# Syllabus
# For
# M.SC. ZOOLOGY
# (I, II, III & IV SEMESTER COURSE)

## W.E.F. - Session 2025 - 2026


## RADHA GOVIND UNIVERSITY
## CHANDAUSI,SAMBHAL (U.P.)

## M.Sc. Zoology Examination Scheme (2025-26)

| Semester | Course Code | Title of the Paper | Credit | L | T | P | T-CCE | T-UE | P-CCE | P-UE | Marks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| First | MBIOSZO101 | Biosystematics, Taxonomy and Evolution | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MSTRUZO102 | Structure and function of Invertebrates | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MQUANZO103 | Quantitative biology, Biodiversity and Wild Life | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MBIOMZO104 | Biomolecules and Structural Biology | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MLABCZO105 | Lab course I | 2 | 0 | 0 | 4 | 0 | 0 | 20 | 30 | 50 |
| | MLABCZO106 | Lab course II | 2 | 0 | 0 | 4 | 0 | 0 | 20 | 30 | 50 |
| | | **TOTAL** | **20** | | | | **160** | **240** | **40** | **60** | **500** |
| Second | MGENEZO107 | General and Comparative animal physiology and Endocrinology | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MPOPUSZO108 | Population Ecology and Environmental physiology | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MTOOLZO109 | Tools and Techniques for Biology | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MMOLEZO110 | Molecular cell biology and Genetics | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MLABCZO111 | Lab course III | 2 | 0 | 0 | 4 | 0 | 0 | 20 | 30 | 50 |
| | MLABCZO112 | Lab course IV | 2 | 0 | 0 | 4 | 0 | 0 | 20 | 30 | 50 |
| | | **TOTAL** | **20** | | | | **160** | **240** | **40** | **60** | **500** |
| Third | MCOMPZO201 | Comparative anatomy of Vertebrates | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MGAMEZO202 | Gamete Biology, Genes, development & differentiation | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MCELLZO203 | Cell Biology | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MCELLZO204 | Cell structure and Molecular Organization | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MLABCZO205 | Lab course V | 2 | 0 | 0 | 4 | 0 | 0 | 20 | 30 | 50 |
| | MLABCZO206 | Lab course VI | 2 | 0 | 0 | 4 | 0 | 0 | 20 | 30 | 50 |
| | | **TOTAL** | **20** | | | | **160** | **240** | **40** | **60** | **500** |
| Fourth | MANIMZO207 | Animal Behaviors and Neurophysiology | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MECOTZO208 | Ecotoxicology | 4 | 4 | 0 | 0 | 40 | 60 | 0 | 0 | 100 |
| | MLABCZO209 | Lab course VII | 2 | 0 | 0 | 4 | 0 | 0 | 20 | 30 | 50 |
| | MDISSZO210 | Dissertation | 10 | 0 | 0 | | 0 | 0 | 0 | 250 | 250 |
| | | **TOTAL** | **20** | | | | **80** | **120** | **20** | **280** | **500** |
| | | **Total marks of all semester** | **80** | | | | **560** | **960** | **140** | **460** | **2000** |

**L – Lecture T- Theory P- Practical CCE- Continuous comprehensive Exam UE- University Exam**

M.Sc. Zoology

Semester I

MBIOSZO101: Biosystematics, Taxonomy and evolution

Unit I

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

Unit II

1. Taxonomic Characters – Different kinds.
2. Origin of reproductive isolation, biological mechanism of genetic incompatibility.
3. Taxonomic procedures: Taxonomic collections , preservation ,curetting, process of identification.
4. Taxonomic keys,different types of keys, their merits and demerits.
5. International code of Zoological Nomenclature (ICZN): Operative principles, interpretation and application of important rules: Formation of Scientific names of various Taxa.

Unit III

1. Taxonomic categories.
2. Evaluation of biodiversity indices.
3. Evaluation of Shannon – Weiner Index.
4. Evaluation of Dominance Index.
5. Similarity and Dissimilarity Index.

