M. Sc. Zoology 2011-2012 Onwards

M.Sc. ZOOLOGY SYLLABUS
(SEMESTER SYSTEM)
2011 - ONWARDS
### FIRST SEMESTER

<table>
<thead>
<tr>
<th>Number &amp; Title of the course</th>
<th>Max. Marks</th>
<th>Min. Marks for Passing</th>
<th>Min. Aggr. Marks for Passing</th>
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<tbody>
<tr>
<td>(A) THEORY PAPERS</td>
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<tr>
<td>I   Biosystematics, taxonomy and evolution</td>
<td>35</td>
<td>12</td>
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<tr>
<td>II  Structure and function of Invertebrates</td>
<td>35</td>
<td>12</td>
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<tr>
<td>III Quantitative Biology, biodiversity and wildlife</td>
<td>35</td>
<td>12</td>
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<tr>
<td>IV  Biomolecules and structural Biology</td>
<td>35</td>
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<tr>
<td>(B) PRACTICALS</td>
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<tr>
<td>I (based on Course I &amp; II)</td>
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<td>(C) INTERNAL ASSESSMENT /</td>
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<td>60</td>
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<tr>
<td>Project/Assignment/Seminar</td>
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<td>TOTAL</td>
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* Candidate has to pass in each test separately

### SECOND SEMESTER

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<tr>
<td>(A) THEORY PAPERS</td>
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<tr>
<td>V   General and comparative animal physiology and endocrinology</td>
<td>35</td>
<td>12</td>
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<tr>
<td>VI  Population ecology and environmental physiology</td>
<td>35</td>
<td>12</td>
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<tr>
<td>VII Tools and techniques in Biology</td>
<td>35</td>
<td>12</td>
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<tr>
<td>VIII Molecular cell biology and genetics</td>
<td>35</td>
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<tr>
<td>(B) PRACTICALS</td>
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<tbody>
<tr>
<td><strong>(A) THEORY PAPERS</strong></td>
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<tr>
<td>IX Comparative Anatomy of vertebrates</td>
<td>35</td>
<td>12</td>
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<tr>
<td>X Limnology</td>
<td>35</td>
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<td>XI Eco toxicology</td>
<td>35</td>
<td>12</td>
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<td>XII Aquaculture</td>
<td>35</td>
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<td><strong>(B) PRACTICALS</strong></td>
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<tr>
<td>II (based on course XI &amp; XII)</td>
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<tr>
<td>XIII Animal behavior and neurophysiology</td>
<td>35</td>
<td>12</td>
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<tr>
<td>XIV Gamete Biology, development and differentiation</td>
<td>35</td>
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<tr>
<td><strong>OPTIONAL THEORY PAPERS</strong></td>
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<tr>
<td>XV Optional (special paper group-1)</td>
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<tr>
<td>XVI Optional (special paper group-2)</td>
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Unit I

- Definition and basic concepts of biosystematics, taxonomy and classification.
- History of Classification.
- Trends in biosystematics: Chemotaxonomy, cytotaxonomy, and molecular taxonomy.
- Dimensions of speciation and taxonomic characters.
- Species concepts: species category, different species concepts, subspecies.
- Theories of biological classification: hierarchy of categories.

Unit II

- Taxonomic Characters. Different kinds.
- Origin of reproductive isolation, biological mechanism of genetic incompatibility.
- Taxonomic procedures: Taxonomic collections, preservation, curetting, process of identification.
- Taxonomic keys, different types of keys, their merits and demerits.

Unit III

- Taxonomic categories.
- Evaluation of biodiversity indices.
- Evaluation of Shannon Weiner Index.
- Evaluation of Dominance Index.
- Similarity and Dissimilarity Index.

Unit IV

Concepts of evolution and theories of organic evolution.
Neo Darwinism and population genetics:
A- Hardy-Weinberg law of genetic equilibrium.
B . A detailed account of destabilizing forces:
   i- Natural selection
   ii- Mutation
   iii- Genetic Drift
   iv- Migration
   v- Meiotic Drive.
Trends in Evolution
Molecular Evolution
   a) Gene evolution
   b) Evolution of gene families
   c) Assessment of molecular variation

Unit V
- Origin of higher categories
- Phylogenetic . gradualism and punctuated equilibrium.
- Major trends in the origin of higher categories
- Micro and macro evolution.
- Molecular population genetics
- Pattern of changes in nucleotide and amino acid sequence.
- Ecological significance of molecular variations (genetic polymorphism)
- Genetic & Speciation
- Phylogenetic and biological concept of species.
- Patterns and mechanism of reproductive isolation.
- Modes of speciation (allopatry & sympathy)
- Origin and Evolution & Economically important microbes and animals.

Suggested Reading Materials:
4. E-Mayer-Elements of Taxonomy
5. Bastchelet-F-Introduction to mathematics for life scientists Springer Verlag, Berling.

M.Sc. Zoology
First semester
Paper –II
STRUCTURE AND FUNCTION OF INVERTEBRATES
UNIT I
- Origin of metazoa
- Organization of Coelom
  o Acoelomates
  o Pseudo coelomates
  o Coelomates
- Locomotion.
  o Amoeboid, Flageller and Ciliary movement in protozoa
  o Hydrostatic movements in Coelenterata
  o Annelida and Echinodermata

UNIT II
- Nutrition and Digestion
- Patterns of Feeding and digestion in lower metazoa, Mollusca,
- Echinodermata, Filter feeding in polychaeta.
- Respiration
- Organs of respiration : Gills, lungs and trachea.
- Respiratory pigments.
- Mechanism of respiration.

