DEPARTMENT OF ZOOLOGY
UNIVERSITY OF ALLAHABAD

Choice Based Credit System Syllabus (Zoology)

SEMESTER I

ZOO 501: Non-Chordata

UNIT I
Protozoa: Reproduction, Locomotory organs and locomotion

UNIT II
Porifera: Canal System, Skeletal system

UNIT III
Cnidaria: Metagenesis in Obelia

UNIT IV
Platyhelminthes: Evolution of Parasitism, Tegument and tegumental organs

UNIT V
Annelida: Metameric segmentation, Trochophore larva- Structure and significance

ZOO 502: Non-Chordata

UNIT I
Arthropoda: Mouth parts and mode of feeding, Crustacean larvae-Structure and significance.

UNIT II
Insect Metamorphosis and its hormonal control,

UNIT III
Mollusca: Archimollusca (Ancestral Mollusca)

UNIT IV
Cephalopoda:Nervous system

UNIT V
Echinodermata: Larval form and its significance

ZOO 503: Chordata

UNIT I
Chordata: Origin of Chordates, Origin of Gnathostomes
Pisces: Ostracoderms and Devonian fishes

UNIT II
Lung fishes (Dipnoi) and their peculiar features:

UNIT III
Reptilia: Origin of Reptiles, Skull of reptiles and its significance in classification of Reptilia

UNIT IV
Aves: Origin of Birds, Palate of Birds

UNIT V
Mammalia: Origin and evolution of Mammalia,

Suggested Readings:
1. Orr, R.T. Morphology and biology of Reptiles.
2. De Beer, G.R. Vertebrate Zoology.
3. Romer, A.S. Vertebrate Body.
4. Majupuria, T.S. Introduction to Chordates.

ZOO 504: Evolution

UNIT I
Facts and theories of evolution: during pre- and Darwin era.

UNIT II
Evolution: a new synthesis: Developments and concept of synthetic theory,
Elemental forces of evolution, Mutation, Selection (types of selection, selection coefficient, selection in naturalpopulation), Genetic drift: Changes in gene frequency in small population; Migration

UNIT III
Population genetics: Gene frequencies in Mendelian population, Hardy-Weinberg equilibrium, Conditions forthe maintenance of genetic equilibrium

UNIT IV
The nature of reproductive isolation, genetic basis of isolating mechanisms
Concepts of species and models of speciation: allopatric and sympatric speciation

UNIT V
The role of hybridization in evolution: Definition and immediate effect of hybridization.

Suggested Readings:
1.Organic Evolution: R.S. Lull
2. Dobzhansky Th.: Genetics and the Origin of Species. Columbia.
3.Freeman S. and Jon C. Herron (1998): Evolutionary Analysis. Prentice Hall
4. Futuyma D. J. (1998): Evolutionary Biology. Sinauer
5. Hartl D. L. and A. G. Clark (1989 & 1997): Principles of Population Genetics. Sinauer
6. Ridley M. (1993): Evolution. Blackwell.
7. Strickberger M. W. (2000): Evolution. White M. J. D. (1978): Modes of Speciation. Freeman

ZOO 505: Biostatistics

UNIT I
Population sample, random sample, tabular and graphical representation of data

UNIT II
Mean and standard deviation of grouped and ungrouped data

UNIT III
Binomial, Poisson and Normal distribution

UNIT IV
Tests of significance- t, F, Chi- square test.
Analysis of Variance

UNIT V
Correlation

Suggested Readings:

1. George W. Snedecor, William G. Cochran. 1992. Statistical Methods. Wiley-Blackwell. 503pp.
2. Frederick Emory *Croxton,* Dudley J. Cowden. 1939. Applied General Statistics. Prentice-Hall, 944pp.
3. Karmel, P.H. &Polasek, M. 1970. Applied statistics for economists. Publisher, Pitman. 519pp.
4. Spiegel, M.R.: Theory & Problems of Statistics, Schaum's outline series, McGraw Hill Pub. Co., NewYork :Schaum's Outline Series (McGrawHill), 1961
5. Spiegel, M.R.: Probability and Statistics. 1982. Paperback. Wiley's Summer Savings Event.
Amazon.com.
6. Marylees Miller, Irwin Miller, 2012. Freund, John, E's Mathematical Statistics with Applications. 624pp.Paperback. Pearson.

