

M.Sc. Zoology 2013-14 onwards
First –Semester
Paper-1
Biosystematics, Taxonomy and evolution

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 .
- Species concepts : species category, different species concepts, subspecies and other infra-specific categories.
- Theories of biological classification, hierarchy of categories.

Unit II

- Taxonomic Characters . Different kinds.
- Taxonomic procedures: Taxonomic collections , preservation, ,cureting, process of identification.
- Taxonomic keys: different types of keys, their merits and demerits.
- International code of Zoological Nomenclature (ICZN):
Operative principles, interpretation and application of important Rules, Formation of Scientific names of various Taxa.

Unit III

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

Unit IV

A-Concepts of evolution and theories of organic evolution.

-Neo Darwinism and population genetics:

Hardy-Weinberg law of genetic equilibrium.

B- A detailed account of

i- Natural selection as a destabilizing force in Hardy-Weinberg law of equilibrium.

ii- Mutation as a destabilizing force in Hardy-Weinberg law of equilibrium.

iii- Genetic Drift as a destabilizing force in Hardy-Weinberg law of equilibrium.

iv- Migration as a destabilizing force in Hardy-Weinberg law of equilibrium.

- Meiotic Drive. -Trends in Evolution -Molecular Evolution

a) Gene evolution

b) Evolution of gene families

Unit V

- Origin of higher categories

a) Phylogenetic , gradualism and punctuated equilibrium.

b)Micro and macro evolution.

- Molecular population genetics

a)Pattern of changes in nucleotide and amino acid sequence.

b)Ecological significance of molecular variations (genetic polymorphism)

- Genetics & Speciation

a) Phylogenetic and biological concept of species. b) Origin and mechanism of reproductive isolation. c) Modes of speciation (allopatry & sympatry)

Suggested Reading Materials:

1. M. Koto-The. Biology of biodiversity-Springer

2. E.O. Wilson-Biodiversity-Academic Press Washington.

3. G.G.-Simpson-Principle of animal taxonomy Oxford IBH Publication company.

4. E-Mayer-Elements of Taxonomy

5. Bastchelet-F-Introduction to mathematics for life scientists Springer Verlag, Berling.

6. Skoal R.R. and F.J.Rohiff Biometry-Freeman, San-Francisco.

7. Snecdor, G.W. and W.G. Cochran Statistical Methods of affiliated-East- West Press, New Delhi.

8. Murry J.D. Mathematical Biology-Springer, Verlag, Berlin.

M.Sc. Zoology
Semester - I
Paper II
Structure and Function of Invertebrates

Unit . I

- Origin of Metazoa .
- Organization of Coelom
 - a) Acoelomates b) Pseudo coelomates c) Coelomates
 - d) Comparative account of invertebrate phylum.
- Locomotion
 - a) Amoeboid , Flagellar and Ciliary movements in Protozoa
 - b) Hydrostatic movements in Coelenterata.
 - c) Annelida and Echinodermata (Pheretima & Water vascular system)

Unit . II

- Nutrition and digestion
 - a) Patterns of Feeding and digestion in Lower Metazoans , Mollusca, (Porifera coelenterate and Platyhelminthes)
 - b) Echinodermata, Filter feeding in Polychaeta.
- Respiration
 - a) Organs of Respiration : Gills , Lungs and Trachea
 - b) Respiratory pigments .
 - c) Mechanism of Respiration .

Unit . III

- Excretion
 - a) Excretion in Lower invertebrates : Simple diffusion , Contractile vacuole , Protonephridia and Solenocytes
 - b) Excretion in Higher invertebrates : Coelom, Coelomoduct , metanephridia , Coxal gland , Malpighian tubules , Organ of Bojanus and Green gland .
- Mechanism of Osmoregulation with special reference to fresh water protozoa.

Unit . IV

Nervous system

a) Primitive Nervous system : Coelenterata and Echinodermata.

b) Advanced Nervous system : Annelida and Arthropoda (Crustacea and Insecta)

Unit .V

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 .

Structure ,affinities and life history of the following Non – Coelomate and Coelomate Minor phyla :

a) Rotifera

b) Entoprocta

c) Phoronida

d) Ectoprocta

Suggested Reading Materials:

1. Hyman, L.H. The invertebrates, Nol. I.protozoa through Ctenophora, McGraw Hill Co., New York

2. Barrington, E.J.W. Invertebrate structure and function. Thomas Nelson and Sons Ltd., London.

3. Jagerstein, G. Evolution of Metazoan life cycle, Academic Press, New York & London.

4. Hyman, L.H. The Invertebrates. Vol. 2. McGraw Hill Co., New York.

5. Hyman, L.H. The Invertebrates. Vol. 8. McGraw Hill Co., New York and London.

6. Barnes, R.D. Invertebrates Zoology, III edition. W.B. Saunders Co. Philadelphia.

7. Russel-Hunter, W.D. A biology of higher invertebrates, the Macmillan Co. Ltd., London.

8. Hyman, L.H. The Invertebrates smaller coelomate groups, Vol. V.Mc.Graw Hill Co., New York.

9. Read, C.P. Animal Parasitism. Parasitism. prentice Hall Inc., New Jersey.

10. Sedgwick, A.A. Student text book of Zoology. Vol. I,II and III. Central Book Depot, Allahabad.

11. Parker, T.J., haswell W.A. Text book of Zoology, Macmillan

M.Sc. Zoology
First semester
Paper-III
Quantitative biology, biodiversity and wildlife