Unit-IV

1. Concepts of evolution and theories of organic evolution.
2. Neo Darwinism and population genetics:
3. A- Hardy-Weinberg law of genetic equilibrium.
4. B – A detailed account of destabilizing forces:
5. i- Natural selection
6. ii- Mutation
7. iii- Genetic Drift
8. iv- Migration
9. v- Meiotic Drive.
10. Trends in Evolution
11. Molecular Evolution

a) Gene evolution
b) Evolution of gene families
c) Assessment of molecular variation

Unit – V

1. Origin of higher categories
2. Phylogenetic – gradualism and punctuated equilibrium.
3. Major trends in the origin of higher categories
4. Micro and macro evolution.

Molecular population genetics

- Pattern of changes in nucleotide and amino and sequence.
- Ecological significance of molecular variations (genetic polymorphism)

- Phylogenetic and biological concept of species.
- Patterns and mechanism of reproductive isolation.
- Modes of speciation (allopatry & sympatry)
- Origin and Evolution & Economically important microscopes and animals.

**Paper-I List of Books**

**SUGGESTED READING MATERIAL**


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. Cocharan Statisical Methods of affiliated-East-West Press, New Delhi.

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

**Class - M.Sc.**
**Subject - Zoology**
**Paper Title - MSTRUZO102: STRUCTURE AND FUNCTION OF INVERTEBRATES**
**Semester – I**

UNIT –I

1. Origin of metazoa
2. Organization of Coelom
    A. Acoclomates
    B. Pscudocoelomates
    C. Coclomates
3. Locomotion.
    A. Amoeboid flageller and cillary movement in protozoa
    B. Hydrostatic movement in Coelenterata
    C. Annelida and Echinodermata

UNIT –II

A: NUTRITION AND DIGESTON

Patterns of Feeding and digestion in lower metazoa, Mollusea, Echinodermata
Filter feeding in polychaeta.
B: Respiration
Organs of respiration : Gills, lungs and trachea, respiratory pigments.
Mechanism of respiration.

UNIT – III

EXCRETION

1. Excretion in lower invertebrates.
2. Excretion in higher invertebrates.
3. Mechanism of Osmoregulation.

UNIT – IV

NERVOUS SYSTEM.

A. Primitive Nervous systems-Coelenterata and Echinodermata.
B. Advanced nervous system in Annelida,
Arthropoda (Crustacea and Insecta) and Mollusa (Cephalopoda)

UNIT – V

A. INVERTEBRATES LARVAL FORMS AND THEIR EVOLUTIONARY SIGNIFICANCE.

A. Trematoda and Cestoda
B. Larval forms of Crustacea
C. Larval forms of Mollusea
D. Larval forms of Echinodermata.

B. 1. Structure affinities and life history of the following minor noncoelomate Phyla -

A. Rotifera
B. Entoprocta

2. Structure affinities and life history of the following minor Phyla

A. Phoronida
B. Ectoprocta

**Suggested Reading Material –**


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 anmd 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 invertbrates, 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 Co., London.

**I Sem**

**MQUANZO103: Quantitative biology, biodiversity and wildlife**

Unit – I Quantitative biology

- Basic mathematics for biologists
- matrices and vectors
- Exponential functions
- Differential equations integration
- Periodic functions
- Sprobability distribution properties and probability theory

Unit – II

- Experimental designing and sampling theory
- Completely randomized design and randomized block design
- Analysis of variance
- Co-relation- types of correlation
- Karl personls coefficient correlation
- Regression

Unit – III Biodiversity

- concept and principal of biodiversity
- causes for the lose of biodiversity
- Biodiversity conservation method
- 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 spices

Unit – V Wildlife and conservation

- National Parks and Sanctuaries
- Project Tiger
- Project Gir lion ang Crocodile breeding project
- wildlife in M.P. with references to Reptiles Birds and mammals
- Biospheres reserves

Suggested Books


- Bataschelet. E. Introduction to mathematics for site scientist springer-verlag, berling
- 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 ordivation.
- 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

Ist Semester

Suggested reading materials:


1. M. Koto : The Biology of Biodiversity. Springer.
2. E. O. Wildon : Biodiversity. Academic Press Washington.
3. G.G. Simpson : Principles of Animal Taxonomy. Oxford IBH Publication Company.
4. E. Mayer : Elements of Taxonomy.
5. Dobzansky : Biosystematics.
6. Dallela and Sharma : Animal Taxonomy and Museology.
7. Dodzhansky: The Genetics and origin of species. Columbia University Press.
8. Futuyama D.I. Evolutionary Biology. INC Publishers Dunderland.
9. Jha A.P. : Genes and Evolution – John Publication, New Delhi.