SEMESTER III

ZOO 510: Formal and Experimental Embryology

UNIT I
Descriptive embryology with particular reference to frog and chick
Egg types; Cleavage Patterns; Fate maps; Morphogenetic movement and formation of germ layers;Gastrulation in amphibian and birds

UNIT II
Organizer concept: Properties and physiology of organizer; Primary Organizer and Primary Induction,neurulation.

UNIT III
Regeneration (Epimorphic/Morphalactic)
Regeneration of the amphibian limb
Regeneration in Hydra

UNIT IV
Foetal membranes; Placentation in animals: Types and functions
Teratogenesis: environmental assaults on development; teratogenic agents; teratological abnormalities

UNIT V
Experimental Embryology: Basic Concepts
Standard techniques and methods of experimental embryology:
Experiments on the analysis of early development and differentiation (Experiments of Spemann and Mangold), vital dyeing, extirpation, isolation, transplantation

RECOMMENDED BOOKS

1. Balinsky, *B.I.* : An Introduction to ***Embryology***, . Holt-Saunders, Philadelphia.
2. S. F. Gilbert. Developmental Biology

ZOO 511: Animal Behaviour

UNIT I
Definition and general mechanism of animal behaviour
Major contribution of scientists: In classical ethology and modern behavioural biology

UNIT II
Modern concepts of animal behaviour: Ethological and Psychological
Methods of study of animal behaviour: In wild and laboratory environment, Neuroanatomical, Neurophysiological and Neurochemical approach

UNIT III
Development of behaviour: Innate and Learned; Comparative account on characteristics of instinct andlearning; Neuro-genetic mechanism of instinct

UNIT IV
Learning and Memory: Classification or forms of learning and memory.

UNIT V
Motivation and behaviour

Suggested Readings:
1. Manning, A. An Introduction of Animal Behaviour.
2. Russell, E.S. The behaviour of Animals.
3. Mc Farland, D. Animal Behaviour: Psychology, Ethology & Evolution.
4. Alcock, J. Animal Behaviour: An evolutionary approach.
5. Dugatkin, L.A. Principles of Animal Behaviour.
6. Silverman, P. Animal Behaviour in the laboratory.

ZOO 512: Biotechnology

UNIT I
Recombinant DNA technology: Introduction, Restriction endonucleases and applications, otheruseful enzymes for molecular cloning, steps in gene cloning, identification and isolation of desiredgene.

UNIT II
Cloning vectors, screening and selection of recombinant DNA clones, gene probes as diagnostic tools, biosynthesis of insulin, somatostatin and growth hormone

UNIT III
Tissue culture, hybridoma technology and monoclonal antibodies: Cell culture, culturemedia, animal cloning

UNIT IV
Environmental biotechnology: Bioconversions, pollution control, microbial enhancement of oil recovery, microbial mining and metal recovery, sewage treatment

UNIT V
Health care biotechnology: gene replacement therapy
Miscellaneous: An introductory knowledge of biosensors, biochips
DNA fingerprinting,
Immobilized enzymes.

ZOO 513: Molecular Biology

UNIT I
Molecular analysis of eukaryotic DNA- overall composition, reassociation kinetics, kinetic analysisof eukaryotic DNA,
Nucleotide polymerases, DNA replication, repair and mispair mechanisms

UNIT II
The basic transcription apparatus, promoters, enhancers, termination and antitermination, Organisation of eukaryotic genes-globin gene, IgG, histone gene

UNIT III
Genetic code, protein synthesis:m-RNA processing and Translation. Organelle genomes.

UNIT IV
Stucture and life cycles of bacteriophage T2 or T4 virulent and temperate phages,RNA phages, tumour viruses and their life cycles, retroviruses,Topoisomerases, gyrases, methylases, nucleases

UNIT V
Molecular biology of cancer: Oncogenes, chemical carcinogenesis
Principles and methods of gene targeting, gene silencing

Elective (Any one of following may be opted)

ZOO 560: Fish & Fisheries

UNIT I
Classification; Elasmobranchs, Holocephalians, Dipnoans and Actinopterygians (including the ancestral groups of Acanthodians. Crossopterygians)