UNIT III
Excretion in lower invertebrates
Excretion in higher invertebrates.
Mechanism of Osmoregulation.

UNIT IV
Nervous System
  a. Primitive Nervous systems:-Coelentrata and Echinodermata.
  b. Advanced nervous system :- Annelida, Arthropoda
     (Crustacea and Insecta) and Mollusca (Cephalopoda)

UNIT V
1. Invertebrate larval forms and their evolutionary significance
   a. Trematoda and Cestoda
   b. Larval forms of Crustacea
   c. Larval forms of Mollusca
   d. Larval forms of Echinodermata.
2. Structure affinities and life history of the following minor Phyla
   a. Rotifera
   b. Entoprocta
   c. Phoronida
   d. Ectoprocta

Suggested Reading Materials:
M. Sc. Zoology 2011-2012 Onwards


M.Sc. Zoology
First semester
Paper-III

Quantitative biology, biodiversity and wildlife

Unit 1

Quantitative biology
- Distribution of the data in biology: mean, mode and median
- Measures of dispersion: range, mean deviation, IQD, standard deviation and coefficient of variation
  - Chi square test
- Normal distribution
- Experimental designing and sample theory

Unit II

- Probability distribution, properties and probability theory
- Completely randomized design and randomized block design
- Analysis of variance
- Co-relation: types of correlation
- Karl Pearson, coefficient correlation
- Regression

Unit III

Biodiversity
- Concept and principal of biodiversity
- Causes for the loss of biodiversity
- Biodiversity conservation methods
- Medicinal uses of forest plant

Unit IV

Wildlife of India, types of wildlife
- Values of wildlife, positive and negative
- Wildlife protection Act
- Conservation of wildlife in India
- Endangered and threatened species

Unit V

Wildlife and conservation
- National Parks and Sanctuaries
- Project Tiger
- Project Gir Lion and Crocodile breeding project
- Wildlife in M.P. with references to Reptiles, Birds and mammals
- Biospheres reserves

Suggested Reading Materials:

- Bataschelet, E. Introduction to mathematics for site scientist, Springer-Verlag, Berlin
- Jorgenserr, S.E. Fundamental of Ecological modelling, Elsevier New York
- Sokal, R.R. and F. J. Rohit Biometry Freeman San Francisco
- Muray, J.D. Methamatical Biology, Springer Verlag Berlin
- Pelon, E.C. The interpretation of ecological data: A primer on classification and ordination.
M.Sc. Zoology 2011-2012 Onwards

- A. Lewis. Biostatics
- B.K. Mahajan Methods in Biostatics
- V.B. Saharia Wildlife in India
- S.K. Tiwari Wildlife in central India
- J.D. Murrey Mathematical Biology
- Georgs & Wilians Startical method
- R.K. Tondon Biodiversity Texonomy & Ecology
- M.P. Arora An Introduction to preventology
- P.C. Kotwal Biodiversity and conservation

M.Sc. Zoology
First semester
Paper IV

BIOMOLECULES AND STRUCTURAL BIOLOGY

Unit 1

Chemical Foundation of biology
- PH, PK, acids bases, buffers, weak bonds
- Free energy, resonance, isomerisation
- Acid soluble pool of living tissues: aminoacids, monosaccharides, oligosaccharides, nucleotides, peptides.
- Nanoparticles
- Biomaterials

Unit II
1. Primary, secondary, tertiary and quaternary structures of proteins, protein folding and denaturation
2. DNA & RNA: Double helical structure of DNA, Structure of RNA, role of RNA in gene expression
3. DNA replication, recombination and repair
4. Functional importance of lipid storage and membrane lipids
5. Membrane channels and pumps

Unit III
1. Basic concepts of metabolism: Coupled and interconnecting reactions of metabolism, cellular energy resources and ATP synthesis
2. Glycolysis and Gluconeogenesis
3. Citric acid cycle
4. Oxidative phosphorylation: Protein and its regulation
5. Fatty acid metabolism: Synthesis and degradation of fatty acids

Unit IV
1. RNA synthesis and splicing
2. Biosynthesis of amino acids
3. Biosynthesis of nucleotides
4. Biosynthesis of membrane lipids and steroids
5. Protein synthesis

Unit V
1. Enzymes: Terminologies, classification and basics of enzyme kinetics
2. Mechanism of enzyme catalysis
3. Regulation of enzyme reaction
4. Concept of free energy and thermodynamic principles in biology
5. Energy rich bonds, compound and biological energy transducers

Suggested Reading Materials:
3. Segal, I.H. Biochemical calculations John Wiley and Sons
5. Freifelder, D. Essentials of Molecular Biology
7. Cooper, T.G. Tools of Biochemistry
8. Hawk, Practical Physiological Chemistry
Unit I

