## M.Sc Zoology Programme Structure
### (For Candidates admitted from the academic year 2019 onwards)

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CC - CORE COURSE, CCE - CORE COURSE ELECTIVE

For the science program oral test will be conducted for the practical papers and 5 marks will be allotted and to be included in the external 75 marks i.e., 70 for the practical lab + 5 for the oral test = 75 marks.
CLASS I – M.Sc., Zoology
Semester I
Course & Code Core Course – (CC1)  Code: P19ZY1
Course Title BIOLOGY OF INVERTEBRATES AND CHORDATES AND PALEONTOLOGY
Hours: 6  Credits : 5  Max Marks : 75

Course Educational Objectives:
1. To understand the biology of invertebrates
2. To understand the respiration, circulation, excretion, and nervous system in invertebrates
3. To understand the biology of vertebrates
4. To understand the integumentary, respiratory, circulatory and excretory systems in vertebrates
5. To understand the paleontology

UNIT - I : Biology of Invertebrates

UNIT - II
Respiration: Gill respiration in prawn; Tracheal respiration in cockroach; Ctenidial and pulmonary respiration in snail (Pila) – Circulation: Earthworm; Prawn; Snail (Pila) – Excretion: Contractile vacuole in Paramecium; Flame cells in Planaria; Green glands in prawn – Nervous systems: Diffused type in hydra; Segmental type in earthworm, Nervous system in prawn.

UNIT - III : Biology of Chordates

UNIT - IV
Structure of skin – Skin derivatives – Accessory respiratory organs in fishes – Pulmonary respiration in birds – Evolution of vertebrate hearts – Types and evolution of kidneys – Comparison of brain in chordates – Principal reproductive organs (testis and ovary) and their accessory glands in human.
Unit - V: Paleontology and Minor phyla

Course Outcomes:
1. Familiar with the biology of invertebrates
2. Familiar with the respiration, circulation, excretion, and nervous system in invertebrates
3. Familiar with the biology of vertebrates
4. Familiar with the integumentary, respiratory, circulatory and excretory systems in vertebrates
5. Familiar with paleontology

Textbooks

References
**Course Educational Objectives:**
1. To understand plasma membrane
2. To understand the structure and function of mitochondria, Golgi complex, lysosome and endoplasmic reticulum
3. To understand the structure and function of DNA and RNA
4. To understand the cancer biology
5. To understand the cytological techniques

UNIT – I: Membrane structure & function and Cellular communication

UNIT – II: Structural organization & function of intracellular organelles and cell cycle

UNIT – III: Fundamental Processes of cell

UNIT – IV: Cancer Biology

UNIT – V: Cytological Techniques
Collection & preservation of animal tissue – Fixation, embedding, Sectioning – Cytochemical staining and detection methods of Carbohydrates, Protein, Lipids, DNA and RNA – Cell fractionation – Autoradiography – In situ hybridisation-by FISH.
Course Outcomes:
- Familiar with plasma membrane
- Familiar with the structure and function of mitochondria, Golgi complex, lysosome and endoplasmic reticulum
- Familiar with the structure and function of DNA and RNA
- Familiar with cancer biology
- Familiar with cytological techniques

Textbooks

References
CLASS I – M.Sc., Zoology

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Course Educational Objectives:
- To understand linkage and crossing over
- To understand gene concept and gene expression
- To understand mutation
- To understand quantitative genetics
- To understand human genetics

UNIT – I: Genetic interaction, Linkage & Crossing over
Gene interaction and types (Complementary genes, supplementary genes, Duplicate genes, Lethal genes, and Epistatsis) – Mechanism of crossing over and its theories (Chiasma, Breakage, Contact-first, Strain, and differential contraction theories) – Kinds of linkage (Complete and incomplete) – Gene Mapping in Chromosome by crossing over method – Somatic Cell Hybridization.