Unit I

- Central tendencies- mean, mode and median
- Measures of dispersion : range, mean deviation, standard deviation and coefficient of variation
- Chi square test - Normal distribution
- Experimental designing and sample method

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 of correlation - Regression

Unit III

Biodiversity

- concept and principle of biodiversity
- causes for the loss of biodiversity
- Biodiversity conservation methods
- Lepidoptera and coleopteran Biodiversity.

Unit IV

Definition of wildlife; introduction to wild life and its scope and importance;
Habitat diversity of Indian wild life, endemic species,
Wild life values; economic, cultural, ecological, ethical, scientific and aesthetic
Wild life protection act.
Important Wildlife Sanctuaries and National Parks in India and MP

Unit V

Wild life conservation and management

Major threats and loss of wild life

IUCN Red List Criterion and categories

- Endangered and threatened species.
- 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:

- Batschelet. E. Introduction to mathematics for site scientist springer-verlag, berlin
- Jorgenserr, S.E. Fundamental of Ecological modling E. sevier New York
- Lenderen D. Modelling in behavioral ecology. Chapman & Hall London U.K.
- Sokal, R.R. and F. J. Rohit Biometry Freeman San Francisco
- Snedecor, G.W. and W.G. cochran, statical methods, Affilited East, West Press New Delhi (Indian ed.)
- Muray , J.D. Methamatical Biology, Springer Verlag Berlin
- Pelon, E.C. The interpretation of ecological data : A promer on classification and ordination.
- Wild life management - Hossetti
- 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 prevantology
- P.C. Kotwal Biodiversity and conservation

M.Sc. Zoology
Semester - I
Paper IV
Biomolecules and Structural Biology

Unit.I

- Chemical foundation of biology -
pH, pK , acids , Bases , Buffers , Weak bonds (Hydrogen bond , Vander waals force ,Hydrophobic effects , Electrostatic force) .
- Free energy, Resonance and Isomerisation
- Acid soluble pool of living tissue aminoacids, Monosaccharides
Oligosaccharides , nucleotides and Peptides .
- Nanoparticles
- Biomaterials .

Unit . II

- Primary , Secondary , Tertiary and quaternary structures of Proteins , Protein folding and denaturation .
- DNA and RNA : Double helical structure of DNA , Structure of RNA
- Role of RNA in gene expression ,protein synthesis in eukaryotes.
- DNA replication ,recombination and repair ..
- Membrane channels -Voltage gated and non- gated ion channels and Sodium potassium pump .

Unit . III

- Basic concept of metabolism : coupled and interconnecting reactions of metabolism (intermediary metabolism), cellular high energy resources and ATP synthesis .
- Glycolysis and Gluconeogenesis
- Citric acid cycle .
- Oxidative phosphorylation :Protein and its Regulation.
- Fatty acid metabolism : biosynthesis from glutamate , aspartate and amphibolic compounds,degradation of fatty acids : Beta oxidation , brief idea of alpha and omega oxidation

Unit . IV

- RNA synthesis and splicing
- Biosynthesis of amino acids.
- Biosynthesis of nucleotides.
- Biosynthesis of membrane lipids and steroids.
- Protein Synthesis

Unit .V

- Enzymes : Terminologies , classification and basics of Enzyme kinetics
- Mechanism of Enzyme catalysis
- Regulation of enzyme reaction
- Concept of free energy and thermodynamic principles in Biology.
- Energy rich bonds , compounds and biological energy transducers

M.Sc. Zoology 2013-14 onwards
Second -Semester
Paper-I

**GENERAL AND COMPARATIVE ANIMAL PHYSIOLOGY AND
ENDOCRINOLOGY**

Unit I

1. Respiratory pigments through different phylogenic 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, poikilotherms, hibernation & aestivation.
5. Physiology of circulation: composition and functions of blood, mechanism of blood clotting- extrinsic and intrinsic pathway and factors effecting blood clotting.

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:

1. EJW Barrington-General & comparative Endocrinology-Oxford, Claredon Press
2. R.H. Williams-Text Book of Endocrinology-W.B. Saunders
3. C.R. Martin- Endocrine Physiology-Oxford University Press.
4. Molecular CellBiology-J. Darnell, H. Lodish and D. Baltimore-Scientific American Book USA
5. Molecular Biology of the cell-B. Alberts, D-Bray, J.Lewis, M. Raff, K. Roberts and J.D. Watson, Garland Pub. New York.