1. Respiratory pigments through different phylogenetic groups
2. Transport of oxygen and carbon dioxide in blood and body fluids
3. Regulation of respiration
4. Physiology of impulse transmission through nerves and synapses
5. Autonomic nervous system, neurotransmitters and their physiological functions
Unit II
1. Patterns of nitrogen excretion in different animal groups
2. Comparative physiology of digestion
3. Osmoregulation in different animal groups
4. Thermoregulation in homeotherms, poikilothermas and hibernation
5. Physiology of pregnancy, placental hormones, pregnancy diagnosis tests, parturition and breast and lactation

Unit III
1. Comparative study of mechanoreception
2. Comparative study of photoreception
3. Comparative study of phonoreception
4. Comparative study of chemoreception
5. Comparative study of equilibrium reception

Unit IV
1. Bioluminescence as means of communication among animals
2. Pheromones and other similar chemicals as means of communication among animals
3. Chromatophores and regulation of their function among animals
4. Hormones, their classification and chemical nature
5. Mechanisms of hormone action

Unit V
1. Phylogeny of endocrine glands (pituitary, pancreas, adrenal, thyroid)
2. Ontogeny of endocrine glands
3. Neuroendocrine system
4. Hormone receptors. signal transduction mechanisms
5. Hormones and reproduction
   a. Seasonal breeders
   b. Continuous breeders

Suggested Reading Materials:

2. R.H. Williams-Text Book of Endocrinology-W.B. Saunders
4. Molecular CellBiology-J. Darnell, H. Lodish and D. Baltimore-Scientific American Book USA
M. Sc Zoology
Second Semester
Paper II

Population Ecology and Environmental physiology

Unit I
1. Populations and their characters.
2. Demography: Life tables, generation time, reproductive value.

Unit II
1. Adaptations: Levels of adaptations, significance of body size.
2. Aquatic environments: Fresh water, marine, shores and estuarine
environments.
3. Eco-physiological adaptations to fresh water environments.
4. Eco-physiological adaptations to marine environments.
5. Eco-physiological adaptations to terrestrial environments.

Unit III
1. Environmental limiting factors.
2. Inter and intra-specific relationship.
3. Predatory-prey relationship, predator dynamics, optimal foraging theory (patch choice, diet choice, prey selectivity, foraging time).

Unit IV
Environmental pollution and human health.
1. Conservation management of natural resources.
2. Environmental impact assessment.
3. Sustainable development.

Unit V
1. Concept of homeostasis.
2. Endothermic and physiological mechanism of regulation of the body temperature.
4. Physiological response to body exercise.
5. Meditation, yoga and their effects.

Suggested Reading Materials:
M. Sc Zoology
Second Semester
Paper III

Tools and techniques in Biology

Unit I

1. Microscopy, principle & applications
   - Light microscope and phase contrast microscope
   - Fluorescence microscope
   - Electron microscope
   - Confocal microscopy
2. General Principle and applications of
   - Colorimeter
   - Spectrophotometer
   - Ultra centrifuge
   - Flame photometer
   - Beer and Lambert's law.
3. Microbiological techniques
   - Media Preparation and sterilization
   - Inoculation and growth monitoring.
   - Microbial assays.
M. Sc. Zoology 2011-2012 Onwards

- Microbial identification (cytological staining methods for bacterial and fungal strains)
- Use of fermentors

Unit II

1. Computer aided techniques for data presentation data analysis, statistical techniques.
2. Cryotechniques
   - Cryopreservation of cells, tissues, organs and organisms.
   - Cryosurgery
   - Cryotomy
   - Freeze fracture and freeze drying.
   - Chromatography, principle type and applicants.
   - Electrophoresis, Principles, types and applications PAGE and agarose gel electrophoresis.
   - Organelle separation by centrifugation.

Unit III

1. Radioisotope and main isotope techniques in biology.
   a. Sample preparation for radioactive counting
   b. Autoradiography.
2. Immunological techniques
   - Immunodiffusion (Single & Double)
   - Immuno electrophoresis
3. Techniques immuno detection
   - Immunocyto / histochemistry
   - Immunoblotting, immunodetection, immunofluorescence.
4. Surgical techniques.
   - Organ ablation (eg. Ovariactomy, adrenalectomy)
   - Perfusion techniques
   - Stereotaxy
   - Indwelling catheters
   - Biosensors.

Unit IV

1. Histological techniques
   - Principles of tissue fixation
   - Microtomy
   - Staining
   - Mounting
   - Histochemistry
2. Cell culture techniques.
   - Design and functioning of tissue culture laboratory
   - Culture media, essential components and Preparation
   - Cell viability testing.

