RKDF UNIVERSITY RANCHI

MASTER OF SCIENCE (M.Sc.)
ZOOLOGY

SEMESTER I

Course	Subject Title	Subject Code
M.Sc. Zoology	**Systematics, Evolution & Bioinformatics**	**PZO101**

Unit 1

Animal Systematics:

Basic concept and nature of taxonomy and Systematics, contribution of systematic to biology.

Different types of Classification Numerical /Phenetic, Cladistic, Evolutionary Systematics (Phylogenetic) Concept of Cytotaxonomy,

Chemical and Molecular taxonomy Systemic hierarchy, names, codes

Operative principles of nomenclature, application of important rules.

Unit 2

Evolution:

Concept of Evolution, Theories of organic evolution: Neo Darwinism Synthetic theory of Evolution Population, Gene frequency, Hardy Weinberg's law in genetic stability

Genome evolution – Evolution of Multigene family, Genetic Drift, Isolation,

Unit 3

Bioinformatics:

Principles of bioinformatics and its application

Biological databases:

- Nucleic acid sequence databases
- Protein sequence databases
- Protein structure databases
- Literature database

Data retrieval systems: Search engines, Entrez

Molecular sequence analysis software packages and tools: BLAST, RasMol, Biologist's Workbench - PERL

Course	Subject Title	Subject Code
M.Sc. Zoology	**Invertebrate Diversity & Quantitative Biology**	**PZO102**

Unit 1

Invertebrate Diversity:

Concept of Protostomes and Deuterostomes

Origin of coelom – Acoela, Pseudocoela, Schizocoela and Enterocoela.

Locomotion in Protozoa, Locomotion in Cnidaria, Annelida and Echinoderm with reference to Hydrostatic movement.

Origin of Segmentation

Excretion and Osmoregulation in Protozoa

Nephridia and Coelomic System in Annelids

Excretion in Arthropods

Respiration: Arthropods, Mollusca

Concept of Host specificity and Host parasite relationship.

Unit 2

Quantitative BIology:

Biostatistics: Samples and population, sampling designs

Probability distributions and their properties: Normal, Binomial, Poisson distribution

Hypothesis testing: Non parametric tests and parametric tests

Chi square, G- , t-, f-test, Analysis of variance, Correlation, Regression

Evaluation of Biodiversity indices: Shannon –Weiner index, index of dominance, Similarity and Dissimilarity index, Association index: 2 x 2 contingency table.

Course	Subject Title	Subject Code
M.Sc. Zoology	**Biotechniques, Histology & Histochemistry**	**PZO103**

Unit 1

Biotechniques:

Analytical instruments: Spectrophotometry and spectrophotometric principles.

Spectroscopy - Atomic Absorption, ESR and NMR Spectroscopy,

Microscopy and Scanning and Transmission electron microscopes,

Fluorescence microscopy.

Cryotechniques-Cryopreservation of cells, tissues and organisms,

cryotechnique for microscopy.

Separation techniques: different types of chromatography (paper, TLC, GLC,

Ion- exchange and HPLC)

Electrophoresis (Agarose and SDS PAGE)

Centrifugation: Basic principles, differential and density gradient centrifugation Immuno–cytochemistry ELISA.

Unit 2

Histology & Histochemistry:

Fixation and tissue processing: Types of fixatives, Chemistry of fixation and selection of Fixatives, Dehydration, Clearing and embedding, Microtomy. Staining of paraffin sections: Principle and methods of staining, Histological stains

Histochemical identification and localization of the following: Glycogen and glycoprotein

- Protein end groups – Mercury Bromophenol Blue, Ninhydrin-Schiff, Performic acid-Schiff and Per formic acid-Alcian Blue
- Lipid moieties - by Sudan Black B method, Sudan III and Sudan IV, Nile Blue Sulphate method
- Nucleic acids - DNA and RNA by Methyl green pyronin-Y, DNA by Feulgen reaction.