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.
3. Population growth: Growth of organisms with non-overlapping generations, stochastic and time lag models of population growth, stable age distribution.
4. Population regulation: Extrinsic and intrinsic mechanisms.

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).
4. Mutualism , evolution of plant pollinator interaction.

Unit IV

- 1.Environmental pollution and human health.(Air pollution, Solid water pollution)
Conservation management of natural resources.Renewable (energy resource & forest resource & Non-renewable- Mineral &Solids).
2. Environmental impact assessment.
 - a) Biological monitoring programme.
 - b) Biological Indicators.
- 3.Concept of Sustainable development.

Unit V

1. Concept of homeostasis.
- 2.Endothermic and physiological mechanism of regulation of the body temperature.
3. Physiological response to oxygen deficient stress.
4. Physiological response to body exercise.
5. Meditation, yoga and their effects.

Suggested Reading Materials:

1. Cherrett,J.M. Ecological Concepts. Blackwell Science Publication, Oxford, U.K.
2. Elseth,B.D. and K.M. Baumgartner,population Biology, Van Nostrand Co., New York.
3. Jorgensen,S.E. Fundamentals of ecological modeling. Elsevier, New York.
4. Krebs, C.J. Ecology. Harper and Row, New York.
5. Krebs,C.J. Ecological Methodology. Harper and Row , New York.
6. Eckert, R. Animal Physiology: Mechanism and Adaptation. W.H. Freeman and Co., New York.
7. Hochachka, P.W. and G.N., Somero. Biochemical adaptation.

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.(SEM &TEM)
 - 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.
 - 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.(Power point &Word Excel)
2. Cryotechniques
 - Cryopreservation of cells, tissues, organs and organisms.
 - Cryosurgery
 - Cryotomy
 - Freeze fracture and freeze drying.

3. Separation techniques.

- 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. Ovariectomy, adrenalectomy)
- Perfusion techniques
- Stereotaxy
- Indwelling catheters
- Biosensor

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.

2. A biologist Guide to principles and Techniques of Practical Biochemistry-K, Wilson and K.H. Goulding ElBS Edn.

3. Clark & Swizer. Experimental Biochemistry. Freeman, 2000.

4. Locquin and Langeron. Handbook of Microscopy. Butterwaths, 1983

5. Boyer. Modern Experimental Biochemistry. Benjamin, 1993

6. Freifelder. Physical Biochemistry. Freeman, 1982.

7. Wilson and Wlaker. Practical Biochemistry. Cambridge, 2000.

8. Cooper. The Cell-A Molecular Approach. ASM, 1997

9. John R.W. Masters. Animal Cell culture- A practical approach. IRL Press.

10. Robert Braun. Introduction to instrumental analysis. 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
- Micro filaments and microtubules structure and dynamics
- Cell movements intracellular transport, role of kinesin and dynein

Unit . II

Cell-Cell signaling

- Cell surface receptors: G-Protein-Coupled receptor & their signal Transduction.
- Second messenger system (cAMP, Phosphatidyl inositol)
- Signaling from plasma membrane to nucleus
- Gap junctions and connexins
- Integrins
- Regulation of Blood Glucose level.
- Signal transduction –Protein Tyrosine Kinase.

Unit III

1. Cell-Cell adhesion and communication

- a) Ca⁺⁺ dependant homophilic cell- cell adhesion
- b) Ca⁺⁺ independant homophilic cell- cell adhesion
- c) Gap junctions and connexins

2. Genome organization,

- a) Hierarchy in organization.(cot value in relation to Non-repetative, Moderately & highly repetitive DNA)
- b) Chromosomal organization of genes and non-coding DNA

Unit IV

Sex determination

- a) Sex determination in *Drosophila*
- b) Sex determination in mammals
- c) Basic concept of dosage compensation
- d) Cytogenetic of human chromosomes
- e) Human genome project (HGP) purpose to implicate

Unit V

Genetic Diseases and Genomics

- 1) Human gene therapy
- 2) Prenatal diagnosis & genetic counseling
- 3) Genetic screening (Screening of recombinants).
- 4) Structural Genomics (study of structure of Genome: cytological & genetic mapping of Chromosome, RFLP, cloning & STS mapping).
 - Functional Genomics (Study of functions of Genome: RNA & Protein assays of genome function by a study of expressed sequence through assay hybridization & gene chips).
 - Gene libraries.
 - Transgenic animals & their applications

Suggested Reading Materials:

- J. Darnell, H. Lodish and D. Baltimore molecular cell biology scientific American book. Inc. USA
- B. Alberts D. Bray, J. Lewis, M. Raff, K. Roberts and J.D. Watson. molecular biology of the cell. Garland Publishing Inc. New York.
- John R. W. animal cell culture A practical approach masters. Irl. Press
- Alberts et. al. 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 origin of species
- Bengt A. Kihlman actions of chemicals of dividing cells