**Paper: IVth Paper**

**MBIOMZO104: BIOMOLECULES AND STRUCTURAL BIOLOGY**

Unit – I

Chemical Foundation of bilogy

- PH, PK, acids bases, buffers, weak bonds
- Free energy, resonance, isomerisation
- Acid soluble pool of living tissues – aminoacids, monosaccorides, oligosaccharides, nucleotides, peptides.
- Nanoparticles
- Biomaterials

Unit – II

1. Primary, Secondry, 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

1. Basic concepts of metabolism: Coupled and interconnecting reactions of metabolism cellular energy recources and ATP synthesis
2. Glycolysis and glyconeogenesis
3. Citric acid cycle
4. Oxidative phosphorylation : Protein and it's regulation
5. Fatty acid metabolism: Synthesis and degradation of fatty acids

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 action
4. Concept of free energy and thermodynamic principals in biology
5. Energy rich bonds, compound and biological energy transducers

Suggested Readings:


1. Voet, D. and J.G. Voet. Biochemistry John Wiley & Sons.
2. Freifelder, D. Physical Biochemistry W.H. Freeman & Co.
3. Segal, I.H. Biochemical calculations John Wiley and Sons
4. Creighton, T.E. Protein Structure and Molecular Properties W.H. Freeman & Co.
5. Freifelder, D. Essentials of Molecular Biology
6. Wilson, K. and K.H. Goulding A Biologists Guide to Principals and Techniques of Practical Biochemistry
7. Cooper, T.G. Tools of Biochemistry
8. Hawk, Practical Physiological Chemistry
9. Garret, R.H. and C.M. Grisham. Biochemistry. Saunders college Publishers.


**Lab I**

1. Spotting – Classification and identification of various phylum.
2. One major dissection of various systems of invertebrates –
   Squilla, Prawn, Sepia, Loligo.
3. One minor dissection- Grosshopper, Honeybee, Echinus, Starfish, Aplysia.
4. Mounting material - permanent balsum mount
5. Spottings related with Adaptation. Homologics, Analogics and modification of month parts :

**Lab II**

1. Problem based on Biodiversity and wild life.
2. Mammals and Fishers group
3. Exercise on mean, mode, & Median.
4. Cell division preparation of slid on Meiosis & Mitosis.
5. Preparation of different types of chromosomes.

**SEMESTER - II**

**Paper: Ist Paper**

**MGENEZO107: GENRAL AND COMPARATIVE ANIMAL PHYSIOLOGY AND ENDOCRONOLOGY**

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, 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

2. Bioliminescence as means of communication among animals
3. Pheromones and other semiochemicals as means of communication among animals
4. Chromatophores and regulation of their function among animals
5. Hormones, their classification and chemical nature
6. Mechanisms of hormone action

Unit –V

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

**SUGGESTED READING MATERIAL**


1. EJW Barrington-General & comparative Endoctrinology-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.

Semester II

Paper II

**MPOPUSZO108: 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.

1. Adaptations : Levels of adaptions, 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.

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. Mutulism , evolution of plant pollinator interaction.

1. Conservation management of natural resources .
2. Environmental impact assessment.
3. Sustainable development.

Unit V

1. Concept of homeostasis.
2. Endothermi 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 Readings:


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. Priceton, New Jersey.