Course	Subject Title	Subject Code
M.Sc. Zoology	**Practical-I**	**PZO154**

A. Invertebrate Diversity

(a) General anatomy of:

Leech/ Prawn/ Squilla/ Scorpion/ Aquatic Beetle/ Mytilus/ Aplysia/ Sea urchin.

(b) Museum specimens:

Important representatives of different invertebrate phyla showing peculiarities/ adaptive features/ associations/ stages

- Specimens showing convergent and divergent evolutions
- Specimens of connecting links and living fossils- Limulus, Peripatus
- Specimens showing mimicry and melanism

(c) Slides:

Slides of larval stages showing recapitulation of ontogeny (Helminthes,

Crustacean).

(d) Preparation of taxonomic key upto order of the following:

1. Coelenterata – Hydra, Obelia (medusa and polyp), Physalia, Gorgonia, Aurelia, Metridium
2. Rotifera - Brachionus
3. Annelida – Earthworm, Tubifex, Neries and Heteronereis, Arenicola, Chaetopterus, Hirudo
4. Arthropods – Sacculina on crab, Crab, Prawn, Lepus,Balanus, Butterfly, Water beetle,Cyclops
5. Mollusca – Chiton, Pila, Unio, Loligo, Sepia, Octopus, Aplysia, Dentalium
6. Echinodermata – Asteria, Echinus, Antedon, Cucumaria, Holothuria.

(e) Study of the following using permanent slides:
Trematode, Cestode, Nematode Larval stages in the life cycle of diagenetic trematodes.

B. Biotechniques:

(a) Use of pH meter, water bath, autoclave, balance, centrifuge, colorimeter, spectrophotometer.
(b) Measurement, figure drawing, and photography through microscope.
(c) Chromatographic separation of proteins (Paper, TLC).
(d) Separation of amino acids, DNA by Gel electrophoresis
(e) Quantitative assessment of Glucose in a test solution by spectrophotometer/ auto-analyzer.
(f) Demonstration of P.C.R. technique.

C. Histology and Histochemistry:

(a) Preparation of fixatives for histological and different histochemical staining
(b) Paraffin sectioning
- Fixation of tissue
- Dehydration, clearing and embedding
- Trimming and sectioning of paraffin blocks
- Stretching and spreading of sections on slides

(c) Preparation of stains for histological and different histochemical staining.

(d) Histological staining of paraffin sections
(e) Histochemical staining of paraffin sections for

- Carbohydrate moieties using PAS, Alcian blue at different pH
- Lipids using Sudan black B, Sudan III, Sudan IV methods IV

D. Bioinformatics:

(a) Use of search engines
(b) Use of data bases – Gene Bank, PubMeD.
(c) Demonstration of software packages – BLAST and CLUSTUL

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SEMESTER II

Course	Subject Title	Subject Code
M.Sc. Zoology	Cellular and Molecular Biology	PZO201

Unit 1

Cellular and Molecular biology:

Biomembranes and cell matrix adhesion

Cell Cycle: Mitosis and Meiosis Protein Synthesis and trafficking

Cell Signalling and Cell-Cell Interaction

Replication: DNA replication, enzymes involved, Telomeric Replication,

Transcription: Mechanism of Transcription, Basic concepts of Transcription Regulation

Translation: Ribosome, Formation of Initiation Complex.

Initiation factors and their

- Control of Gene Expressionin Prokaryotes: Operon Concept, Lac Operon, Tryptophan Operon and Arabinose Operon.
- Control of Gene Expression in Eukaryotes: Conserved Mechanisms in Transcriptional Regulation

Course	Subject Title	Subject Code
M.Sc. Zoology	**Vertebrate Diversity, Ethology & Classical Genetics**	**PZO202**

Unit 1

Vertebrate Diversity:

Neomorphic air breathing organs in fish

Electric organ & Electro-Receptors in fishes

Organs of Distance Touch Orientation in fishes

Reproductive adaptations - Internal fertilization, Viviparity, Paedomorphosis and neoteny

Endocrine control of metamorphosis of the tadpole

Aerodynamics and energetic of flying and gliding in birds

Nest building and Parental care in Birds

Sensory system in birds - Vision, Olfaction, Hearing, Special senses used in navigation

Dentition in mammals, Aquatic mammals.