M Sc Semester II
Practical I (Paper I & II)

**General and comparative Physiology and Endocrinology, Population Ecology
and Environmental physiology.**

1. Experiment on Haematology, blood group, Hb, Total and Different counts..
2. Demonstration of Osmosis in RBC.
3. Preparation of Blood Report (Hb%, RBC Counts, Blood Group and ESR)
4. Demonstration of ESR
5. Estimation of pH
6. Demonstration of Enzyme Action (Papain –raw papaya extract as a meat tenderizer) and Chromatography
7. Demonstration of Blood Glucose (GOD and POD)
8. Colorimetric estimation of Protein in two different varieties of Hen Eggs (Country/Farm) –Biuret or Folin-Lowry Method
9. Detection of Nitrogenous Products in given samples (Milk and Urine)
10. Endocrinological spots comments on prepared histological slides.
11. Effect of posture, and exercise to stress on Blood Pressure

Scheme of Practical Examination

Exercise

M M. 50

1. Experiment based on Haematology	10
2. Demonstration of enzyme action and chromatography	10
3. Demonstration of blood glucose	05
4. Detection of Nitrogenous products	04
5. Colorimetric estimation of protein	05
6. Spotting	06
7. Viva Voce	05
8. Practical Records and Collection	05

Total Marks

50

Practical II (Paper III &IV)

Exercise

- Comments upon the structure and application of analytical instruments
 - Colorimeter
 - Spectrophotometer
 - Ultracentrifuge
 - ESR and NMR spectrometer
 - Chymographic Instruments
 - ELISA Reader
 - PCR
 - Biochemical Analyser
- Problem based on genetics
- Estimation techniques based for RNA and DNA
- Estimation of chromosome polymorphism isozyme polymorphism in some insect population.
- Demonstration of antibiotic sensitivity /resistance of E.Coli to antibiotic pressure and interpretation.
- Demonstration of Ag-Ab reaction by Oucferlony method /VDRL test
- Demonstration of ELISA Technique
- Estimation of gene and Genotype frequencies in light of Hardy Wienberg Law based on facial traits.
- Calculation of the rate of heart beat from recording provided.

Scheme of Practical examination

Exercise	M.M. 50
1.Comments on analytical instruments	10
2.Problem based on genetics	10
3.Estimation techniques based for RNA and DNA isolation	05
4. Estimation of gene and Genotype frequencies in light of Hardy – Wienberg law basedon facial traits.	05
5. Experiments based on Immunology	10
6. Viva Voce	05
7. Practical Records	05
Total Marks	50

Session – 2013-2014 onwards
Subject - Zoology
M.Sc Semester III
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) in Vertebrates.
3. Respiratory system : 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 & electroreception.
2. Flight adaptations in vertebrates.
3. Perching Mechanism in Birds.
4. Flight adaptation in Vertebrates.
5. Aquatic adaptations in birds and mammals.

Unit-5

- 1.. Origin, evolution general organization and affinities of Ostracoderms.
2. General organization, specialized, generalized and degenerated characters of Cyclostomes.
3. Origin, evolution general organization of early Gnathostomes .
4. General account of Elasmobranchi, Holocephali, Dipnoi and Crossopterygii.

SUGGESTED READINGS :

1. Carter, G.S. Structure and habit in vertebrate evolution – Sedgwick and Jackson, London.
2. Kingsley, J.S. Outlines of Comparative Anatomy of Vertebrates, Central Book Depot. Allahabad,
3. Kent, C.G. Comparative anatomy of vertebrates
4. Malcom Jollie, Chordata morphology. East – West Pres Pvt. Ltd., New Delhi.
5. Milton I lildergrand. Analysis of vertebrate structure. IV. Ed. John Wiley and Sons Inc., New York.
6. Smith, H.S. Evolution of Chordata structure. Hold Rinchart and Winstoin Inc. New York.
7. Sedgwick, A.A. Students Text Book of Zoology, Vol.II.
8. Walter, H.E. and Sayles, L.D. Biology of vertebrates, MacMillan & Co. New York.
9. Romer, A.S. Vertebrate Body, IIIrd Ed. W.B. Saunders Co., Philadelphia
10. Young J.Z. life of vertebrates. The oxford University Press, London
11. Parker & Haswell to III Rev. by Marshall willians latested Macmillan Co. ltd.
12. Young J.Z. Life of mammals. The Oxford University Press, London
13. Weichert, C.K. and Presch, W. Elements of chordate anatomy, 4th Edn. McGraw Hall Book Co., New York.