Unit V
1. Cytological techniques
   - Mitotic and meiotic chromosome preparations from insects and vertebrates.
   - Chromosome banding techniques (G.C.Q. R. banding)
   - Flowcytometry.
2. Molecular cytological techniques
   - In site hybridization (radio labelled and non-radio labelled methods)
   - FISH
   - Restriction banding
3. Molecular biology techniques
   - Southern hybridization
   - Northern hybridization
   - DNA Sequencing
   - Polymerase chain reaction (PCR)

Suggested Reading Materials:

1. Introduction to instrumental analysis-Robert Braun-McGraw Hill.
M. Sc. Zoology  
Second Semester  
Paper IV

**Molecular Cell Biology and genetics**

**Unit I**
Biomembrane
- Molecular composition arrangement and functional consequences
- Transport across cell membrane diffusion active transport, pumps, uniports, symports and antiports
- Microfilaments and microtubules structure and dynamics
- Cell movements intracellular transport, role of kinesis and dynein

**Unit II**
Cell. Cell signaling
- Cell surface receptors
- Second messenger system
- Signaling from plasma membrane to nucleus
- Gap junctions and connexins
- Integrins

**Unit III**
Cell. Cell adhesion and communication
- Ca++ dependant homophilic cell-cell adhesion
- Ca++ independant homophilic cell-cell adhesion
- Gap junctions and connexins
- Genome organization, hierarchy in organization
- Chromosomal organization of genes and non-coding DNA

**Unit IV**
Sex determination
- Sex determination in Drosophila
- Sex determination in mammals
- Basic concept of dosage compensation
- Cytogenetic of human chromosomes
- Human genome project (HGP) purpose 2 implicate

**Unit V**
Genetic Diseases and Genomics
- Human gene therapy
- Prenatal diagnosis & genetic counseling
- Genetic screening
- Structural Genomics
- Functional Genomics
- Gene libraries
- Transgenic animals & their applications

Suggested Reading Materials:

- J. Darnell, H. Lodish and D. Baltimore molecular cell biology scientific American book. Inc. USA
- Alberts et. all Essentials cell biology garland publishing Inc. New York 1998
- J.M. Barry molecular biology
- Philip E. Hartman Gene Action
- L.C. dunn, principals of Genetics
- A.M. Winchester genetics
- Edgar Alterbrg Genetics
- L.C. Dunn genetics and the oregin of species
- Bengt A. Kihlman actions of chemicals of dividing cells
Msc Zoology
Third semester
Paper- I

Comparative Anatomy of Vertebrates

Unit-1
1. Origin of Chordata: Concept of Protochordata
2. Development, structure and functions of integument and its derivatives (glands, scales, feathers and hairs)
3. Respiratory system: Characters of respiratory tissue, external and internal respiration. Comparative account of respiratory organs.
4. Comparative account of Digestive System.

Unit-2
1. Evolution of heart.
2. Evolution of aortic arches and portal systems.
3. Blood circulation in various vertebrates groups.
4. Comparative account of jaw suspensorium and vertebral column.

Unit-3
1. Evolution of urinogenital system in vertebrates.
2. Comparative account of organs of olfactory and taste.
3. Comparative anatomy of brain and spinal cord (CNS).
4. Comparative account of peripheral and autonomous nervous system.

Unit-4
1. Comparative account of lateral line system.
2. Comparative account of electrorception.
3. Flight adaptations in vertebrates.
4. Aquatic adaptations in birds and mammals.

Unit-5
2. General organization, specialized, generalized and degenerated characters of Cyclostomes.
Suggested Reading Materials:

3. Kent, C.G. Comparative anatomy of vertebrates
7. Sedgwick, A.A. Students Text Book of Zoology, Vol.II.
Unit-1
1. Limnology – Definition, historical development and scope of Limnology.
2. Types of freshwater habitats and their ecosystem -
   (a) Ponds, Streams and rivers.
   (b) Lakes – Origin and classification.
3. Morphometry – Use of various morphometric parameters and Zonation.

Unit-2
Physico – Chemical Characteristics.
1. Light and Temperature-
   (a) Light as an ecological parameter in freshwater.
   (b) Temperature- Radiation, Stratification and Heat Budget.
   Physico – Chemical characteristics of freshwater with special reference to different parameters-Turbidity, dissolved gases
   (Oxygen, Carbon dioxide, Hydrogen Sulphide), Seasonal changes in dissolved gases and pH.

Unit-3
1. Study of Biota
   (a) Phytoplankton, Zooplankton and their inter-relationship.
   (b) Aquatic insects, birds and their environmental significance.
2. Ecological classification of aquatic fauna higher aquatic plants and their significance.

Unit-4
1. Methods of water quality testing BOD and COD.

Unit-5
2. Resource Conservation – Aquatic pollution, control, legislation, regulation on discharge of industrial effluents and domestic wastes in rivers and reservoirs.
3. Use and misuse of inland waters.

Suggested Reading Materials:

Anathakrishnan : Bioresources Ecology
Goldman : Limnology
Odum : Ecology
Pawlosuske : Physico- chemical methods for water
Wetzal : Limnology
Trivedi & Goyal : Chemical and biological methods for water pollution studies
Welch : Limnology Vols. I-II
Perkins : Ecology
Arora : Fundamentals of environmental biology
ECO-TOXICOLOGY

Unit-1
1. General principles of Environmental Biology with emphasis on ecosystems.
2. Abiotic and biotic factors of ecosystems.
3. Communities of the environment, their structure & significance.

Unit-2
1. Productivity, Production and analysis.
2. Recycling and reuse technologies for solid and liquid wastes and their role in environmental conservation.
3. Remote sensing – basic concepts and applications of remote sensing techniques in environmental conservation.
4. Environmental indicators and their role in environmental balance.

Unit-3
1. Kinds of environmental pollution and their control methods.
2. Radioactive compounds and their impact on the environment.
3. Vehicular exhaust pollution causes and remedies.