Unit 2

Ethology:

General concepts of Ethology: Motivation; Fixed Action Pattern; Sign or key stimulus or release; Innate Releasing Mechanism;Action specific energy; Learning or Experience Imprinting; Physiological Basis; Behavioral genetics; Evolution of Behaviour; Behaviour and its types: Individual and social interaction , Social organization , Innate and learned behavior.

Orientation in animals - its nature and types

Biological rhythms – occurrence and significance.

Unit 3

Classical Genetics:

Extension of Mendelian principles – codominance, incomplete dominance, gene interactions, pleiotropy, sex limited and sex influenced characters

Gene mapping – linkage maps.

Extra chromosomal inheritance – inheritance of mitochondrial and chloroplast gene**.**

Course	Subject Title	Subject Code
M.Sc. Zoology	**Environmental and General Vertebrate Physiology**	**PZO203**

Unit 1

Environmental Physiology:

- Elementary idea of stress and strain

  Adaptation, Fundamental mechanisms of adaptation. Physiological responses to exposure to cold, heat, low pressure (hypobaria), high pressure, electromagnetic radiation.
- Thermoregulation

  Mechanism of thermoregulation in vertebrates, Ectotherms and Endotherms Endothermy as a high–energy approach to life. Anatomical, Physiological and Behavioral adaptations in endotherms to extreme hot & extreme cold.
- Excretion/Osmoregulation

  Patterns of excretion, organs of excretion. Physiology of Urine formation. Problems of salt balance in aquatic vertebrates.

Unit 2

General Vertebrate Physiology

- Respiration

  Respiratory pigments in animals, Transport of gases, O_2 dissociation curve, Bohr's effect, Root effect, CO_2 transport, CO_2 equilibrium curve, Regulation of acid base balance. Hb and associated diseases: sickle cell Anemia & Thalassemia. Cardio-Vascular System.
- Contractibility / Motility
- Molecular structure of striated muscles and mechanism of muscle contraction.

  Nervous system

  Electrical potentials and its molecular basis. Propagation of impulses along myelinated nerves, Neurotransmitters.

  Autonomic nervous system

Course	Subject Title	Subject Code
M.Sc. Zoology	**Practical-II**	**PZO254**

A. Vertebrate diversity

1. Anatomical observation of:

(a) Accessory respiratory organs in fish- Channa, Heteropneustes, Clarias, Anabus.

(b) Cranial nerves and blood vessels in Labeo / Wallago

(c) Flight muscles and air sacs in chick

2. Museum studies:

(a) Models – Latimeria, Sphenodon, Ostrich, different types of beaks and feet in birds, nest of birds.

(b) Specimens – Petromyzon, Myxine, Electric ray, Acipenser, Caecilian, Hyla/ Rhacophorus, Axolotl larva/ Salamander, Draco,Turtle, Snakes: Cobra, Krait, Rattle snake, Sea snake, Water snake, Bat

(c) Bones – Skeleton of a bony fish, Chelonia, Snake, Dentition in mammals

B. **Physiology**

1. Measurement of metabolic rate in small animals - effect of stress on gill ventilation in fish – plotting zone of resistance and zone of tolerance.

2. Determination of blood pressure in man with help of Sphygmomanometer by auscultation method to show effects of exercise plotting time of acclimation.