M.Sc Zoology
Semester III
Paper –II
Limnology

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.
2. (a) Dissolved Solids – Carbonate, Bicarbonates, Phosphate and Nitrate.
(b) Physico – Chemical characteristics of freshwater with special reference to different parameters- Turbidity, Dissolved gases (oxygen, carbon dioxide, Hydrogensulphide) 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.
2. Sewage – Definition, composition and its treatment.
3. Bioindicators- Aquatic flora and fauna in relation to water quality in an aquatic environment.

Unit-5

1. Causes of pollution of Aquatic Resources, their management and conservation.
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 Readings :

Anathakrishnan : Bioresources Ecology

Goldman : Limnology

Odum : Ecology

Pawlosuske : Physico- chemical methods for water

Wetzel : Limnology

Trivedi & Goyal : Chemical and biological methods for water pollution studies

Welch : Limnology Vols. III

Perkins : Ecology

Arora : Fundamentals of environmental biology

M.Sc Zoology
Semester III
ECO- TOXICOLOGY
Paper- III

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.
4. Energy flow in environment : Ecological energetics.

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.
4. Noise pollution.

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 READINGS :

1. Clark : Elements of ecology
2. Odum : Fundamentals of Ecology
3. South Woods : Ecological methods
4. Trivedi and Goel : Chemical and biological methods for water pollution studies.

M.Sc Zoology
Semester III
Paper- IV
Aquaculture

Unit-1

1. Aquaculture: history, definition, scope & importance.
2. Fishery resources of India in general & Madhya Pradesh in particular.
3. Abiotic & biotic factors of water necessary for fish life.
4. Cold water fisheries.

Unit-2

1. Fish culture –mono,poly,mixed & composite fish culture.
2. Fresh water prawn culture and its prospects in India.
3. Culture of 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 & identification.
5. Common weeds of fish ponds & 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.
3. Biochemical composition and nutritional value of fish.
4. Fisheries economics and marketing.
5. Fisheries managements and extension.

Suggested Readings :

1. C.B.L. Shrivastava : Fishes of India
2. Jhingran : 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
6. H.D. Kumar : Sustainability & Management of Aquaculture & Fisheries
7. A.J.K. Mainan : Identification of fishes
8. R. Sanatam : A Manual of fresh water Aquaculture
9. S.K. Gupta : Fish & Fisheries
10. P.D. Pandey : Fish & Fisheries
11. K.P. Vishwas : Fish & Fisheries

Class - M.Sc
Semester -III
Subject - Zoology

Practical I : Related to I & II Theory Papers

1. Study of Specimens, slides and bones related to theory papers.
2. Major Dissection- General anatomy of cranial nerves of Labeo, Wallago, Torpedo.
3. Minor Dissection-
 - (a) Accessory respiratory organs of Clarias, Heteropneustes and Anabas
 - (b) Herdmania
 - (c) Amphioxus
4. Estimation of DO, chloride, BOD, COD, Hardness, pH and Alkalinity of water to check Eutrophication of water bodies of Jabalpur.
5. Study of fresh water ecosystem.
6. Estimation of Turbidity in the water sample.
7. Potable Water Testing.

Scheme for Practical Examination

Exercise	M.M 50
1. Major Dissection	10 Marks
2. Minor Dissection	04 Marks
3. Spotting	12 Marks
4. Limnological exercise	10 Marks
5. Practical Record	05 Marks
6. Viva Voce	05 Marks
7. Collection	04 Marks
Total	50 Marks

Class-- M.Sc
Semester -- III
Subject -- Zoology

Practical II : Related to III & IV Theory Papers

1. Study of plankton- Collection, preservation and identification of planktons 8from different water bodies of Jabalpur.
2. Visit to fresh water bodies in and around Jabalpur.
3. Identification of commercially important fishes of Narmada River.
4. Visit to fish farm in action.
5. Working out of the growth curve of fish by length-weight ratio by using suitable fish.
6. Preparation and Maintenance of Aquarium.
7. Study of common weeds of fish ponds.
8. Methods of culture related to theory papers.
9. Study of abiotic factors of water related to fish life.
10. Determination of different toxic chemicals in samples of soil, water and air.
11. Toxicological testing methods, General tests, acute toxicity test and LD **50** Test.
12. Milk Adulteration.
13. Identification and comments on Aquaculture animals;
 - (a) Prawn, Oyster, Frog, Mussel, Clam and Pearl
 - (b) Edible fishes- Labeo, Catla, Mrigala, L. Calbasu, Mystus and Wallago.
14. Visit to agricultural field to study pest of cereals and vegetables.

Scheme of practical examination.