Unit-4
1. Toxicology- Basic concepts, Principles and various types of toxicological agents.
2. Toxicity testing principles, hazards, risks and their control methods.
3. Food toxicants and their control methods.
4. Public Health Hazards due to environmental disasters.

Unit-5
1. Pesticides, types, nature and their effects on environment.
2. Important heavy metals and their role in environment.
3. Agrochemical use and misuse, alternatives.
4. Occupational Health Hazards and their Control.

Suggested Reading Materials:
1. Clark : Elements of ecology
2. Odum : Fundamentals of Ecology
4. Trivedi and Goel: Chemical and biological methods for water pollution studies

Msc Zoology
Third semester
Paper- IV

Aquaculture

Unit-1
1. Aquaculture: history, definition, scope & importance.
M. Sc. Zoology 2011-2012 Onwards

2. Fishery resources of India in general & Madhya Pradesh in particular.
3. Abiotic & biotic factors of water necessary for fish life.
4. Ecological characteristics of lakes & rivers.
5. General ecological characteristics of reservoirs of India.

Unit-2

1. Fish culture :- Mono, Poly, mixed and composite Fish culture.
2. Fresh water prawn culture and its prospects in India.
3. Culture of Mussels , clams,oysters & pearl culture.
4. Sewage fed fish culture, paddy cum fish culture.
5. Frog culture.

Unit-3

1. Fish breeding in natural conditions , bundh breeding, hypophysation & stripping.
2. Transport of live fish & seed.
3. Different types of crafts & gears used for fish catching.
4. Plankton- its definition, culture & indentification.
5. Common weeds of fish ponds and methods of their eradication.

Unit-4

1. Fresh water fish farm engineering: selection of site, construction of fish farm & soil chemistry.
2. Designing, layout & construction of different types of fish ponds.
3. Setting and management of fresh water aquarium.
4. Preservation & processing of fish.
5. By products of fish Industry & their utility.

Unit-5

1. Water pollution, its effects on fisheries and methods of its abatement.
2. Common fish diseases & their control.
4. Fisheries economics and marketing.
5. Fisheries managements and extension.

Suggested Reading Materials:

1. C.B.L. Shrivastava : Fishes of India
2. Jhingaran : Fish and fisheries of India
3. S.S. Khanna : An Introduction to fishes
4. R.S. Rath : Fresh water Aquaculture
5. Gopalji Shrivastava : Fishes of U.P. & Bihar
7. A.J.K. Mainan : Identification of fishes
9. S.K. Gupta : Fish & Fisheries
10. P.D. Pandey: Fish & Fisheries
11. K.P. Vishwas: Fish & Fisheries
ANIMAL BEHAVIOUR AND NEUROPHYSIOLOGY

Unit-1
1. Introduction:
   - Ethology as a branch of biology.
   - Animal psychology, classification of behavioural patterns, analysis of behaviour (ethogram)
2. Reflexes and complex behaviour.

Unit-2
1. Neural and hormonal control of behaviour.
2. Genetic and environmental components in the development of behaviour.

Unit-3
1. Ecological aspects of behaviour: Habitat selection, food selection, optimal foraging theory, anti-predator defences, aggression, homing territoriality, dispersal, host parasite relations.
2. Biological rhythms: Circadian and circannual rhythms, orientation and navigation, migration of fishes, turtles and birds.
3. Learning and memory: Conditioning, habituation, insight learning, association learning and reasoning.

Unit-4
2. Social behaviour. aggregations, schooling in fishes, flocking in birds, herding in mammals, group selection, kin selection, altruism, reciprocal altruism, inclusive fitness, social organization in insects and primates.

Unit-5
1. Thermoregulation: Homoeothermic animals, poikilotherms &
Hibernation.
2. Receptor physiology a comparative study –
   Mechano receptor
   Photo receptor
   Phono receptor
   Chemo receptor
   Equilibrium receptor
3. Bioluminescence

Suggested Reading Materials:

M. Sc. Zoology 2011-2012 Onwards

M.Sc Zoology
Semester-IV
Paper- II(compulsory)

Gamete Biology, Development and Differentiation in vertebrates

Unit-1
1. Comparative account of differentiation of gonads in mammals.
2. Spermatogenesis : Morphological basis in rodents.
   Gamete specific gene expression and genomics
M. Sc. Zoology 2011-2012 Onwards

4. Fertilization: Prefertilization events Biochemistry of fertilization post fertilization events.

Unit-2
1. Ovarian follicular growth and differentiation: morphology, endocrinology, molecular biology oogenesis and vitellogenesis, ovulation and ovum transport in mammals
2. Biology of sex determination and sex differentiation a comparative account.

Unit-3
2. Hormonal regulation of development of mammary gland and lactation.
3. Endocrinology and Physiology of placenta.
4. Cryopreservation of gametes and Embryo.
5. Teratological effects of xenobiotics on gametes.

Unit-4
2. Germ cell determinants and germ cell migration.
3. Development of gonads.

Unit-5
1. Creating new cell types, the basic evolutionary mystery.
2. Cell diversification in early Amphibian embryo, totipotency and pleuripotency.
3. Embryonic stem cells, renewal by stem cells, epidermis.
4. Connective tissue cell family
5. Haemopoietic stem cells: Blood cells formation, stem cell disorders.