**SEMESTER - II**
**Paper: IIIrd Paper**
**MTOOLZO109: Tools and techniques in Biology**

Unit – I

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

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.
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 man 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
- Immunioblotting, immunodetection, immunofluroscence.
4. Surgical techniques.
- Organ ablation (eg. Ovariactomy, adrenalectomy)
- Perfusion techniques
- Stereotaxy
- Indwelling cathethers
- 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 situ hybridization (radio labeled and non-radio labeled methods)
- Fish
- Restriction banding
3. Molecular biology techniques -
Southern hybridization
- Northern hybridization -
DNA Sequencing
- Polymerase chain reaction (PCR)

**SUGGESTED READING MATERIAL**


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

**MMOLEZO110: 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 kinesis and dynein

Unit – II

- Cell surface receptors
- Second messenger system
- Signaling from plasma membrane to nucleus
- Gap junctions and connexius
- Entegrius
- $Ca^{++}$ depandant homophilic cell – cell ahension
- $Ca^{++}$ indepandant homophilic cell – cell ahension
- Gap junctions and connexius
- 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 Implicatic

- Human gene therapy
- Prenatal diagnosis & genetic counseling
- Genetic screening
- Structural Genomics
- Functional Genomics
- Gene libraries
- Trasgenic animals & their applications

**Suggested Readings**


- 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. Wattson. molecular biology of the cell. Garland Publishing Inc. New York.
- John R. W. animal cell culture A practical approach masters. Irl. Press
- 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


**Practicals**

1. Experiment on Hematology Blood group, Total and different counts.
2. Demonstration of Enzyme Action, and chromatography
3. Estimation of pH.
4. Detection of protein carbohydrate and fats.
5. Endocrinological spots comments on prepared histological slides.
6. Detection of Nitrogenous products in given samples.
7. Estimation techniques based for RNA and DNA
8. Estimation of Gene and Genotypic frequencies in light of hardy weinbecey law
9. based on facial traits.
10. Demonstration of chromosome polymorphism isozyze polymorphism in some

**SEMESTER - III**

**Paper: Ist Paper**

**MCOMPZO201: Comparative Anatomy of Vertebrates**

Unit – I

1. Origin of Chordata : Concept of Protochordata
2. Origin and classification of vertebrates.
3. Vertebrates morphology : Definition, scope and importance.
4. Development, structure and functions of vertebrates integument and its derivatives (glands, scales, feathers and hairs)
5. Respiratory system : Characters of respiratory tissue, external and interal respiration, comparative account of respiratory organs.

Unit – II

1. Evolution of heart
2. Evolution of aortic arches and portal systems
3. Blood circulation in various vertebrates groups
4. Formation, function, body size and skeletal elements of the body.
5. Comparative account of jaw suspensorium and vertebral column

Unit – III

1. Comparative account of limbs and girdles.
2. Evolution of urinogenital system in vertebrates.
3. Comparative account of organs of olfaction and taste
4. Comparative anatomy of brain and spinal cord (CNS)
5. Comparative account of peripheral and autonomic nervous system

Unit – IV

1. Comparative account of lateral line system.
2. Comparative account of electroreception.
3. Comparative account of simple receptors.
4. Flight adaptations in vertebrates.
5. Aquatic adaptations in birds and mammals.

Unit – V

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 crossoptergii

Suggested Readings :


1. Carter, G.S. Structure and habit in vertebrate evolution – Sedgwick and Jackson, London.
2. Kingsley, J.S. Outlines of Comparative Autonomy 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**
**II paper**
**MGAMEZO202: Gamete Biology, genes development and differentiation**

Unit I

1. Comparative account of differentiation of gonads in mammals and invertebrate.
2. Spermatogenesis : Morphological basis in rodents and in any invertebrates.
   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 II

1. Ovarion 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.
3. Multiple ovulation and embryo transfer technology : in vitro osyte maturation, superevolution.

Unit III

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. Collection and cryopreservation of gametes and Embryo.
5. Teratological effects of xenobiotics on gametes.

Unit – IV

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

1. Creating new cell types, the basic evolutionary mystery.
2. cell diversification in early embryo, Xenopus, Blastomeres, morphigen gradients, totipotency and pleuripotency.
3. Embryonic stem cells, renewal by stem cells, epidermis.