Exercise	M.M. 50
1. Spotting	08Marks
2. Study of Plankton	04Marks
3. Identification of commercially important fishes	04Marks
4. Exercise on toxicology	10Marks
5. Study of culture methods related to theory	05Marks
6. Maintenance of aquarium	05Marks
7. Study of growth curve of fish	05Marks
8. Practical Record/ Collection	05Marks
9. Viva Voce	04Marks
Total	50Marks

M.Sc Zoology (2013-2014 Onwards)
Semester-IV
Paper- I (Compulsory)
ANIMAL BEHAVIOUR AND NEUROPHYSIOLOGY

Unit-1

1. Introduction:

- Ethology as a branch of biology.
 - Animal psychology, classification of behavioural patterns, analysis of behavior (ethogram)
2. Reflexes and complex behavior.
3. Perception of the environment: mechanical, electrical, chemical, Olfactory, auditory and visual.
4. Evolution and ultimate causation: Inheritance behaviour and relationships.

Unit-2

1. Neural and hormonal control of behaviour.
2. Genetic and environmental components in the development of behaviour.
3. Motivation: Drive, timing and interaction of drives, physiological basis of motivation, hormones and motivation, aggregation.
4. Communication: Chemical, visual, light and audio, evolution of language (primates).

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 of fishes, turtles and birds.
3. Learning and memory: Conditioning, habituation, insight learning, association learning and reasoning.
4. Memory Basic Concept & Type.

Unit-4

1. Reproductive behaviour. Evolution of sex and reproductive strategies, mating systems, courtship, sexual selection, parental care.
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

Human Ethology

1. Ethological concept and Human behavior.
2. Concept of sign stimuli.
3. Concept of Imprinting.
4. Kinship and human social system.
5. Territorial behavior in animals.
6. Aggressive behavior in animals.
7. Bird Song.

Suggested Reading Materials:

1. Eibl-Eibesfeldt, I. Ethology. The biology of Behaviour. Holt, Rinehart & Winston, New York.
2. Gould, J.L. The mechanism and Evolution of Behaviour.
3. Kerbs, J.R. and N.B. davies : Behaviourable Ecology. Blackwell, Oxford, U.K.
4. Hinde, R.A. Animal Behaviour : A Synthesis of Ethology and Comparative Psychology. McGraw Hill, New York.
5. Alcock, J. Animal Behaviour : An Evolutionary approach. Sinauer Assoc. Sunderland, Massachsets, USA.
6. Bradbury, J.W. and S.L. Vehrencamp. Principles of Animal Communication. Sinauer Assoc. Sunderland, Massachsets, USA.

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
3. Biochemistry of Semen : Semen composition and formation, assessment of sperm function.
4. Fertilization: Prefertilization events Biochemistry of fertilization post fertilization events.

Unit-2

1. Ovarian follicular growth and differentiation: morphology, endocrinology, molecular biology of oogenesis and vitellogenesis, ovulation and ovum transport in mammals.
2. Biology of sex determination and sex differentiation in mammals.
3. Multiple ovulation and embryo transfer technology : in vitro oocyte maturation, super Ovulation (elementary idea of IVF).

Unit-3

1. Hormonal regulation of ovulation, pregnancy and parturition.
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

1. Cell commitment and differentiation.
2. Germ cell determinants and germ cell migration.
3. Development of gonads.
4. Melanogenesis

Unit-5

1. Stem cell concept- Embryonic and adult stem cells.
2. Adult stem cells niches-mesenchymal.
3. Epidermal stem cell culture.
4. Connective tissue cell family.
5. Haemopoietic stem cells- blood cell formation
6. Stem cell disorders.

Suggested Reading Materials:

1. Long J.A. Evan H.M. 1922 : the oestrous cycle in the Rat and its associated phenomenon.
2. Nalbandou. A.C. – Reproductive physiology
3. Prakash A.S. 1965-66 Marshall's, Physiology Reproduction (3 Vol.)
4. Gilbert, S.F. Developmental Biology , Sinauer Associated Inc. Massachusetts.
5. Ethan Bier, the cold Spring. The cold spring Harbor laboratory Press, New York.
6. Balinsky B.I. Introduction to Embryology sanders, Philadelphia.
7. Berril N.J. and Karp. G. Development Biology. McGraw Hill New York.
8. Davidson, E.H. Gene Activity During Early Development. Academic Press, New York.

M.Sc Zoology
Semester-IV
Paper- III B (Optional)
Cell Biology

Unit-1

1. Molecular organization of eukaryotic chromosomes : structure of nucleosome particles and higher order compaction of mitotic chromosomes, chromatin remodeling.
2. specialized chromosomes: structural organization and functional significance of polytene chromosomes
3. DNA methylation and DNA Aase-1 Hypersensitivity in relation to gene activity and chromatin organization.
4. specialized chromosomes II : structural organization and functional significance of lampbrush chromosome.
5. Organisation and significance of heterochromatin.