UNIT II
Origin and evolution of major groups of fish

UNIT III
Adaptation of fishes; Hill-stream

UNIT IV
General features of the skin and fins of teleosts

UNIT V
Fish migration with particular reference to Salmon. Hormonal regulation of fish migration

Suggested Readings:

1. DattaMunshi, J.S. and M.P. Srivastava. Natural History of Fishes and Systematic of Fresh water
Fishes of India. 2006 Narendra Publ. House, New delhi
2. Gupta S.K. and Gupta P.C. General and Applied Ichthyology.
3. Srivastava, C.B.L. A. textbook of Fishery Science and Indian Fisheries.
4. Lagler et. al. Ichthyology
5. Norman, J.R. A History of Fishes.
6. Kyle, H.M.A. Biology of Fishes
7. Khanna, S.S. An Introduction to Fishes.

ZOO 561: Environmental Biology

UNIT I
Meaning and Scope of Environmental Biology.
Practical application of Environmental Biology.

UNIT II
Environmental Problems: Local, regional and global.

UNIT III
Environmental problems associated with resource exploitation and energy utilization in developing anddeveloped countries.

UNIT IV
Environmental Biochemistry.

UNIT V
Sources of toxic substances in the environment.
Factors affecting toxicity.

Suggested Readings:

1. Elements of Ecology. Clarke
2. Ecology, Eugene P. Odum. 1965. Amerind Publishing, New delhi
3. Ecology with Special reference to Animal and Man. S. Charles Kendeigh
4. Principles of Animal Ecology: Allee, Emeroon, Park and Schmidt.
5. Ecology. C.J.Krebs.
6. Ecology 2000. Eds. Edmond Hillary. London Michael Joseph. 1984.

ZOO 562: Cell Biology

UNIT I
Plasma membrane:
Fine structural details with reference to various models, functions of plasma membrane; Transport across cell membranes: active transport.

UNIT II
Endoplasmic reticulum: Structure and function (protein uptake and modification).
Golgi apparatus: Fine structural details and functions; protein sorting in Golgi apparatus.

UNIT III
Ribosomes; prokaryotic and Eukaryotic ribosomes.
Lysosomes: Structure, types (primary and secondary), formation and function.

UNIT IV
Mitochondria: Fine structural detail and functions (Electron Transport Chain and Oxidative phosphorylation)

UNIT V
Nucleus: Ultra structure, nuclear envelope, structure and function of nuclear pore complex, internal organization.

Suggested Readings:
1. Lodish, Molecular Biology of the Cell.
2. Karp, G. (7th Edition), Cell and Molecular Biology: Concepts and Experiments.
3. Alberts ET Al., Essentials of Cell Biology

SEMESTER II

ZOO 506: Ecology

UNIT I

Population growth: Exponential and logistic patterns of population growth, Intrinsic rate of natural increase [r], its determination and importance in population ecology.

UNIT II

Lotka- Volterra Model of interspecific competition. Modern concepts of Niche. Niche parameters. Niche overlap.

Biodiversity: Measures of species diversity.

UNIT III

Law of thermodynamics as they relate to ecological energetic. Food webs

UNIT IV

Biogeochemical cycles: Nitrogen, Phosphorous and Sulphur cycles in terrestrial and aquatic ecosystems. Energy flow models.

UNIT V

Ecological succession, its types and concept of climax.

Remote sensing, Practical applications of ecology.

Suggested Readings:

1. Calver, M., Lymbery, A., McComb, J. and Bamford, M. Environmental Biology.
2. Clarke. Elements of Ecology.
3. Odum. E.P. 1965. Ecology. Amerind Publishing, New Delhi.

4. Kendeigh. S.C. Ecology with Special reference to Animal and Man
5. Allee, Emeroon, Park and Schmidt. Principles of Animal Ecology.
6. Krebs, C.J. Ecology
7. Joseph. M. 1984. Ecology 2000. (Eds. Edmond Hillary. London).