3. Detection of presence of blood in urine / fecal matter by Benzidine test.

4. Preparation and study of hemin and haemochromogen crystals.

5. Determination of Haemoglobin content.

6. Permeability of erythrocyte membrane as a function of osmolarity of salt solution.

7. Effect of temperature, drugs, hormones, and neurotransmitters on the rate of heart beat

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SEMESTER III

Course	Subject Title	Subject Code
M.Sc. Zoology	**Endocrinology & Developmental Biology**	**PZO301**

Unit 1

Comparative and Molecular Endocrinology:

- Chemical messengers, hormones and mechanism of their action Hormone – synthesis, secretion, mode of delivery, half life, entry into the target cells, actions. Receptor types and structure, second messenger system, cytosolic receptors and their action via gene expression
- Pineal in vertebrates, its hormones and their function
- Mammalian endocrine glands, their hormones and functions: Adenohypophysis, Neurohypophysis; Thyroid; Adrenal; Parathyroid
- Physiological Endocrinology: Endocrinology of calcium regulation, Endocrinology of osmoregulation.

Unit 2

Developmental Biology:

- Fertilization: Specialization of egg, structural specialization of sperm, species-specific binding of gamates, sperm-egg fusion, capacitation, Acrosomal reaction, prevention of polyspermy.
- Cell differentiation: Myogenesis (skeletal muscle - formation, regeneration and hypertrophy), Differentiation of erythrocytes (Stem cells and their diversification, control of haemoglobin synthesis, erythrocyte membrane); Neurogenesis
- Post-embryonic Development: Metamorphosis – Anuran and Insect

Books Suggested:

1. Austin C. R. & Short R.V. – Reproduction in Mammal Books 1 to 7 Cambridge
2. Nalbandov A.V. – Reproductive Physiology Taraporevala 1970

3. Tienhoven A. V. – Reproductive Physiology of Vertebrates 2nd edn. Cornell Univ.
4. A Text-Book Reproduction in Farm Animals (Theriogenology)Varghese 1994.
5. Ramaswami L.S. – Vertebrate Neurosecretion: A Review INSA 1980

Course	Subject Title	Subject Code
M.Sc. Zoology	**Invertebrate Diversity & Quantitative Biology**	**PZO302**

Unit 1

Biological Chemistry-Biomolecules and Metabolic regulations:

- Water – As a biological solvent; Unique physical and chemical properties Ionization of water; Equilibrium constant and ionic product of water and pH; Weak acids and Weak base; Buffering properties of water.
- Biomolecules: Chemical bonds and bond energy.
- Structure and significance of Biomolecules: Monosaccharide, Oligosaccharides and Polysaccharides Proteins – Amino acids, Primary, secondary, tertiary and quarternary structures Lipids – simple and complex. Significance of Biopolymers and their formation.
- Metabolism: Biosynthesis and degradation of protein Metabolism of fructose, glucose, and glycogen.
- Enzymes: Mechanism of action, regulation of enzyme activity; Enzyme Kinetics Coenzymes and isoenzyme; Immobilised enzyme and their application.
- Free Radicals and antioxidants

Unit 2

Immunology:

- Vertebrate immune system: Innate immune system; Organization and structure of lymphoid organs; Cells of immune system and their differentiation; Lymphocyte structure – lymphocyte traffic MHC complex and antigen; Cytokines; Hypersensitivity reaction.
- Acquired immune systems: B-cells, type and receptors; T-cells, type and receptors; Antigens, antigenecity and immunogenesity; Epitopes, and Haptens types, structures, functions and diversity of antibody.
- Immunoglobins: Ig genes, Differential expression of Ig genes.

Books Suggested:

1. Barrington E.J.W. - Invertebrate structure and function. 2nd edn. ELBS/Nelson 1973
2. Meglitsch P.A. & Schram F.R. - Invertebrate Zoology. 3rd edn. Oxford Univ Press 1991
3. Ruppert E.E. & Barnes, R.D. - Invertebrate Zoology. 6th edn. Harcourt Asia 1994 Zar