Suggested Reading Materials:

2. Nalbandou. A.C. – Reproductive physiology
5. Ethan Bier, the cold Spring. The cold spring Harbor laboratory Press, New York.
Msc Zoology  
Semester IV  
Optional papers

* The following optional papers are being suggested as below

OPTIONAL (SPECIAL PAPER) GROUP 1
a. Fish (ichthyology) structure and function  
   Or
b. Cell Biology  
   Or
c. Entomology  
   Or
d. Wild life conservation  
   Or
OPTIONAL (SPECIAL PAPER) GROUP 2
a. Pisci culture and economic importance of fishes (Ichthyology)
   Or
b. Cellular organization and molecular organization
   Or
c. Applied entomology
   Or
d. Environment and Biodiversity conservation
   Or
e. Molecular endocrinology and reproductive technology

** Student has choice to opt for one paper each (special paper) from group 1 and group 2

Unit-1
1. Origin and evolution of fishes
2. Classification of fishes as proposed by Berg
3. Fish integument
4. Locomotion

Unit-2
1. Alimentary canal and digestion
2. Accessory respiratory organs
3. Air bladder and its functions
4. Weberian ossicles their homologies and functions
Unit-3
1. Excretion and osmoregulation
2. Acoustico-lateral line system
3. Luminous organs
4. Colouration in fishes

Unit-4
1. Sound producing organs
2. Deep sea adaptions
3. Hill stream adaptions
4. migration in fishes

Unit-5
1. Sexual cycle and fecundity
2. parental care in fishes
3. Early development and hatching
4. Poisonous and venomous fishes.
4. Environmental modulation of gene activity (stress response) stress genes and stress proteins
5. Molecular basis of thalassemias muscular dystrophy cystic fibrosis

Unit-4
1. DNA rearrangement
2. Amplification during development with special response to
   (a) Ciliates
   (b) Chlorine gene
   (c) 58 RNA genes
3. Drosophila development
   (a) Cleavage
   (b) Grastrulation
   Origin of Anterior – Posterior (Maternal effect genes ans segmentation genes)

Unit-5
1. Drosophila development II origin of dordal ventral polarity
2. Basic idea of homoeotic selector genes and homeotic mutation
3. Basic idea of organization of homeoboxes
4. Evolutionary significance of homeoboxes

Suggested Reading Materials:

1. Robertis, De and Robertis Cell and molecular biology Lea and Febiger.
   a) Karp Gerald Cell Biology.
   b) Lewin B., Genes VII.
   c) King Cell Biology.
6. Roitt Male Snustad Immunology.
Entomology

Unit-1
1. Insect head types and modification as per their habit and habitat
2. Modification of mouth parts and feeding behaviour
3. Structure types and function of antennae
4. Hypothetical wing venation

Unit-2
1. Structure of cuticle and pigment
2. Sclerotisation and tanning of the cuticle
3. Structure of alimentary canal and Physiology of digestion
4. Malphighian tubules – anatomical organization, Transport mechanism

Unit-3
1. Structure of circulatory system
2. Cellular elements in the haemolymph
3. Cell mediated and humoral immunity
   Structure of compound eye and Physiology of Vision

Unit-4
1. Sound Production in insect
2. Structure and function of endocrine glands
3. Pheromones
4. Embryonic membranous up to the formation of blastoderm

Unit-5
1. Metamorphosis
2. Insecticide effects on CNS
3. Important pest of Soybean
Modern concept of pest management

Suggested Reading Materials:

1. The Insect: Structure and function by R.F. Chapman
3. Entomophagous Insect by Clausen
4. Entomology bu Gilbert
5. Principles of Insect Physiology by Wigglesworth.
6. Fundamentals of Entomology by Elzinga
8. Insect cytogenetics by R.E.F.Symposium.
9. Insects and plants by Sting, Lawton and southwood.
10. Insect and hygiene by Busvine.
11. Insect Physiology by Wigglesworth.
12. Insect morphology by Mat Calf and Flint
13. Applied Agricultural Entomology by Dr. Lalit Kumar Jha
Unit-1
1. Wild life -
   (a) Values of wild life - positive and negative.
   (b) Our conservation ethics.
   (c) Importance of conservation.
   (d) Causes of depletion.
   (e) World conservation strategies.
2. Habitat analysis, Evaluation and management of wild life.
   (a) Physical parameters - Topography, Geology, Soil and water.
   (b) Biological Parameters - food, cover, forage, browse and cover estimation.
   (c) Standard evaluation procedures - remote sensing and GIS.
3. Management of habitats -
   (a) Setting back succession.
   (b) Grazing logging.
   (c) Mechanical treatment.
   (d) Advancing the successional process.
   (e) Cover construction.
   (f) Preservation of general genetic diversity.

Unit-2
   (a) Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation.
   (b) Faecal analysis of ungulates and carnivores - Faecal samples, slide preparation, Hair identification, Pug marks and census method.
   (a) Indian board of wild life.
   (b) Bombay Natural History Society.
   (c) Voluntary organization involed in wild life conservation.

Unit-3
1. Management planning of wild life in protected areas.
2. Estimation of carrying capacity.
3. Eco tourism / wild life tourism in forests.
4. Concept of climax persistence.
5. Ecology of perturbation.