ZOO 507: Methodology & Instrumentation

UNIT I
Fluorescence and Electron Microscopy (SEM & TEM) with principles and working.
UNIT II
General laboratory methods, Autoradiography, radioactive labeling and counting i.e. liquid scintillation UNIT III
Principles of chromatography and electrophoresis, centrifugation and ultracentrifugation UNIT IV
UV- VIS Absorption Spectrophotometry, Spectroflurometry UNIT V
Hydrobiological techniques for determination of inorganic ions in water (Na^+, K^+, Ca^{++}, Li^+, SO^-, PO^-, and Cl^-)

ZOO 508: Animal Physiology

UNIT I
Ultrastructure of Muscle and its contraction Nerve conduction and neurotransmitters UNIT II
Major sense organs and receptors, electric organs Excretion and osmoregulation
UNIT III
Reproduction- Male and female reproductive physiology UNIT IV
Bioluminiscence
Active transport across membranes UNIT V
Endocrinology: Glands, hormonal secretions and functions Stress Physiology: High altitude and deep sea physiology

ZOO 509: Biochemistry

UNIT I
Thermodynamics: Elementary knowledge, oxidation-reduction, Electrolytes: Concepts of buffer, Handerson-Hasselbach equation UNIT II
Glycolysis, Kreb's cycle, oxidative phosphorylation, gluconeogenesis,

Hexose monophosphate pathway, glycogen metabolism, peptidoglycan, UNIT III

Amino acid: Chemistry, properties and metabolism

Proteins; Structure-Primary, secondary, tertiary and quatqrnary structure, Ramchandran plot, protein isolation, Solubilities and protein targeting

UNIT IV

Lipids: chemistry, metabolism of fatty acid and cholesterols Nucleic acids: Chemical nature, biosynthesis of nucleotides UNIT V

Enzymes: Kinetics, inhibition, mechanism of action, Michaelis and Menton equation, isoenzymes allosteric enzymes, ribozymes, Abzymes

Elective (Any one of the following may be opted)

A. **For Biology Student**
   Biodiversity and Wild
   Life Nematology
   Skill-development
   Communication
   Biology

B. **For Non Biology**
   Students Hormones and
   Health Basic Genetics
   Elementary Biochemistry

ZOO 551: Biodiversity and Wild Life

UNIT I

Animal Taxonomy and Diversity

Conservation Biology

Quantitative Biology

UNIT II

Genomics and Biodiversity

Molecular Tools for diversity studies-Significance of Molecular Tools in Diversity and Conservation Studies- Barcoding, RT-PCR.

UNIT III

Wildlife habitat and species populations Threat of species extinction

Wildlife Health and Population Management; Wildlife Health; Population Management.

UNIT IV

Principles of forest management, forest and wildlife as natural resources. Conservation and sustainable development.
Over-exploitation of wildlife natural
resources UNIT V
Concept of conservation with special reference to forest and wildlife management

a) Conservation verses preservation
b) Conservation Genetics-Genetic management of threatened species
c) Management and Conservation Practice
d) Values of biodiversity and conservation ethics
e) Role of zoos and aquariums in conservation, Concept of stakeholders. International conservation bodies; IUCN, UNDP, FAO, WWF

Suggested Readings:

1. Edward O. Wilson, 1996, Biodiversity, 521pp., National Academy Press.
2. Alison J. Stattersfield, Michael J. Crosby, Adrian J. Long, and David C. Wege. 1998. Endemic Bird Areas of the World: Priorities for Biodiversity Conservation. 846pp.
3. Bibby, J., Collar, N.J., Crosby, M.J., Heath, M.F., Imboden, Ch., Johnson, T.H., Long, A.J., Stattersfield, A.J., and Thirgood, S.J. 1992. Putting biodiversity on the map: priority areas for global conservation.

ZOO 554: Skill Development: Sericulture

UNIT I

Sericulture: Definition, history and present status. Silkworms: Types of silkworms, their food plants and distribution. Silk production: Mulberry and non-mulberry cocoon and yarn.

UNIT II

Prospects of Sericulture in India. Sericulture industry in different states, employment, potential in mulberry and non-mulberry sericulture.

UNIT III

Sericulture Centres. Research Training and extension. Central Silk Board (CSB): Role in Extension and development. Directorate of Sericulture: Extension and development in sericulture on state level.

UNIT IV

Mulberry plant morphology: Mulberry species: Classification, distribution and common varieties used in Sericulture in India.

UNIT V

Mulberry cultivation, harvesting & management. Economics: irrigated, non-irrigated & temperate region cultivation. Cost-benefit ratio.