4. Connective tissue cell family
5. Homopoietic stem cells : Blood cells formation, stem cell disorders.

**Suggested Readings :**


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. Developmenal Biology , Sinauer Associated Inc. Massachulsetts.
5. Ethan Bier, the cold Spring. The cold spring Harbor laboratory Press, New York.
6. Balinsky B.I. Introduction to Embryology sanders, Phliedelphia.
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. Semester III**
**Paper – III**
**MCELLZO203: Cell Biology**

Unit - I

1. Principle and applications of spectrophotometer.
2. Cell sorting : Principle and applications of flow cytometer
3. Basic idea of MMR and ESR
4. Principle and application flurimeter
5. Atomic force microscopy

Unit – II

1. Gel Electophoresis : 2D- page and isoelctric focusing
2. Stem cells : Embryaonic stem cells, culture and application.
3. General idea of X-ray crystallography and its applications
4. Immune techniques : Precipitation, Immunodiddusion, immunoletrophoresis, ELISA and RIA

Unit – III

1. Methods in protein purification
2. DNA – protein interactions : Electrophoritic mobility shift ass
3. Methods in analysis of gene expression – I : Transformation, transfections and mammalian expression
4. Methods in gene analysis – II : Feneral idea of sit directed mutagensis, Linker scanning mutations analysis Reporter assay.

Unit – IV

Recombinant DNA Technology

1. DNA modifying enzymes of RDT.
2. Properties of RDT
3. Process of RDT
4. Uses of RDT ( Recombinant DNA Technology)

Practicals

General Idea of yeast

1. Two hybrid systems
2. Subtractive hybridization
3. Chromosome walking
4. Chromosome jumping
5. Positional cloning
6. General idea of RNA se protection assay.
7. Primer extension

**M.Sc. Semester III**
**Zoology**
**Paper – IV ( Optional)**
**Cellular Structure and molecular organization**

Unit – I

1. General organization and characterizes of viruses ( examples SV40and HIV)
2. Yeast : Structur, reproduction and chrosom organization : Basic idea of its applications as vectors for gene cloning.
3. Molecular organization of respiratory chain assemblies, ATP / ADP Translocase and $F_OF_L$ ATPase.
4. Cell cycle : Cell cycle control in mammalian cells and Xenopus.

Unit – II

1. Cytochemistry of Golgi complex and its role in cell seretion
2. Peroxisomes and targeting of paroxysmal proteins
3. Nucleouls : Structure and biogenesis and functions of lysosomes
4. Intracullular digestion : Ultrastructure and function of lysosmes

Unit – III

1. Synthesis and targeting of mitochondrial proteins
2. Secretary pathways and translocation of secretary proteins across the EPR membrane
3. Genome complexity : C-value [aradox and cot value
4. DNA sequences of different complexity

Unit – IV

1. Difference between normal cells and cancer cells.
    1. Biochemical changes
    2. Cytoskeleton changes
    3. Cell surface changes
2. Genetic basis of human cancer
3. Chromosomal abnormalities in human cancer

Unit – V

1. General idea of onchogens and proto onchogens. 2- Onchogence and Cancer.
3. Transforming Agents.
4- Tumor Supressor geanes.
5. Receptor – ligand interaction and signal transduction
6. Cross – talk among verious Signaling Pathways.

Suggested Readings:


1- De Robertis 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.
3- Bruce Alberts , Bray , Lewis, Raff, Roberts, Watson Molecular Biology of the cell Garland Publishing Inc.
4- P.K. Gupta Molecular Cell Biology Rastogi Publications.

5- Watson Gilman Witkowski, Zoller Recombinant D,N.A Scientific American Books.
6- Gerald Karp. Cell Biology.
7- Lewin B. Genes VII,
8- King Cell Biology.
9- Daniel L. Hartl, Elizabeth W. Jones. Genetics Principles and anylysis. Jones and Bartlett Publisher.
10- Lodish, Berk Zipursky, Matsudaira Baltimore Dernell Molecular Cell Biology W. H. Freemen and Company.
11- J, Travers Immunology Current Biology limited.
12- Kuby Immunology W.H. Freeman and Company
13- Riott, Male Snustad Principles of Genetics John Weley and Sons Inc.
14- Gardner Simmons Snustad Principles of Genetics John Wiley and Sons INC.
15- Gibson Muse A Primer to Genome Science Siauer Associates Inc. Publishers
16- S.M. Brown Bioinformatics Eaton Publisher.
17- Pelczar Chan Kreig Microbiology Tata Mc Graw Hill
18- Prescott Harley Klein Microbiology Wm C. Brown Publisher.
19- T.A. Brown Genomes.
20- T.A. Brown Genomes.
21- D. Frefielder Physical Biochemistry.
22- Sambrook Frisch Maniatis Molecular Cloning Vol I-III.