UNIT – II: Gene concept and regulation of gene expression

UNIT – III: Mutation
Gene Mutations: Base substitutions; Insertions and deletions; Phenotypic effects of mutations; Suppressor mutations – Chromosome Mutations: Chromosome Rearrangements (Duplications, Deletions, Inversions, and Translocations); Aneuploidy (nullisomy, monosomy, trisomy, and tetrasomy); Polyplody (Autopolyplody and Allopolyplody) – Causes of mutation: Spontaneous Replication Errors; Spontaneous Chemical Changes; Chemically Induced Mutations; Radiation – Ames Test.

UNIT – IV: Microbial, Quantitative genetics & Extra chromosomal inheritance
Transposon – Types and mechanism of transposition – Methods of genetic transfers: Transformation; Conjugation; Transduction; Sex-duction – Mapping genes by interrupted conjugation mating – Polygenic inheritance – Types of heritability – Mapping QTLs – Maternal inheritance.
UNIT – V: Human Genetics

Inborn errors of metabolism: Phenylketonuria; alkaptonuria; albinism; Lesh-Nyhan syndrome; ADA deficiency; galactosemia; G6PD deficiency; Tay Sach’s disease and Gaucher’s disease – Preparation and analysis of human karyotype – Cytogenetic banding nomenclature – Chromosomal syndromes in man: Klinefelter; Turner; Down. Monogenetic disorders: Sickle cell anemia; Cystic fibrosis. Genetic counseling – Prenatal diagnosis (Aminocentosis, CVS).

Course Outcomes:
- Familiar with linkage and crossing over
- Familiar with gene concept and gene expression
- Familiar with mutation
- Familiar with quantitative genetics
- Familiar with human genetics

Textbooks

References
CLASS | I – M.Sc., Zoology
---|---
Semester | I
Course & Code | Core Course – (CC4)  | Code: P19ZY4P
Course Title | Practical - I (Pertaining to Biology of Invertebrates and Chordates and Palaeontology, Cell and Molecular Biology and Genetics).
Hours: 6 | Credits : 5  | Max Marks : 75

Course Educational Objectives:
- To gain knowledge on identification and classification of invertebrates and vertebrates
- To understand various fossil forms.
- To understand the concepts of microscopy
- To understand histochemical and cytochemical techniques.
- To understand blood group identification, differential cell counting in blood, human karyotype, and calculation of gene frequency

BIOLOGY OF INVERTEBRATES AND CHORDATES AND PALAEOLOGY

1. Mounting of Teleost fish scales.
2. Study of frog nervous system and brain using virtual laboratory.
3. Study of frog circulatory system and heart using virtual laboratory.

Spotters:
4. Radial symmetry (Sea anemone).
5. Bilateral symmetry (Cockroach).
6. Acoelomates (Planeria).
7. Pseudocoelomates (Round worm).
8. Eucoelomates (Earthworm).

CELL AND MOLECULAR BIOLOGY

10. Measurements using ocular and stage micrometers.
11. Histochemical technique (Micrometry).

Spotters:
14. Stage micrometer.
15. Microtome.
GENETICS


Spotters:

Reference Books:


Course Outcomes:

- Familiar with identification and classification of invertebrates and vertebrates
- Familiar with various fossil forms.
- Familiar with the concepts of microscopy
- Familiar with histochemical and cytochemical techniques.
- Familiar with blood group identification, differential cell counting in blood, human karyotype, and calculation of gene frequency
Course Educational Objectives:

- To understand the principles and applications of various analytical instruments used in biological sciences.
- To gain knowledge about various separation techniques, and physiological measuring instruments.
- To understand the pharmacological techniques.
- To understand basic concepts of bioinformatics.
- To understand the sequence alignment and prediction.

BIOINSTRUMENTATION

UNIT – I: Analytical instruments
Analytical Balance: Methods of weighing (weighing by difference & taring the balance)
- pH meter: Sorensen’s pH scale, principle (Combined electrode), operation & applications – Microscopy: Light, Fluorescence, Phase contrast, Dark field microscopes – Radioactive counters (Geiger Muller and Scintillation counters).