Suggested Readings:

1. Ganga, G. and Sulochana Chett, J. 1997. Introduction to Sericulture. 302pp.
2. Anonymous. 1987. Manuals on Sericulture, CSB, Bangalore
3. Koshy, T.D. 1990 Silk Export and development, Ashish Publ. House, New Delhi
4. Yokoyama, T. 1959. Silkworm Genetics illustrated, Japanese Society for Promotion of Science, Japan.
5. Annonymous. 1993. Principles and techniques of silkworm Breeding, United Nations, USA (Oxford IBH, Calcutta)
6. Anonymous. 1997. Silkworm Egg production (Translated from Japanese) Oxford IBH, New Delhi

7. Anonymous. 1997. Silkworm rearing. (Translated from Japanese) Oxford IBH, New Delhi
8. Anonymous. 1972. Handbook of Silkworm rearing, Fuji Publ. Co., Tokyo, Japan
9. Jolly et al. 1974. Tasar Culture, CSTRI, Ranchi
10. Sathe, T.V. 1998. Sericultural crop Protection, Asawari Publ, Osmanabad.
11. Aruga, H. 1994 Principle of Sericulture, (Translated from Japanese) Oxford and IBH Publ., New Delhi
12. Sarkar, Dilip de 1998. The silkworm Biology, Genetic and breeding, UBS Publ. New Delhi
13. Jolly et al. 1987. Appropriate sericulture techniques, CSR & TI, Mysore

Department of Zoology, University of Allahabad
Curtailed Syllabus

SEMESTER IV

ZOO 514: Bioinformatics

UNIT I

Biology & IT, Computers in Biology and medicine, Introduction to Genomics and Proteomics etc.

Definition and terminology: Cladogram, Dendrogram, Phylogram and Phenogram.

UNIT II

Biological sequence data banks (GENBANK, EMBL, SWISSPORT, PDB)

Sequence alignment (Global & Local), Algorithms used (Dynamic & Heuristic) - Needleman Wunsch, Smith Waterman BLAST, FASTA

UNIT III

Trees: Rooted and unrooted trees

Species Tree and Gene Tree: Homology, Homoplasy, Orthology, Paralogy and Xenology

Trees Construction Methods: Maximum Parsimony, Maximum Likelihood, Branch and Boumd

UNIT IV

Fitch- Margoliash method and distance based methods.

Distance based methods: Least squares,

Neighbor joining, UPGMA

UNIT V

Bootstrapping and split decomposition; Concepts and its application in tree construction Application of Phylogeny: Pedigree analysis.

Suggested Readings:

1. Bioinformatics-Sequence and Genome Analysis-David W. Mount, CSHL Press
2. Molecular Systematics, 2nd ed. D.M. Hillis, C. Moritz and B.K. Mable, Sinauer Associates, Sunderland. Massachusetts.
3. Fundamental Concepts of Bioinformatics, Krane, D.E. and Raymer M.L. Pearson Education

Elective Papers

Fish & Fisheries

ZOO 569: Fish & Fisheries

UNIT I
General features of the anatomy, physiology and function of internal organs of teleosts Alimentary canal & digestion.
UNIT II
Respiration, Swim bladder, Accessory respiratory organs
UNIT III
Execration and Osmoregulation Reproduction and Reproductive organs
UNIT IV
Endocrine glands and Caudal neuroseretory system
UNIT V
Sense Organs, Lateral line organs.
Electric organs.

Suggested Readings:

1. Datta Munshi, J.S. and M.P. Srivastava Natural History of Fishes and Systematic of Fresh water Fishes of India. 2006 Narendra Publ. House, New Delhi
2. Gupta S.K. and Gupta P.C. General Applied Ichthyology.
3. Srivastava, C.B.L. A. textbook of Fishery Science and Indian Fisheries.
4. Lagler et. Al. Ichthyology
5. Norman, J.R. A History of Fishes.
6. Kyle, H.M.A. Biology of Fishes
7. Khanna, S.S. An Introduction to Fishes.

ZOO 570: Fish & Fisheries

UNIT I
Marine fishery: Important coastal fishery resources and fish landing in relation to different maritime states of India. Productivity of west coast and east coast, Problems of inshore fishery, off shore and deep sea fishery

UNIT II
Ecology of sea, Exclusive Economic Zone (EEZ) Fishery of Sardine, Mackerel
Past, present and future prospects of marine fishery in India
UNIT III
Inland Fishery: Inland capture fishery resources of India, Important riverine systems and their fishery.