Unit-4
1. Management of excess population & translocation.
3. Care of injured and diseased animal.
4. Quarantine.
5. Common diseases of wild animal.

Unit-5
1. Protected areas National parks & sanctuaries, Community reserve.
2. Important features of protected areas in India.
3. Tiger conservation - Tiger reserve in M.P, in India.
Suggested Reading Materials:

1. Gopal Rajesh : Fundamentals of wild life management
2. Agrawal K.C : Wild life India
4. Asthana D.K : Environmet problem and solution
5. Rodgers N.A & Panwar H.S : Planning of wild life / Protected area Network in India vol. the report, wild life Institute of India Dehradun.
7. Saharia V.B : Wild life in India
8. Tiwari S.K : Wild life in Central India
9. E.P Gee : Wild life of India
Unit-1
1. Tissues of Immune system- Primary lymphoid organs, structure and functions (Thymus and Bursa of Fabricius)
2. Tissues of Immune system- Secondary lymphoid organs, structure and functions (Spleen, lymphnode and Payers patches)
3. Antigen processing
4. Antigen presentation

Unit-2
1. T-cell lineage and receptors
2. T-cell activation
3. B-cell lineage and receptors
4. B-cell activation

Unit-3
1. Immunoglobulin structure, Biological and physical properties of immunoglobulin
2. Gene model for Immunoglobulin gene structure
3. Generation of antibody diversity (Light and heavy chain)
4. Immunization

Unit-4
1. Immediate type of hypersensitivity reaction of Anaphylactic type-1.
2. Antibody dependent cytotoxic type II reaction.
3. Complex mediated type III reaction
4. Delayed type cell mediated hypersensitivity type IV reaction.

Unit-5
1. Enzyme linked immunosorbent assay (ELISA) technique and its applications.
2. Immunofluorescence technique (Direct & Indirect and Sandwich antibody labelling techniques).
3. Immunodiffusion techniques (Mancini and Ouchterlony immunodiffusion techniques) Monoclonal antibody technology (Hybridoma technology)

M.Sc Zoology
Semester-IV
Paper- IV A (Optional)

Pisci Culture and Economic Importance of Fishes (Ichthyology)

Unit-1
1. Collection of fish seed from natural resources.
2. Dry bundh breeding of carps.
3. Wet bundh breeding of carps.
4. Hypophysation and breeding of Indian major camps.

Unit-2
1. Drugs useful in induced breeding of fish
2. Types of ponds required for fish culture farms
3. Management of hatcheries, nurseries and rearing ponds
4. Management of stocking ponds

Unit-3
1. Composite fish culture
2. Prawn culture and pearl industries in India.
3. Fisheries resources of MP
4. Riverine fisheries.

Unit-4
1. Costal fisheries in India
2. Offshore and deep sea fishery’s in India
3. Role of fishries in rural development
4. Sewage fed fisheries

Unit-5
1. Methods of fish preservation
2. Marketing of fish in India.
3. Economic importance and by product of fishes
4. Shark liver oil industry in India
   Transport of live fish &fish seed.

Suggested Reading Materials :
Paper III A & IV A

1. JR. Norman - The History of fishes.
3. Lagler Ichthyology.
4. Herclen Jones Fish migration.
5. Marshal The life of fishes.
6. Thomas - Diseases of fish.
7. Greenwood - Inter relationship of fishes.
M. Sc. Zoology 2011-2012 Onwards

10. Hoar and Randall -Fish physiology of fishes Vol. 1 & IX.
11. Gunther Sterba C.N.H.-Freshwater fishes of the world
13. G.V. Nikolsky -The ecology of Fishes,
14. Borgstram -Fish as food Vol. I & II.
15. Nilsson -Fish physiology -Recent Advances.
18. M. Jobling -Environmental Biology of fishes.
19. Santosh Kumar & Manju Ternbhre -Fish and Fisheries.
20. S.K. Gupta -Fish and Fisheries
22. Jhingaran -Fish and Fishries.

M.Sc Zoology
Semester-IV
Paper- IV B (Optional)
Cellular Organization and Molecular Organization.

Unit-1

1. General organization and characterizes of viruses (Examples SV 40 and HIV).
2. Yeast : Structure, reproduction and chromosome organization: Basic ides of its applications as vectors for gene cloning.
3. Molecular organization of reioratory chain assemblies, ATP / ADP Translocase and F0F1 AT pase.

Unit-2

1. Cytochemistry of Golgin complex and its role in cell seretion.,
2. Peroxisomes and training of paroxysmal proteins.
M. Sc. Zoology 2011-2012 Onwards

4. Intracellular digestion : Ultra structure and function of lysosomes.

Unit-3
2. Secretary pathways and translocation of secretary proteins across the EPR membrane.
3. Genome complexity: C- value [paradox and cot value].
4. DNA sequences of different complexity.

Unit-4
1. Difference between normal cells and cancer cells.
   a. Biochemical changes.
   b. Cytoskeleton changes.
   c. Cell surface changes.
2. Genetic basis of human cancer.

Unit-5
1. General idea of onchogens and proto onchogens.
2. Onchogeneity and cancer.
3. Transforming Agents.
4. Tumor Suppressor genanes.
5. Receptor – Ligand interaction and signal transduction.
   Cross – talk among various signaling pathways.