UNIT – II: Separation techniques

UNIT – III: Pharmacological techniques

BIOINFORMATICS

UNIT – IV: Databases, Tools, and Phylogenetics
Applications of bioinformatics: Molecular medicine, Personalized medicine, Preventive medicine, Gene therapy, Drug development, Evolutionary studies – Biological database and its properties – Nucleotide sequence database – Protein sequence database – SwissProt, NCBI, GENBANK, BLAST – Phylogeny and Structure of phylogenetic tree – Construction of a phylogenetic tree – Steps in molecular phylogenetic analysis.
UNIT – V: Sequence alignment and Prediction
Components of Bioinformatics – Sequence Alignment: Pair-wise sequence alignment (Dot matrix method), Dynamic programming (Optimal global alignment and optimal local alignment) – Word method – Multiple sequence alignment (dynamic programming, progressive method, and iterative method) – Prediction of Protein Structure and Function.

Course Outcomes:
- Familiar with the principles and applications of various analytical instruments used in biological sciences.
- Familiar with various separation techniques, and physiological measuring instruments.
- Familiar with the pharmacological techniques
- Familiar with basic concepts of bioinformatics
- Familiar with sequence alignment and prediction

Textbooks

References
Murthy, C.S.V. 2003, Bioinformatics, Himalaya Publishing House, Mumbai, Delhi, Nagpur, Bangalore- India.
Subramanian, C. 2004, A Text Book of Bioinformatics, Dominant Publishers and Distributors, New Delhi, India.
CLASS I – M.Sc., Zoology

Semester II
Course & Code Core Course – (CC5) Code: P19ZY6
Course Title ANIMAL PHYSIOLOGY
Hours: 6 Credits : 5 Max Marks : 75

Course Educational Objectives:
- To understand thermoregulation and osmoregulation
- To understand nervous coordination and excretion
- To understand muscular system and sense organs
- To understand bioluminescence and chronobiology
- To understand the biology of reproduction

UNIT - I: Thermoregulation and Osmoregulation
Homeostasis – Classification of animals based on thermoregulation – Temperature compensation in poikilotherms (aquatic and terrestrial animals) – Temperature regulation in homeotherms (Response to cold and heat) – Acclimatization – Mechanism of osmoregulation in freshwater animals – Mechanism of osmoregulation in marine animals.

UNIT – II: Nervous coordination and Excretion

UNIT - III: Sense organs, Muscular system, and Respiratory system
Photoreceptor – Chemoreceptor (Olfactory System) – Mechanoreceptors: Phonoreceptors; Tactile receptors – Muscular system: Structure of muscle; Mechanism of muscle contraction – Respiratory system: exchange of gases; transport of gases; control of breathing.

UNIT - IV: Bioluminescence and Chronobiology
Bioluminescence: Occurrence; Structure of bioluminescent organs; Chemistry of light production; Functional significance – Animal behaviour: Taxis, Kinesis, Reflexes, physiological basis of learning and memory – Biological rhythms: Circadian, Lunar, Circannual rhythms – Biological clock.

UNIT - V: Physiology of Reproduction
Mammalian reproductive physiology – Reproductive cycles (Menstrual & Oestrous cycle) – Molecular mechanism of hormone action – Prostaglandins, Reproductive disorders – Birth control methods.
Course Outcomes:
- Familiar with thermoregulation and osmoregulation
- Familiar with nervous coordination and excretion
- Familiar with muscular system and sense organs
- Familiar with bioluminescence and chronobiology
- Familiar with the biology of reproduction

Textbooks

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Course Educational Objectives:
- To understand the recombinant DNA technology and genomics.
- To understand enzyme biotechnology
- To understand pharmaceutical biotechnology.
- To understand molecular markers and gene therapy.
- To understand basics of nanobiotechnology

UNIT - I: Introduction to Biotechnology  
Scope – Strategies of Recombinant DNA technology (Preparation of desired DNA, Preparation of desired vector, types of vectors – Plasmid (PBR322 & M13 Phage) – Bacteriophage (Cosmid – Transgenic animals) and its applications – Genomics – Human Genome Project – Methods of gene sequencing (Random shotgun, Whole genome Shotgun sequencing).

