM)

Total Credits: 2

1. Measurement of serum biochemical markers of hepatotoxicity (ALT, AST, ALP) in murine/piscine models.
2. Assessment of biomarkers of genotoxicity: a) Micronucleus assay
3. Assessment 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. Identification of PAP smear slides
6. Studying the effect of DNA alkylating agents in murine model in Haematopoietic stem cells
7. Maintenance of transplantable tumor cell line, development of in vivo tumors and identifying dysplastic.

3rd Semester

Theory

Course ZOOTO11: Animal Physiology & Endocrinology (CC-SS)

Total credits: 3

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. Gastrointestinal hormones
12. Invertebrate hormones
13. Hormone receptors and regulation
14. The second messenger system

Suggested Books- Elaine N Marieb, Guyton and Hall, Schmidt Nielsen, Williams, Franklyn Bolander, Greenspan and Baxter, Hadley

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.

Course ZOOTO12: Animal Structure & Function (CC-NG)

Total credits: 3

1. Insect Vision
2. True Flights in birds, bats and insects
3. Acoustics: Sound production in insects
4. Special aquatic adaptive traits in fishes
5. Aquatic respiration with special reference to fish

Course Objectives:

Dissect, examine and illustrate organs in a wide variety of animal organisms. Identify organs and determine function of organs in a wide variety of animal organisms. A survey of the animal kingdom and animal-like protists from an evolutionary perspective. Major lines of evolution will be traced as characteristics of each animal group are compared and contrasted

Course ZOOTO13: Environmental Biology (CC-DPM/SB)

Total credits: 3

Part I

1. **Environmental Physiology:** body response to cold, heat, stress, altitude, g-forces, diving.
2. **Environmental Stressors:** Chemicals, Radiations, Noise, climate change.
3. **Response to Environmental Stress:** Health and cellular impacts of environmental stress, Endocrine Response to Stress, Stress and adaptation, altered cellular signalling.
4. **Environmental Influences on Gene Expression**

Part II

1. **Ecotoxicology:** Concepts of Bioaccumulation and Biomagnification
2. **Solid Waste disposal and soil pollution**
3. **Environmental Monitoring-** use of Bioindicators, Biomarkers, Bioremediation and Biosensors.

Suggested Books- Schmidt Nielsen, Cassarett & Doull's Toxicology.

Course Objectives:

Upon completion of the course the students will understand the major concepts of environmental science, Identify how toxic chemicals used for many purposes are affecting ecosystem and human health and apply the scientific method and quantitative techniques to describe, monitor and understand environmental systems.

Course ZOOT014: Developmental Biology (CC- CP)

Total Credits: 3

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 *Caenorhabditis elegans*, eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons.
4. Programmed cell death, aging and senescence
5. Developmental immunology: Immune relations during development; role of cytokines in development.

Course Objectives:

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.

Course ZOOT015: Neurobiology (CC-SJB)

Total Credits: 3

1. Memory: taxonomy of memories, brain structures associated with different kind of memories
2. Cognition: levels of cognition in primates and birds
3. Modern methods for mapping brain activities: CT-Scan, fMRI, EEG
4. Neurotransmissions
5. Phantom in human brains

Course Objectives:

Students can expect to achieve the following learning goals: Demonstrate a solid understanding of basic neuroanatomy and nervous system function on a molecular, cellular, systems level.

Practicals

Course ZOOP009: Animal Physiology & Endocrinology (CC-SS)

Total Credit: 3

1. Blood pressure estimation
2. TC, DC, Arneath count, colour index
3. Haemoglobin count
4. Blood sugar estimation
5. Preparation of hypothyroid rat model
6. Preparation of Diabetic animal model
7. Histopathology
8. Liver function test
9. ELISA for hormone assay
10. Semi quantitative RT-PCR for gene expression study.

Course ZOOP010: Developmental Biology & Animal Structures **(CC-NG)**

Total Credit: 3

1. Study of gametes: Snails, fish and mammals
2. Study of embryo: Chick, fish and amphibian
3. Study of different kinds of bird flights and insects
4. Study of sound producing organ in crickets.

Course ZOOP011: Environmental Biology & Neurobiology **(CC- SB)**

Total Credit: 3

1. Measurement of productivity of an aquatic ecosystem and classifying ponds according to their productivity.
2. Detection of Nitrate and Phosphate levels in water samples
3. Detection of Heavy Metals in water samples
4. Detection of Oil and Grease in water samples
5. Ecotoxicological studies of an aquatic ecosystem using fish/amphibia as bioindicator
6. Case studies/ Surveys to study the adverse health effects of Pesticide/Heavy metals/ other toxicants in people who are occupationally exposed to them.
7. Habituations and learning in snails and rats
 8. Impacts of pesticides on motor behaviour in fishes
 9. Psychological tests and measurements

4th Semester

Theory

Course I (Elective): Cellular and Molecular Approach

Total Credits: 5

Subunit 1 Course ZOOTO16: Advanced Immunology

Theory

1. Functional anatomy of local & systemic immune responses; lymphocyte homing.
2. Toll- Receptor & Innate Immunity; Regulation of Immune response.
3. Dendritic cells & its implication in vaccine designing.
4. Insight the Regulatory T Cells & Memory T Cells.
5. NK cells & its Receptor, NK-T Cells & CD1-New dimension in Antigen presentation.
6. Immune Tolerance.
7. Reproductive immunology.
8. Neuroimmunology.
9. Allergy and Asthma.
10. Autoimmunity.
11. Transplantation Immunology
12. Immunodiffusion Techniques.
13. Immunoelctrophoresis & Western blotting.
14. Radio immuno Assay (RIA).
15. ELISA.
16. Fluorescence Activated Cell Sorter (FACS).
17. Hybridoma technique.
18. Detection of Apoptosis.