Present and future prospects of cold water fishery of India

UNIT IV

Estuarine Fishery: Ecology of estuary, Present and future prospects of estuarine fishery of India

UNIT V

Crafts and Gears : Important traditional and modern crafts used for fish catch in inland and marine water, Conventional and unconventional fishing methods used in inland and marine sector

Age and growth determination

Methods and principles of fish preservations, development of fish bye - products

Suggested Readings:

1. Jhingran, V.G. Fish and Fisheries of India.
2. Bardach. Aquaculture.
3. Aggarwal, S.C. Fishery Management.
4. Govindan, T.K. Fish Processing Technology.
5. Beavan, C.R. Handbook of Freshwater fishes of India.
6. Bal and Rao, Marine Fisheries.

ZOO 571: Fish & Fisheries

UNIT I

Aquaculture: Definition, types, resources and cultivable fish and non-fish organisms, including sea-weeds Current and future prospects of aquaculture in India

Basic principles of aquaculture

Mariculture: Important cultivable organisms

UNIT II

Inland culture: Principal methods used in fish culture: composite fish culture, air-breathing fish culture, Integrated fish farming, cage.

UNIT III

Pond preparation: Brooder, nursery, rearing and stocking ponds

Management of pond : Pond preparation, use of fertilizers, aquatic vegetation and their control, eradication of weed and predatory fishes as well as aquatic insects, supplementary feeding, physico-chemical and biological factors, control of algal blooms and swarms.

UNIT IV

Carp seed raising: Natural spawning and seed collection of fish seeds, technique of induced breeding, natural and synthetic drugs for fish breeding.

UNIT V

Freshness of fish: Features of raw fish, decomposition of fish, state of rigor mortis,

Fish diseases and their control.

Suggested Readings:

1. Jhingran, V.G. Fish and Fisheries of India.
2. Bardach. Aquaculture.
3. Aggarwal, S.C. Fishery Management.
4. Govindan, T.K. Fish Processing Technology.
5. Beavan, C.R. Handbook of Freshwater fishes of India.
6. Bal and Rao, Marine Fisheries.

Cell Biology

ZOO 575: Cell Biology

UNIT I

Molecular organization of eukaryotic chromosomes; Chromosome compaction (Nucleosome, solenoid); Organization and significance of heterochromatin.

UNIT II

Cell signaling:

Signaling through membranes receptors (G protein coupled receptors, Receptor Tyrosine kinase) ; intracellular receptors (signaling of steroid molecules)

UNIT III

Communication between cells and their environment: Interaction of cells with extracellular matrix and other cells; Integrin, selectins and cadherins

UNIT IV

Cytoskeleton: structure and dynamics of microfilaments, intermediate filaments and microtubules

UNIT V

Cell cycle and its regulation; Cell aging

RECOMMENDED BOOKS

1. Molecular Biology of the Cell: By Lodish
2. Cell and Molecular Biology: Concepts and Experiments : Gerald Karp (7^{th} Edition)
3. Essentials of Cell Biology: Alberts et al
4. Lehninger Principles of Biochemistry: Nelson and Cox

ZOO 576: Cell Biology

UNIT I

Bioenergetics: Laws of energy changes (concept of entropy, free energy), Redox couples, coupled reactions.

UNIT II

Special cell function:

Immunecompetent cells; Differentiation of B lymphocytes and humoral immune response, Differentiation of T lymphocytes and cellular immune response; Antigen Processing and Presentation, Antigen presenting cells, Major Histocompatibility Complex (MHC), MHC Restriction of Lymphocytes.

UNIT III

Polyclonal antibody, Types, structure and function; antibody diversity

UNIT IV

Monoclonal antibody, hybridomas; Function of monoclonal antibody

UNIT V

Cancer: Molecular Biology of cancer, tumor suppressor genes and oncogenes

RECOMMENDED BOOKS

1. Kuby Immunology: JA Owen, SA, Stranford, PP Uones.
2. Cell and Molecular Biology: Concepts and Experiments : Gerald Karp (7^{th} Edition)
3. Essentials of Cell Biology: Alberts et al
4. Lehninger Principles of Biochemistry: Nelson and Cox

ZOO 577: Cell Biology

UNIT I

Tools and Techniques of cell Biology Microscopy

Principles of light and electron microscopy Tissue preparation:

Fixation of tissue for paraffin and cryocut sectioning and electron microscopy:

Tissue embedding (Paraffin and epoxy resin) Tissue sectioning (Rotary and ultra microtome)

UNIT II

Histochemical techniques for detection of carbohydrates, lipids, proteins,

Techniques for detection of special cells: Neuronal staining: Cresyl violet and Silver Impregnation staining (Golgi Cox)

UNIT III
Immunocytochemistry/ Immunohistochemistry
Light microscopic immunocytochemistry, Direct and Indirect Method
Fluorescence and Enzymatic Method Antigen Retrieval

UNIT IV

Immunoelectron microscopy: Nano-gold immunoprobe and Protein A-gold immunocytochemistry
Applications of Immunocytochemistry/Immunohistochemistry.

UNIT V
Cell culture: Detection of apoptotic and necrotic
cells (AO/EB staining)

Suggested Readings:

1. Owen, J.A. Stranford, S.A. and Uones, P.P. Kuby Immunology
2. Cell and Molecular Biology:
3. Karp, G. (7thy Ed.) Concepts and Experiments
4. Alberts et al. Essentials of cell Biology
5. Lehninger Principles of Biochemistry: Nelson and Cox

ZOO 578: Project// Seminar
Presentation ZOO 536-542:
Lab course/Practical

Environmental Biology

ZOO 572: Environmental Biology

UNIT I
Air pollution, effect and control Pollution indicators, Saprobian lndex
UNIT II
Water pollution sources, effect and control, Water quality criteria standards.
Physico-chemical and biological monitoring of water quality
UNIT III
Marine pollution; sources, effect and control Soil pollution: source, effect and control

UNIT IV
Biodegradation of pesticides, Bio-geochemical cycle of pesticides Hazards of pesticide pollution
UNIT V
Noise pollution: sources, effect and control Radioactive pollution: Sources, effect and control Bio-concentration & Bio-magnification
Indian legislation for pollution control.

Suggested Readings:

1. Elements of Ecology, Clarke.
2. Ecology, Eugene P. Odum, 1965. Amerind Publishin, New Delhi
3. Ecology with Special reference to Animal and Man. S. Charles Kendeigh.
4. Principles of Animal Ecology: Allee, Emeroon, Park and Schmidt
5. Ecology. C.J. Krebs.
6. Ecology 2000. Eds. Edmond Hillary. London Michael Joseph. 1984

ZOO 573: Environmental Biology

UNIT I
Diversity of environmental habitats Animal resource management
UNIT II
Vermiculture
Forest management (policies and problems) Wetland and Wasteland management
UNIT III
Integrated pest management
Biological control with the help of natural enemies
UNIT IV
Soil monitoring and management Management of soil erosion
UNIT V
Recycling of non- degradable substances
Role of NGO's in Environmental Management and Conservation Basic knowledge of use of computer in Environmental Management.

Suggested Readings:

1. Clarke, Elements of Ecology.
2. Odum, E.P. 1965 Ecology, Amerind Publishing, New Delhi
3. Kendeigh, S.C. Ecology with Special reference to Animal and Man
4. Allee, Emeroon, Park and Schmidt, Principles of Animal Ecology.
5. Krebs. C.J. Ecology
6. Joseph, M. 1984. Ecology 2000 (Edmond Hillary. London)

ZOO 574: Environmental Biology

UNIT I
Environmental management of agricultural land, urban land, rural land and forest land
UNIT II
Land use classification and practices Land use planning and management
UNIT III
Environmental impact assessment
Purposes of environmental assessment methods
UNIT IV
Environmental monitoring: purpose of monitoring, trend monitoring, ambient source-linked monitoring, Monitoring activities and directions, design and applications
UNIT V
Sensors and methods
Role of remote sensing in environmental management.

Suggested Readings:

1. Elements of Ecology, Clarke.
2. Ecology, Eugene P. Odum, 1965. Amerind Publishin, New Delhi
3. Ecology with Special reference to Animal and Man. S. Charles Kendeigh.
4. Principles of Animal Ecology: Allee, Emeroon, Park and Schmidt
5. Ecology. C.J. Krebs.
6. Ecology 2000. Eds. Edmond Hillary. London Michael Joseph. 1984