Suggested Reading Materials:

1. DeRobertis and De Robertis Cell and Molecular Biology. Lea and Febiger.
2. We Watson Hopking reberts steits, Weiner molecular biology of the gene, the Benjamin / Cummings Publishin Company Inc.
7. Lewin B. Genes VII.
8. King Cell Biology.
11. J. Travers Immunology current Biology limited.
13. Riott, Male snustad Principles of genetics john weley and sons Inc.
Unit-1
Classification according to imms
1. Classification of apterygota upto families.
2. Classification of following insect orders
   (a) orthoptera (b) hemiptera (c) diptera.
3. Classification of following insect order
   (a) hymenoptera (b) lepidoptera (c) coleoptera

Unit-2
1. Insect pest-Management strategies and tools
2. Biological control
3. Genetic control
4. Chemical control

Unit-3
1. Pests of Cotton
2. Pests of sugarcane
3. Pests of paddy
4. Pests of stored food grains  
5. Pests of citrus fruits and mango  
6. Pests of pulses  
7. Household insect pests

Unit-4
1. Insects in relation to forensic science  
2. Insects migration, population fluctuation and factors  
3. Insects of medical and veterinary importance  
4. Ecological factors affecting the population and development of  
   Insects

Unit-5
1. Mulberry and non mulberry sericulture  
2. Apiculture  
3. Lac culture  
4. Insects as human food for future.

M.Sc Zoology  
Semester-IV  
Paper- IV D (Optional)  
Environment & Biodiversity Conservation

Unit I
• Basic concept of Environmental Biology  
  Scope and Environmental Science  
• Biosphere and Biogeochemical cycles.  
• Environmental monitoring and impact assessment.  
• Environmental and sustainable development.  
• Water conservation, rain water harvesting, water shed management.

Unit II
• Cause, effects and remedial measure of Air pollution, Water pollution.  
• Noise, radioactive and thermal pollution.  
• Agriculture pollution  
• Basic concepts of Bioaccumulation.  
• Solid waste management.
Unit III
Global warming and disaster management
• Cause of global warming
• Impact of global warming – acid rains and ozone depletion, green house effect.
• Control measures of global warming
  (a) Afforestation (b) reduction in the use of CFCS
• Disaster management -floods, earthquake, Cyclones landslides.
• Environmental legislation.

Unit IV
Natural Resources:-
Forest -
  - Use and over exploitation of forests.
  - Timber extraction.
Land
  - Land degradation. Landslides.
  - Soil-ersion and desertification.
Water
  - Use and over utilization of surface and ground water
  - Floods. Drought dams- benefits and problems
Mineral
  - Use and exploitation ,
  - Environmental effect of extracting and using mineral resources
Food
  - World food problem
  - Effects of modern agriculture and overgrazing
Energy
  - Conventional and nonconventional energy resources.
  - Using of alternate energy sources
  - Role of an individual in conservation of natural resources
  - Equitable use of resources for sustainable life

Unit V
• Conservation of Biodiversity
  - Biodiversity crisis – habitat degradation poaching of wild life.
  - Socio economic and political causes of loss of biodiversity.
  - In situ and exsitu conservation of biodiversity
  - Value of biodiversity.
  - Hot spots of Biodiversity.
Suggested Reading Materials:
Paper III D & IV D

1. Arora : Fundamentals of environmental biology
2. Anathakrishnan : Bioresources ecology
3. Bottain : Environmental studies
4. Bouhey : Ecology of populations
5. Clark : Elements of ecology
6. Dowdoswell : An introduction to animal ecology
7. Goldman : Limnology
8. Kormondy : Concepts of ecology
9. May : Model ecosystems
10. Odum : Ecology
11. Perkins : Ecology
12. Simmons : Ecology of estuaries and coastal water
13. Pawlosuske : Physico-chemical methods for water
15. Trivedi and Goel : Chemical and biological methods for water pollution studies
16. Willington : Fresh water biology
17. Wetzel : Limnology
18. Welch : Limnology Vols. I-II
M. Sc. Zoology 2011-2012 Onwards

M.Sc Zoology
Semester-IV
Paper- IV E (Optional)

Molecular Endocrinology and Reproductive Technology

Unit-1
1. Definition and scope of molecular endocrinology.
2. Chemical nature of hormones.
3. Purification and characterization of hormones.
4. Production of hormone by r DNA technology

Unit-2
2. Eicosanoids and hormone action.
3. Concentration and transport of hormones in the blood.

Unit-3
1. Hormonal regulation of energy metabolism.
2. Hormonal antagonism.
3. Hypothalamic nuclei and their physiological function.
4. Endocrine – Immune interaction

Unit-4
1. Extraction and estimation of pregnanediol from urine.
2. Extraction of Gonadotrophin from urine.

Unit-5
1. Contraception.
2. Multiple ovulation and embryo transfer technology.
3. Study of estrous cycle by vaginal smear technology.
4. Surgical technique–castration, ovariectomy, vasectomy, tubectomy and laprotomy.
Suggested Reading Materials:

2. Lodish etal- Molecular Cell Biology.
5. Bentley, P.J. – Comparative Vertebrate endocrinology.