UNIT - II: Enzyme Biotechnology  

UNIT - III: Pharmaceutical Biotechnology  
Monoclonal Antibodies Production (Hybridoma Technology) – Pharmaceutical products of DNA Technology – Insulin, Human Growth hormone, Interferon. Recombinant vaccines (Subunit, DNA and Attenuated vaccines).

UNIT - IV: Molecular Markers and Gene Therapy  
RFLP, RAPD, AFLP, PCR, and Northern, Southern and Western Blotting techniques – Gene Therapy: Ex vivo (Bone marrow transplantation) and in vivo gene therapy – Gene silencing.

UNIT - V: Nanobiotechnology  
Introduction to Nanobiotechnology – Nanobiotechnological devices – Types and applications of Nanobiosensors – Drug delivery technologies – Cancer diagnosis and therapy – Preparation and uses of DNA microarrays.
Course Outcomes:

- Familiar with the recombinant DNA technology and genomics.
- Familiar with enzyme biotechnology
- Familiar with pharmaceutical biotechnology.
- Familiar with molecular markers and gene therapy.
- Familiar with the basics of nanobiotechnology

Textbooks:

References
Course Educational Objectives:
- To understand classification of microorganisms
- To understand the culture techniques
- To understand food microbiology
- To understand industrial microbiology
- To understand medical microbiology

UNIT - I: Characteristics of Microorganisms
General Features and Classification of bacteria, virus, fungi, and protozoa.
Structure of Bacteria (E. coli) – Structure of Virus: T4 Bacteriophage, Adenovirus.

UNIT - II: Culture Techniques
Bacterial growth and nutritional requirements – Types of culture media – preparation of culture media – methods of maintenance of culture – culture characteristics of bacteria: Gram’s staining techniques.

UNIT - III: Food Microbiology
Microbial examination of food – Food Spoilage intrinsic & extrinsic factors (Meat, Fish, milk, egg, and bread) – Food Poisoning (Botulism, Staphylococcal poisoning, and Mycotoxicosis) – Food Preservation – Bacteriology of Milk – Bacteriological examination of Milk – Pasteurization of Milk.

UNIT - IV: Industrial and Agricultural Microbiology
Fermentation technology – Stages of fermentation – Fermentation products (alcohol, vinegar, pharmaceuticals, organic acids, amino acids, and fuels).
Biological nitrogen fixation; Nif genes, Nitrogen fixers – Bio fertilizers (Rhizobium, Azotobacter, Azospirillum, VAM) – Bio pesticides (Bacterial, Fungal, Viral).

UNIT - V: Medicinal Microbiology
Pathogenecity, Infection, Virulence, Causative agents, Modes of transmission, control measures: Bacterial diseases (Diptheria, Tuberculosis, Tetanus, Typhoid, Cholera); Viral diseases (Polio, Viral Hepatitis A & B); Sexually transmitted diseases (AIDS, Gonorrhrea, Syphilis, Urethritis); Protozoan diseases (Malaria, Leishmaniasis, Trypanosomiasis).
Course Outcomes:

- Familiar with classification of microorganisms
- Familiar with culture techniques
- Familiar with food microbiology
- Familiar with industrial microbiology
- Familiar with medical microbiology

Textbooks

References
Course Educational Objectives:
- To obtain knowledge about the quantitative estimation of salivary amylase activity.
- To obtain knowledge on quantitative estimation of ammonia and urea.
- To understand physiological mechanism of various receptors.
- To gain knowledge on electrophoretic techniques.
- To obtain knowledge on bacterial culture techniques.

ANIMAL PHYSIOLOGY

1. Quantitative estimation of amylase activity.
2. Quantitative estimation of ammonia.
4. Estimation of salinity in aquarium water samples.

Spotters:
- 5. Photoreceptor.
- 6. Phonoreceptor.

BIOTECHNOLOGY

8. Demonstration of DNA isolation.
10. Demonstration of SDS-PAGE.

Spotters:
- 11. pBR322 plasmid.
- 12. T₄ Bacteriophage.
- 14. DNA Microarray.