## LIST OF PRACTICAL EXERCISES FOR LABORATORY COURSE

### M.Sc. Zoology Semester III
### PRECTICAL I CELL BIOLOGY

1. Histology and Histochemisty : Microtomy, staining and detection of cell organelles (e.g. Mitochondria Golgi Bodies, lysosomes nucleus and nucleoli)
2. Hisochemical demonstration of lipids, proteins (including enzymes), carbohydrate and nucleic acids (DNA/RNA)
3. Immunocytochemistry : Intracellular localization of specific target molecules by antibody staining.
4. Fluorescence microscopy and immunofluorescence : Application of fluorochromes and flurochrome tagged antibodies in the demonstration of proteins and nucleic acids
5. Get electrophoresis of proteins : Separation of Proteins on polyacrylamide get electrophoresis (PAGE)
6. Gel electrophoresis of nucleic acids (DNA/RNA) Isolation and detection of DNA.RNA on agarose gel.
7- Preparation of mitotic chromosomes from ret/ mice bone marrow cells and construct karyotype of G-or C-banded chromosomes
8. Short Terms rat/human blood lymphocyte culture and preparation of mitotic chromosomes for karyotyping.
9. Study of permanent slides and electron micrographs

Paper Title - Paper I ANIMAL BEHAVIOUR AND NEUROPHYSICOLOGY

Semester – IV

UNIT I –

1. Introduction :
   - Ethology as a branch of biology.
   - Animal psychology, classification of behavioral patterns, analysis of behaviour (ethgram)
2. Reflexes and complex behaviour.
3. Preception of the environment: mechanical, electrical, chemical, olfactory, auditory and visual.
4. Evolution and ultimate causation:Inheritance behaviour and relationships.

UNIT II –

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 (primites).

UNIT III –

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

UNIT IV-

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 V –

1. Thermoregulation: Homeothermic animals, poikilotherms & Hibermation.
2. Receptor physiology a comparative study –
   Mechano reception
   Photo reception
   Phono reception

chemo reception
Equilibrium reception

3. Bioluminescence

Suggested Readings -


1. Eibl-Eibesfeldt, I. Ethlogy. The biology of Behaviour. Holt, Rineheart & 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. Animnal 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.

**Semester IV**

**Paper II**

**MECOTZO208: Eco-Toxicology**

Unit – I

1. General principles of environmental Biology with emphasis on their ecosystems.
2. Abiotic and biotic factor of ecosystems.
3. Communities of the environment, their structure and significanance
4. Energy flow in environmentl : Ecological energetics

Unit – II

Productivity, Production and analysis.

7. Recycling and reuse technologic for solid and liquid wastes and their role in environmental conservation
8. 3- Remote sensing – basic concept and applications of remote secsing techniques in environmental conservation.

4- Environmental indicators and their role in environmental balance

Unit – III

1. Kinds of environmental pollution due to pollutants and their methods
2. Radioactive compounds and their impact on the environment
3. Vehicular exhaust pollution, causes and remedies.
4. Noise pollution

Unit – IV

1. Toxicology basic concepts, Principles and various types of toxicology agents.
2. Toxicity testing principles, hazards, risk and their control methods
3. Food toxicants and their control methods.
4. Public Health Hazards due to environmental disasters.

Unit – V

1. Pesicids, types nature anf their effects on our environment
2. Important heavy, metals and their role in environment.
3. Agrochemical use and misue , alternatives
4. Occuptational Health Hazasds and their control.

List of books-


1. Arora : Fundamentals of environmental
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. Wetzal : Limnology
18. Weleh : Limnology Vols. I-II

**MLABCZO209: LAB COURSE**

**MDISSZO210: DISSERTATION**