J.H. – Biostatistical Analysis. 4th edn. Pearson 2005.
4. Khan I.A. & Khanum A. – Fundamentals of Biostatistics 2nd edn. Ukaaz Publ. 2007
5. Pagano M. & Gauvreau K. – Principles of Biostatistics. 2nd edn. Thomson 2007
6. Sundar Rao P.S.S. & Richard J. – An Introduction to Biostatistics. 4th edn. PHI 2006
7. Forthofer R.N., Lee E.U. & Hernandez M. – Biostatistics : A guide to Design, Analysis and Discovery. Elsevier/ Academic Press 2007

Course	Subject Title	Subject Code
M.Sc. Zoology	**Mammalian Reproductive Physiology & Biotechnology**	**PZO303**

Unit 1

Mammalian Reproductive Physiology & Biotechnology:

Different mechanisms of sex determination in vertebrates (genetic, hormonal, thermal) Testicular and ovarian hormones: sites of secretion, control and effects; Sperm maturation in male reproductive tract and the role of testicular hormones in eutherian mammals Ovarian and uterine cycles and their control by ovarian and hypophyseal hormones in eutherian mammals

Implantation - mechanism and control. Delayed implantation; Sterility due to hormonal defects Manipulation of mammalian reproduction: Hormonal contraceptives, Super ovulation, IVF, Embryo-transfer.

Environment and reproduction in mammals: Bruce effect, Lee Boot effect, Whitten effect

Unit 2

Biotechnology:

Enzymes and their application.

Vectors: Cloning and expression vectors, Properties of vectors.

Some important vectors: pBR322, pUC, Cosmids, BAC, YAC.

Selection of recombinants; Sources of cloned DNA; Genomic DNA library; cDNA library, PCR.

Application of Biotechnology: Preparation of transgenic animals

Mechanism of production of growth hormone, insulin, interferons.

Hybridoma technology: Monoclonal antibody production

Gene Therapy

Books Suggested:

1. Kay I. – Introduction to Animal Physiology. Bios Scincetific Publ Ltd 1998
2. Sherwood L., Klandorf H. & Yancey P.H. – Animal Physiology: From Genes to Organisms. Thomson 2005
3. Schimdt-Nelson K. - Animal Physiology: Adaptation and Environment. 5th edn. Cambridge Univ. Press 1998
4. Hoar W.S. – General Comparative Physiology. 3rd edn. Prentice Hall India 1983.

5. Mitra S. – Genetic Engineering; Principle and Practice. Mac Millan 2002.
6. Smith J.E. – Biotechnology. 3rd edn. Cambridge Univ. Press 1986.
7. Balsubramanian D., Bryce C.F.A., Dharmalingam K., Green J. & Jayaraman . – Concepts in Biotechnology. Universities Press 2002.
8. Bains W. - Biotechnology: From A to Z. 2nd edn. Oxford 1998.
9. Kumar H.D. – A Textbook on Biotechnology. Affiliated East West 1991

Course	Subject Title	Subject Code
M.Sc. Zoology	**Practical-I**	**PZO354**

(A) Endocrinology:

1. Study of histochemical slides
   - Endocrine glands of mammals
   - Ultimobranchial glands and fish
2. Quantitative estimation of cortisol in blood Qualitative analysis of chorionic gonadotrophin hormone in mammals.

(B) Development Biology:

1. Study of permanent slides of
   - Different stages of development in frog (cleavage, blastula, gastrula, organogenesis)
   - Different stages of development in chick Sperm motility.
2. Sperm count, Sperm vitality study using suitable stain.
3. Study of vaginal smear in rat by temporary mounting (methylene blue).