MICROBIOLOGY

15. Culturing of bacterial broth – Bacterial growth curve.
17. Serial Dilution technique
19. Gram staining.

Spotters:
20. Inoculation loop.
22. Incubator.
23. Hot air oven.
24. Laminar flow hood.

“Industrial-/Forest-/Zoo-visit (Educational Tour) report should be included in the practical record”

Course Outcomes:
- Familiar with the technique that quantitatively estimate salivary amylase activity
- Familiar with quantitative estimation of ammonia and urea
- Familiar with rate physiological mechanism of various receptors.
- Familiar with electrophoretic techniques
- Familiar with bacterial culture techniques

Reference Books:

Course Educational Objectives:
- To understand vermiculture techniques
- To understand apiculture techniques
- To understand sericulture techniques
- To understand aquaculture techniques
- To understand poultry farming techniques

UNIT – I: Vermiculture

UNIT – II: Apiculture

UNIT – III: Sericulture

UNIT – IV: Aquaculture

UNIT – V: Poultry Farming
Common Breeds of Poultry – Pre-requisites of a poultry house – Deep litter system – Cage system – Selection and incubation of eggs – Brooding of chick – Rearing of

**Course Outcomes:**
- Familiar with vermiculture techniques
- Familiar with apiculture techniques
- Familiar with sericulture techniques
- Familiar with aquaculture techniques
- Familiar with poultry farming techniques

**Textbooks**

**References**
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Course Educational Objectives:
- To understand reproduction and assisted reproductive technologies
- To understand the metamorphosis and regeneration
- To understand cell differentiation
- To understand the concepts of evolution
- To understand the adaptive pattern and speciation concepts.

UNIT – I: Reproduction and Assisted Reproductive Technologies

UNIT – II: Metamorphosis and Regeneration

UNIT – III: Cell Differentiation

UNIT – IV: Origin of Life and Mechanism of evolution

UNIT – V: Adaptive patterns and Speciation
Course Outcomes:
- Familiar with the knowledge of reproduction and assisted reproductive technologies
- Familiar with metamorphosis and regeneration
- Familiar with cell differentiation
- Familiar with the concepts of evolution
- Familiar with the adaptive pattern and speciation concepts.

Textbooks
Publishers. Massachusetts, USA.

References
House Pvt.Ltd.
and Allieded, Pvt., LTD., Kolkata.
Course Educational Objectives:
- To acquire knowledge about the structure, classification, and metabolism of biomolecules.
- To gain knowledge about enzymes, hormones and their functions.
- To understand the thermodynamics.
- To gain knowledge about radiation and its impacts on biological system.
- To study the principles and applications of various microscopes and Spectroscopies.

UNIT – I: Proteins and Lipids
Lipids: Classification, Fatty acids, Triglycerides, Compound lipids, Phospholipids, Sphingolipids, Glycolipids, Steroids, Prostaglandins, Oxidation of fatty acids and Ketosis.

UNIT – II: Carbohydrates
Classification – Structure and Properties of monosaccharides, disaccharides (Maltose, Lactose, Sucrose), and polysaccharides (Starch, Glycogen, Chitin, Proteoglycan, Glycoproteins) – Acid Mucopolysaccharides – Biosynthesis of Glycogen – Glycolysis – Kreb’s cycle – HMP pathway – Gluconeogenesis.

UNIT – III: Enzymes and Hormones
Hormones: Hypothalamic releasing hormones and function, Mechanism of hormone action, Peptide hormones, Adenylate cyclase, cyclic AMP mechanism- Ca++, Phosphoinositol, Steroid hormones and Transcriptional control.

UNIT – IV: Thermodynamics and Radiation Biology
UNIT – V: Electron Microscopy and Spectroscopy
Electron Microscopy: Principle & applications of SEM, TEM, AFM & STM.

Course Outcomes:
- Familiar with the structure, classification, and metabolism of biomolecules.
- Familiar with enzymes, hormones and their functions.
- Familiar with the laws of thermodynamics.
- Familiar with radiation and its impacts on biological system.
- Familiar with the principles and applications of various microscopes and Spectroscopies.