Unit-2

1. Structural organization of Eukaryotic genes, interrupted genes and overlapping genes and their evolution
2. Gene families: organization, evolution and significance
3. Transposable genetic elements of prokaryotes and eukaryotes Gene imitation and molecular mechanism of occurrence of mutation repair mechanism

Unit-3

1. Organisation of eukaryotic transcriptional machinery promoter enhancers transcription factors polymerase activators and repressors.
2. DNA binding domains of transcription apparatus zinc finger steroid receptors hemeo domains HILIX-loop, Helix and Leucine Zipper.
3. Eukaryotic transcription of Eukaryotic transcriptional control.
4. Environmental modulation of gene activity (stress response) stress genes and stress proteins
5. Molecular basis of thalasemia, 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) Gastrulation

Origin of Anterior –Posterior (Maternal effect genes and segmentation genes)

Unit-5

1. Drosophila development II origin of dorsal ventral polarity
2. Basic idea of homeotic 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.
2. Watson Hopkis Roberts Steitz Weiner, Molecular Biology of the Gene the Benjamin, Cummings Publishin Company inc.
3. Bruce A; berts Bray ewis Raff Roberts Watson Molecular Biology of the Cell, Garland Publishing inc.
4. Watson Gilman Witkowski Zoller Recombinant DNA Scientific American Books.
 - a) Karp Gerald Cell Biology.
 - b) Lewin B., Genes VII.
 - c) King Cell Biology.
 - d) Kaniel L. Hartl, Elizabeth W. Jones. Genetics Principals and Analysis, Jones and Bartlett Publishers.
5. Kuby, Immunology, W.H. Freeman and Company.
6. Roitt Male Snustad Immunology.

**M.Sc Zoology
Semester-IV
Paper- III D (Optional)
Wild Life Conservation**

Unit-1

Wild life –

Definition of wildlife; Introduction to wildlife with its scope and importance, Wildlife values; economical, cultural, ecological, scientific, ethical and aesthetic Important Indian fauna and their distribution: Asiatic Lion, Indian Tiger, Indian one horned Rhinoceros, Indian Elephant, Golden Langur, Lion-tailed Macaque, Red Panda, Brow Antler Deer, Indian Wild Buffalo, Crocodile, Great Indian Bustard, Dolphin.

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.
Habitat Diversity of Indian Wildlife, Endemic species.
- (c) Standard evaluation procedures - remote sensing and GIS.

Unit-2

1. Population estimation.

(a) Population density, Natality, Birth rate, Mortality, fertility schedules and sex ratio computation.

Capturing and marking techniques- entrapping, darting, tagging and banding population enumeration-Line transect, capture-recapture, pellet count, Pug marks and census method, call track count; radio telemetry& photography.

(b) Faecal analysis of ungulates and carnivores - Faecal samples, slide preparation, Hair identification,.

2. National Organization.

- (a) Indian board of wild life.
- (b) Bombay Natural History Society.
- (c) Voluntary organization involved in wild life conservation.

3. Wild life Legislation - Wild Protection act - 1972, its amendments and implementation.

Unit-3

A. 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.

B. Management planning of wild life in protected areas.

- 1. Estimation of carrying capacity.
- 2. Eco tourism / wild life tourism in forests.
- 3. Concept of climax persistence.
- 4. Ecology of perturbation.

Unit-4

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

Unit-5

Causes of Wild life depletion, **IUCN Red List Criterion and categories; indeterminate, rare, vulnerable, endangered, critically endangered and extinct.**

Conservation ethics and strategies; **identification of priority areas in conservation research; habitat management and establishment of wildlife corridors.**

In-situ conservation; establishment of protected areas /PAN, Biosphere reserves, critical wild life habitats (CWH).

Ex-situ conservation; captive breeding and repopulation programme, Role of Zoos, Parks National and International conventions-CITES.

Important wildlife sanctuaries and National parks in India and MP.

Tiger conservation - Tiger reserve in M.P, in India. Management challenges in Tiger reserve.

Suggested Reading Materials:

1. Gopal Rajesh : Fundamentals of wild life management
2. Agrawal K.C : Wild life India
3. Dwivedi A.P (2008) : Management wild life in India
4. Asthana D.K : Environment 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.
6. Odum E.P : Fundamentals of Ecology
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
10. Negi S.S : Wild life conservation (Natraj Publishers)

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 ideas of its applications as vectors for gene cloning.
3. Molecular organization of respiratory chain assemblies, ATP / ADP Translocase and F₀F₁ ATPase.
4. Cell cycle: Cell cycle control in mammalian cells and xenopus.

Unit-2

1. Cytochemistry of Golgin complex and its role in cell secretion.,
2. Peroxisomes and training of peroxysmal proteins.
3. Nucleolus: Structure and Biogenesis and functions of lysosomes.
4. Intracellular digestion : Ultra structure and function of lysosomes.

Unit-3

1. Synthesis and targeting of mitochondrial proteins.
2. Secretory pathways and translocation of secretory 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.
3. Chromosomal abnormalities in human cancer.