(C) Biochemistry:

1. Biochemical estimation of protein: Lowry's method
2. Estimation of glucose Estimation of serum total cholesterol
3. Determination of glycogen content of rat liver colorimetrically
4. Quantitative analysis of lipid: Saponification value of fat

(D) Immunology:

1. Study of permanent slides: Thymus, Spleen, lymph node
2. Antigen antibody interaction (Blood group analysis)
3. Collection of serum & plasma
4. Blood film preparation and identification of cell types.
5. Demonstration of ouchterlony double diffusion (ODD)

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SEMESTER IV

Course	Subject Title	Subject Code
M.Sc. Zoology	Fish and Fisheries-I	PZO401A

Unit 1

Nutritional Value and Economic Importance of Fishes:

Brief account of byproducts

Unit 2

Aquaculture:

Definition and classification

Outlines of fish culture in ponds

Ornamental fishes, larvivorous fishes

Classification of living fishes up to orders

Freshwater and important marine fishes of India

Unit 3

Adaptations in Teleosts:

Hill stream, cave dwelling, antifreeze, colouration, bioluminescence Migratory behaviour in fishes

Locomotion in teleosts

Aquatic respiration in teleosts

Structure of gills, gill areas and its significance, gas exchange and ventilation of gills

Digestive system of teleosts

Alimentary canal and its modification in relation to food and feeding habits in teleosts

Books Suggested:

1. Wootton R.J. - Fish Ecology Blackie 1992.

2. Nikolsky G.V. – The Ecology of Fishes Academic Press 1963.
3. Greenwood P.H. – Norman's History of Fishes 3rd edn Ernest 1975

OR

Course	Subject Title	Subject Code
M.Sc. Zoology	**Entomology-I**	**PZO401B**

Unit1

Classification and Phylogeny of Insects:

Classification of the Apterygote Orders : Thysanura, Diplura, Protura and Collembola Classification of Exopterygote Orders : Orthoptera, Dictyoptera, Hemiptera Classification of Endopterygote Orders : Lepidoptera, Diptera, Hymenoptera and Coleoptera.

Unit 2

Structures and Life Processes:

Integument: Structure and chemistry, cuticular modifications, Apolysis, Ecdysis and sclerotization

Head and Thorax : Its appendages and their modifications

Digestive system : Alimentary canal, salivary glands, mechanism of digestion, micro-organisms of the intestine.

Unit 3

Sense organs and Perception:

Mechanoreceptors, Auditory organs, Chemoreceptors, Thermoreceptors. Humidity receptors and visual organs Effector organs : The sound and light producing organs.

Unit 4

Insect Physiology:

Respiration - Respiration in aquatic, terrestrial and endoparasitic insects Excretion - Malphighian tubules and other organs of excretion, Metabolic pathways of nitrogenous excretion i.e. urea, uric acid, ammonia and aminoacids.

Unit 5

Reproductive Physiology:

Oogenesis, yolk formation, ovulation and oviposition spermatogenesis, transfer of sperms and spermatophores, Mating and fertilization, Endocrine system and hormones & pheromones

Books Suggested:

1. Chapman – The Insects: Structure and Function 4th edn ELBS 1998.
2. Imms A.D. – A General Text Book of Entomology 2 volsw. Asia Publ 1997

OR

Course	Subject Title	Subject Code
M.Sc. Zoology	**Ecology-I**	**PZO401C**

Unit 1

Concept of Productivity:

Primary, Secondary and Tertiary; Factors and Methods of measurement. Energy Flow in Ecosystem: Food chain, Food web, Food pyramid, Lindeman's Trophic Dynamic concept, Energy flow models. Concept of Limiting Factor: Shelford's Law of Tolerance, Leibig's Law of Minimum Fundamentals of Limnology.

Unit 2

Community Ecology:

The community concept. Development of the community through succession. Community organization and stratification. Classification of the community on the basis of life forms; Ecological Dominants, Species Diversity, Ecotypes, Ecotone and Edge Effect,, Concept of Ecological Niche: Niche Overlap, Niche Breadth, Ecological Release and Ecological Compression. Periodicity (Seasonal, Lunar and Diel) as a niche dimension.

Unit 3

Major Biomes of the World:

Forests, Tropical, Tundra, Grassland and Deserts and adaptations.

Unit 4

Population Ecology:

Population Growth and attributes: Exponential, Sigmoid, Time lag Model, Stochastic Model; Natural Regulation of Population: Theories and Model for Population Regulation Competition: Intra and Interspecific competition, Competitive ability, Lotka &Volterra models for competing species.