Textbooks

References
CLASS II – M.Sc., Zoology

Semester III

Course & Code Core Course – (CC11) Code: P19ZY13P

Course Title PRACTICAL – III (Pertaining to Developmental Biology & Evolution, Biochemistry & Biophysics).

Hours: 6 Credits : 5 Max Marks : 75

Course Educational Objectives:
- To understand Hardy Weinberg law and calculation of gene frequency
- To understand solution preparation
- To understand buffer preparation
- To understand quantitative estimation of total sugar in animal tissues
- To understand Beer and Lambert’s law

DEVELOPMENTAL BIOLOGY AND EVOLUTION
1. Study of fertilization through a model diagram

Spotters:
3. Female infertility: PCOS, Endometriosis.
4. Intracytoplasmic Sperm Injection Technique.
5. Gamete Intrafallopian tube Transfer Technique.
6. In-Vitro Fertilization Technique.

BIOCHEMISTRY AND BIOPHYSICS
7. Calculation of normality, molarity, and percentage.
8. Determination of pH of water samples.
10. Quantitative estimation of total carbohydrate.

Spotters:
15. Spectrophotometer.

Reference Books:
Course Outcomes:

- Familiar with Hardy Weinberg law and calculation of gene frequency
- Familiar with solution preparation
- Familiar with buffer preparation
- Familiar with quantitative estimation of total sugar in animal tissues
- Familiar with Beer and Lambert’s law
CLASS II – M.Sc., Zoology

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<tr>
<th>Semester</th>
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<tr>
<td>Course Title</td>
<td>BIOSTATISTICS AND RESEARCH METHODOLOGY</td>
</tr>
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<td>Hours:</td>
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**Course Educational Objectives:**
- To understand the descriptive statistics
- To understand the hypothesis testing methods
- To understand methods involved in research
- To understand various resources of journals
- To understand the methods in field biology

**BIOSTATISTICS**

UNIT – I: Descriptive statistics and Presentation of data

UNIT – II: Testing Hypothesis
Test of hypothesis (Null hypothesis and Alternative hypothesis) – Confidence Interval – Levels of significance – Student’s t test (paired and unpaired tests) – Chi square test – One way and two way analyses of variance (F-values) – Correlation.

**RESEARCH METHODOLOGY**

UNIT – III: Research Methodology
Research: Definition, Sources for Literature collection, Selection of research theories, Experimental Design, Components of research report (Introduction, Materials and Methods, Results and Discussion, Summary, References), Presentation of results (in the form of Tables, Figures), Evaluation of Data (Statistical Analysis).

UNIT – IV: Journals and Online browsing of research articles
Popular Magazines and periodicals (monthly, quarterly and half-yearly journals and reviews). Online browsing of research articles: infonet, inflibnet and Pubmed. Peer-reviewed journals, indexed and non-indexed journals.
UNIT - V: Methods in field biology

Primary and secondary data collection – Estimation of population density – Estimation of ranging patterns – Sampling methods to the study the animal behavior – Ground and remote sensing methods for habitat characterization.

Course Outcomes:
- Familiar with the descriptive statistics
- Familiar with the hypothesis testing methods
- Familiar with method involved in biological research
- Familiar with various resources for research articles
- Familiar with the methods in field biology

Textbooks

References
Zar, J.H. 1984, Biostatistical analysis, Prentice Hall, New Jersey, USA.
<table>
<thead>
<tr>
<th>CLASS</th>
<th>II – M.Sc., Zoology</th>
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**Course Educational Objectives:**
- To understand our immediate environment
- To understand the population ecology
- To understand community ecology
- To understand the concepts of ecosystem
- To understand the ecological resources

**UNIT – I: Environment, Habitat, and Niche**

**UNIT – II: Population Ecology**

**UNIT – III: Species Interactions, Community Ecology and Ecological Succession**
Types of species interactions (Positive, negative and passive), interspecific competition, herbivory, carnivory, pollination, symbiosis – Community structure and attributes – Levels of species diversity and its measurement – Edges and ecotones – Types and mechanisms of ecological succession – Concept of climax.