Unit-5

1. General idea of oncogenes and proto oncogenes.
 2. Oncogenesis and cancer.
 3. Transforming Agents.
 4. Tumor Suppressor genes.
 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 rebersts steits, Weiner molecular biology of the gene, the Benjamin / Cummings Publishin Company Inc.
3. Bruce alberts, Bray, Lewis, Raff, Roberts, Watson molecular Biology of the cell garland publishing inc.
4. P.K. Gupta, Molecular Cell Biology Rastogi Publication.
5. Watson Gilman Witkowski, Zoller Recominant D.N.A. scientific American Books.
6. Gerald Karp. Cell Biology.
7. Lewin B. Genes VII.
8. King Cell Biology.
9. Baniel L. Hartl Elizabeth W. Jones, Genetics Principles and analysis . Jones and Bartlett Publisher.
10. Lodish, Berk Zipursky, Matsudaira Baltimore Dornell Molecular Cell Biology W.H.Freeman and company.
11. J. Travers Immunology current Biology limited.
12. Kubey Immunology W.H. Freeman and Company.
13. Riott, Male snustad Principles of genetics john weley and sons Inc.

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 costal water
13. Pawlosuske : Physico-chemical methods for water
14. South Woods : Ecological methods
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

General Practical-I
Paper- I & II (Compulsory)
Animal behavior and gamete biology
M.M. : 50

1. Exercise on Animal behavior

- a. Taxes**
- b. Reflexes**
- c. Biological clocks**
- d. Social behavior**
- e. Learning behavior**
- f. Reproductive behavior**

2. Developmental Biology

- Study of embryological slides**
- Study of gametes of frog and chick**
- Study of fate maps**
- Study of different stages of spermatogenesis and oogenesis**

Animal behavior and gamete biology

Scheme for Practical Examination

Exercise	M.M.50
1. Exercise based on animal behavior	20 Marks
2. Exercise based on developmental biology	15 Marks
3. Practical record/Collection	10 Marks
4. Viva Voce	05 Marks
Total	50Marks

M.Sc IV Sem

Special Practical II Paper III(b) and IV (b)

Practical List

1. Preparation of mitotic chromosome from bone marrow
2. Karyotype preparation any animal
3. Calculation of *mitotic index*(in bone marrow or in root tip cells)
4. Demonstration of mitochondria, Golgi body ,RNA,DNA in tissue section ,any tissue
5. Sex chromatin demonstration
6. Study of Electron micrographs of pro and eukaryotic cell
7. Karyotype preparation of human syndromes from books
8. G&C banding in mitotic chromosomes
9. Gel Electrophoresis (PAGE) for protein
10. Polytene chromosome preparation
11. Meiosis –slide preparation in testis or in Anther
12. Study of mutants of *Drosophila w.m.*
13. Histochemical localization of age pigment
14. Demonstration of Alkaline Phosphatase/Ascorbic acid
15. Slides of cancerous tissue

Scheme of Practical Examination

Based on Paper III(b) and IV (b)

M.M.50

Time 4 hrs

Exercise

1 Demonstration of mitochondria/ Golgi body/ RNA/DNA in tissue section (any one)	06Marks
2. Calculation of mitotic index or Preparation of mitotic chromosomes (in Bone marrow or <i>Allium</i> root tips)	06
3. Demonstration Meiosis (anther/testis)	05
4. Separation of Protein by PAGE or Histochemical demonstration of age pigment or Demonstration of Alkaline Phosphatase or Ascorbic acid in any tissue plant/animal)	05
5. Spotting on - <i>Drosophila</i> mutants (w.m) Karyotype of human syndromes Permanent slides of cytology Electron micrographs Chromosomal aberrations (Total 08 spots, 1.5each)	12
6 Viva voce	08
7. Practical Record	08
Total	50

M.Sc IV Sem

Wild life conservation, Environment & Biodiversity

Special Practical Paper III(d) and IV (d)

II- PRACTICAL SYLLABUS

Wild life conservation, Environment & Biodiversity

1. Identification and comments upon wild fauna associated with central zone.
2. Study of endangered species/Importance of remote sensing.
3. Study of local birds and their habit habitats
4. Study of ecosystem surrounding area of Marhatal(old trees).
5. Study of local Biodiversity.
6. Distribution of wild life of India and M.P. (National parks and sanctuaries)
7. Soil and water analysis.
8. Interspecific relationship – Naturalism, Symbiosis, Mutualism, Commensalism, Parasitism, Predation Competition.
9. Study of Pug marks of wild animals to prepare ‘pug mark tracing ‘ from a track of wild animals.
- 10 Hypothetical Population Pyramid.
- 11 Light microscopic investigation of hair/fur samples of different captive wild animals.
12. Field – expedition and project report
13. Viva- voice
14. Practical Record & collection.

Practical Scheme

Exercise	Marks
1 Spotting	10
2 Endangered species / interspecific relationship	10
3 Pug mark tracing	05
4 Field expedition(Study of local and migratory birds & reptiles)Project report submission .	10
5 Viva voce	05
6 Practical Record/ collection	10
Total	50