Unit 5

Habitat Ecology:

Physico-chemistry and Biological Characteristics of Freshwater and Marine System; Origin and Classification of Lakes, Types and significance of Freshwater Biota.

Unit 6

Biodiversity:

Definition, Status, monitoring and documentation, Major factors affecting

biodiversity destruction, Biodiversity conservation and management strategies

Unit 7

Pollution Ecology:

Air, Water and, Soil pollution. Concept of: Bioaccumulation, Biomagnification, Bioremediation, Biosensors.

Books Suggested:

1. Mukherjee, B. Fundamentals of Environmental Biology, Silverline Publications, Allahabad 2011.
2. Riddle M. – Evolution. 2nd edn. Blackwell 1996 .
3. Piyanka E.R. - Evolutionary Ecology 5th edn Harper Collins 1994.

Course	Subject Title	Subject Code
M.Sc. Zoology	Fish and Fisheries-II	402A

Unit 1

Cultivable Water:

Cultivable Water – quality and quantity

Physical and chemical properties of water influencing fish culture

Natural food for fish in pond

Role of plankton, blooms and benthos in fish culture

Fertilizers and their role

Supplementary feeding and artificial feeds

Sewage fed fisheries, Integrated fish culture, paddy field fish culture and cage culture.

Important reservoirs and rivers of Jharkhand – their problems and commercial

Common aquatic weed and their control

Unit 2

Cultivable Species:

Introduction of exotic species – Composite culture, extensive and intensive culture

Unit 3:

Fish Seed Production:

Induced breeding – importance, technique, physiology and new generation of commercial agents

Collection of seeds from natural resources - transport of carp seeds and breeders

Management of nursery, rearing and stocking ponds

Fishing technology – nets, crafts, gears, acoustic and other recent techniques

Books Suggested:

1. Lagler, Bardach, Miller & May Passino – Ichthyology Wiley 2003.
2. Pillay – Aquaculture : Principle and Practices of Fishing 1st Indian edn New Books 2006

OR

Course	Subject Title	Subject Code
M.Sc. Zoology	**Entomology-II**	**PZO402B**

Unit 1

Entomology:

Ecological management of the crop environment

Sanitation, destruction or modification of alternate hosts and habitats

Tillage, irrigation and water management Trap cropping and strip harvesting

Unit 2

Chemical Control

Insecticides - nomenclature, formulae and different types of formulations.

Common insecticides used in pest control

Mode of action of insecticides and toxicity to humans.

Definition of Biological control, agents of Biological Control Parasites, Parasitoids, Predators and Pathogenic microorganisms. Mass production and distribution. Advantages and disadvantages of Biological control.

Integrated Pest Management (IPM)

Other methods of Insect Pest Management

Management of Insect Pests by Sterile-Insect Technique (Chemosterilants)

Attractants, Repellants, Antifeedants and Pheromones.

Books Suggested:

1. Wigglesworth - Principles of Insect Physiology ELBS 1972.

OR

Course	Subject Title	Subject Code
M.Sc. Zoology	**Ecology-II**	**PZO402C**

Unit 1

Pollution Ecology:

Pollution Ecology

Unit 2

Water Pollution:

Types and sources of pollution; Biodegradable and Non-degradable pollutants; Eutrophication.

Unit 3

Air Pollution:

Sources and Effects of Air Pollutants; control measures.

Unit 4

Ecotoxicology: Toxicology: Routes and rate of administration; Environmental and behavioral factors affecting Toxicity; Synergism and Antagonism; Mechanism of action; Basic Principle of Dose Response relationship; Biotransformation of Toxicants; Translocation of Toxicants Antidotes; Toxicity Tests; Xenobiotics.