Course Objectives:

The course aims to provide students with the necessary training to enable them to understand the principles that underpin clinical research, and to translate that understanding into good research practice.

Subunit 2 Course ZOOTO17: Molecular Oncology (Elective)

1. Oncogenes:
2. Tumor Suppressor genes
3. Cell Proliferation and Differentiation
4. Apoptosis: Signal Transduction and Apoptosis Dysregulation in Cancer
5. Growth Factors and Signal Transduction in Cancer:
6. Cancer Invasion and Metastasis
7. Angiogenesis
8. Cancer Immunology
9. Cancer Etiology: Genetic Basis of Cancer Syndromes, Chemical Carcinogenesis, Hormones and cancer, Ionizing radiation, Tumor Viruses, Life Style factors
10. Therapeutic Modalities

Course Objectives

The aim of the course is to provide an in-depth understanding of the molecular mechanisms underlying the development of cancer. The course will provide students with the knowledge and training needed to approach and formulate scientific questions relevant to the cancer biology. The course will also survey the frontiers of cancer research and aims to make the students acquainted with the applied advanced methods, technologies and state-of-the-art web-tools used in cancer research.

Course II: Organismal Approach (CC- SJB/NG/SS)

Total Credits: 5

Subunit 1 Course ZOOT018: Behavioural Ecology and Endocrinology **(Elective)**

1. Behavioural ecology – introduction to the approach
2. Levels of selection- genic, population, kin, group and species
3. Explaining eusociality in Hymenoptera, isopteran and other groups- emerging theories
4. Emergence of cognition- in primates, birds and others
5. Cultural transmissions and complexities of human behaviours
6. The approach of Behavioral Endocrinology
7. Sex Differences in Behavior: Sex Determination and Differentiation
8. Male & female Reproductive Behavior: Endocrinological aspect
9. Hormones and Social Behavior (including parental behaviour, homeostasis)
10. Biological Rhythms
11. Hormones & Stress
12. Hormonal aspect of Learning and Memory

Course Objectives:

The field of behavioural endocrinology is a truly interdisciplinary effort. It involves the study of phenomena ranging from genetic, molecular, and cellular levels of analysis to the study of individual and social behaviour. The course deals about the interaction of hormones and behaviour from diverse perspectives. This course inspires students to enter the exiting field of Behavioral Endocrinology and to work in such an exciting research discipline too.

Subunit 2 Course ZOOT019: Conservation Biology and Wild Life **(Elective)**

1. Global Conservation efforts-IUCN, WWF
2. Conservation of wildlife in India, Indian Wildlife Act, Traditional efforts.
3. Study of Indian Forest types

4. Conservation of mammals, amphibians, reptiles and birds
5. Concept of hotspot, National Park and Sanctuary
6. Threats to wildlife
7. Man-animal conflict: Elephant and Tiger
8. Joint Forest Management: Arabari Model

Course Objectives:

The elective course of Conservation Biology is designed for those PG students who aspire to become a professional in the emerging field of Conservation, as researcher / teacher or a conservation manager of Indian/State Forest Services, Non Gov. conservation related agencies.

Practicals

ZOOP012:Advanced Immunology

Total Credit-2

1. Preparation of growth media and techniques related to sterile culture of cells.
2. Cell proliferation assay by MTT
3. Microscopic detection of apoptosis by DAPI &/or Acridine orange- PI method

ZOOP013 :Avanced Molecular Oncology

Total Credit-2

1. Development of tumor in murine model: Transplantable tumor model and carcinogen induced tumor model
2. Longitudinal study of the effects of development of tumor on host physiology
3. Study of angiogenic factors
4. Experimental therapeutics in cancer biology: Study of nutraceuticals and other non nutrient phytochemicals
5. Tumor Immunology: Histological study of primary and secondary lymphoid organs , Evaluation of cytokines by ELISA,

ZOOP014 : Behavioural Ecology & Endocrinology

Total Credit-2

1. Psychological tests for cognition
2. Study of human behaviours under different contexts
3. Study on crows' social and cognitive behaviours
4. Exploratory behaviours in fishes
5. Behavioural and Endocrinal response to different external stimuli in fishes
6. ELISA for hormone assay

7. Semi quantitative RT-PCR for gene expression study.

ZOOP015: Conservation Biology and Wild Life

Total Credit-2

1. Wildlife Census Techniques
2. Sampling Techniques
3. Documentation of urban wildlife
4. Visit to an important National Conservation site

Dissertation include project on an original problem under the supervision of any faculty WBSU or from other Institute of National repute.

Credit: 9