Books Suggested:

1. Simmons I.G. - The Ecology of Natural Resources 2nd edn ELBS / Edward Arnolds 1983
2. Dash M.C. & Mishra P.C.- Man and Environment McMillan 2001.
3. Stiling P. – Ecology : Theories and Applications 4th edn Prentice Hall India 2002

Course	Subject Title	Subject Code
M.Sc. Zoology	**Practical-IV**	**PZO453**

FISH AND FISHERIES

(a) Anatomical observation of a bony fish:

General anatomy, Digestive system of herbivore and carnivore fishes, Reproductive system, Pituitary gland, Weberian Ossicle. Representatives of major groups (except teleosts) Taxonomic identification of important fresh water and marine fishes up to genus

(b) Study of histological slides of various organs:

Study of slides, related to annual breeding cycles - ovary, testis, pituitary etc. Study of skeletal system of bony fish Study of exotic, ornamental, larvicidal fishes Study of adaptive features: hill stream fishes, fishes showing parental care, bioluminescence, adaptations - feeding, respiratory, flying, poisonous, electric organs etc Haematology – blood corpuscles, T.C., D.C., and Hb content/ Haematocrit

(c) Study of fishing gears and ecological equipments:

Collection, identification of plankton, weeds and aquatic plant Determination of feeding habit on the basis of gut / gut content

Visit to fish market, landing site, fish pond, fish farm, breeding centers, fish reservoir and National Institutes of Fisheries Research

ENTOMOLOGY

Taxonomy description & identification of following order:

- Orthoptera, Dictyoptera, Hemiptera, Hymenoptera, Diptera, Coleoptera & Lepidoptera.
- Study of permanent slides of body parts.
- Study of Histological slides.
- Pest study on affected objects.
- Life history of beneficial insects like- lac & tasar.
- Study of parasites, predators, parasitoids & pattrogens.
- Embryological study through Drosphila culture.
- Study of adaptive features in some order of insects.
- Minor dissection: Temporary mounting of special type of mouth parts, wings, legs, ovpositer,
- Sting apparatus antennae- adaptation – arista.
- Calculation of species diversity by Shannon-weiner index from generated data
- Study of the external morphology of an insect, wings, haltere, elytra
- Study of the adaptive feature of terrestrial and aquatic insects
- Study of parasitic insects (Fleas and Lice)
- Study of the mouthparts of the representative of the order: Orthoptera, Dictyoptera, Hemiptera, Lepidoptera and Hymenoptera.
- Study of respiratory structure of terrestrial, semi-aquatic and aquatic insects.
- Study of the life cycles of Termites, Honeybee, Mosquitoes.

ECOLOGY

(a) Water Analysis:

Estimation of BOD of sample Estimation of Carbonate, Bicarbonate and Hydroxide & chloride in sample water Estimation of hardness & Oxygen and Carbon of sample water Estimation of Magnesium and Calcium in sample water

(b) Soil Analysis:

Estimation of OMC / Total Carbon of a soil sample Estimation of $CaCO_3$ in a soil sample Estimation of soil respiration rate in a sample

(c) Biotic Analysis:

Sampling and identification of freshwater planktons. Qualitative, quantitative assessment and working of Indices of diversity and dominance of Plankton, Benthos, Soil fauna, Soil microbes

(d) Biostatistical Analysis:

(e) Analysis of correlation coefficient and simple linear regression in a set of data Estimation of density and relation frequency by quadrate analysis Analysis of similarity index in the species composition by 2X2 contingency table

(f) Adaptation study:

Aquatic insects, Terrestrial Insects, Freshwater fish (Hill Stream fish) Marine fish & Higher Vertebrates Ecological Equipments Ecological significance of plants and earthworm Identification of Aquatic plants and Bioindicator Species

Course	Subject Title	Subject Code
M.Sc. Zoology	**Dissertation**	**PZO464**

Dissertation/ Project Work:

The project work will consist of

(a) Field work/Lab work related to the project.
(b) Preparation of dissertation based on the work undertaken.
(c) Presentation of project work in the seminar on the assigned topic
(d) Open viva voce