**UNIT - IV: Ecosystem Ecology**

**UNIT – V: Applied Ecology**
Course Outcomes:

- Familiar with our immediate environment
- Familiar with the population ecology
- Familiar with the community ecology
- Familiar with the concepts of ecosystem
- Familiar with the ecological resources

Textbooks

References
Course Educational Objectives:
- To understand the lymphoid organs
- To understand the antigens and immunoglobulins
- To understand immune response
- To understand immune disorders
- To understand immunotechniques

UNIT – I: Lymphoid organs

UNIT – II: Antigens and Immunoglobulins
Antigen: Types of antigens – Antigenicity – B and T cell epitopes – haptens, adjuvants and carriers. Antibody: Monoclonal and polyclonal antibodies, Ultra structure & types of immunoglobulin; paratopes (characteristics and functions) – Immunogenicity – Antibody receptors (T cell receptors – TCR), Genes for TCR and diversity – Complement: Nomenclature, complement activation and function (Classical and Alternate pathway).

UNIT – III: Immune response
Antigen processing and presentation – Activation and differentiation of B and T cells – B and T cell receptors – Immune response: Primary and secondary immune response – Mechanism of humoral and cell mediated immune response – Immunity to infections: Immune response during bacterial (tuberculosis), parasitic (malaria) and viral (HIV) infections – Immunoprophylaxis: Vaccines (antigen, subunit, recombinant, anti idiotypic antibodies & toxoids as vaccines) – Immunization schedule for children.

UNIT – IV: Immune Disorders
Major Histocompatibility Complex: Functions; Structure and Pathway of class I and class II MHC Molecules – Hypersensitivity: Types – I, II, III, IV and V – Autoimmune disorders – Immunodeficiency diseases – Tumor immunity: Tumour antigens; Immune response to tumours – Transplantation immunity: Host versus Graft reaction; Graft versus Host reaction.
UNIT – V: Immunological Techniques


Course Outcomes:
- Familiarize with the lymphoid organs
- Familiarize with the antigens and immunoglobulins
- Gain knowledge on immune response
- Gain knowledge on immune disorders
- Familiar with immunotechniques

Textbooks

References
Course Educational Objectives:
- To understand the classification of insects
- To understand the Digestive, respiratory and circulatory system of insects
- To understand the excretory, nervous and reproductive system of insects
- To understand the insect pests and their management
- To understand the pest control methods

UNIT – I: Taxonomy and Morphology of Insects
Basis of insect classification – Key characteristics with common South Indian examples – Morphology of the insect – Head Sutures and Sclerites – Types of mouth parts – Thorax areas and sutures of tergum, sternum and pleuron – Wings: structure and modifications; venation – Leg structure and modifications – Abdominal segmentation with genitalia and their modifications.

UNIT – II: Physiology of Insects
Structure and chemistry of integumentary system – Structure and physiology of digestive system – Respiratory system: Aerial and Aquatic – Circulatory system: Structure of heart; Mechanism of haemolymph circulation; Haemolymph and its composition & Haemocytes and their functions.

UNIT – III: Physiology of Insects
Malpighian tubules and their functions – Nervous system: Structure; Neurotransmitters; Structure and function of compound eye – Male and female reproductive systems – Endocrine system: Neuroendocrine system of insects; Endocrine control of moulting and metamorphosis; Role of hormones in male and female reproduction.

UNIT – IV: Insect Pests
Biology, damage caused and control methods: Paddy (Scirpophaga incerulas, Orseolia oryzae, Leptocorisa acuta); Rice (Sitophilus oryzae) Sugarcane (Chilo infuscaticullus, Chilo Sacchariphagus indicus, Tryporyza nivella); Cotton (Earias insulana, Aphis gossypii, Thrips tabaci); Coconut (Rhyncophorus ferrugineus, Oryctes rhinoceros); Brinjal (Leucinodes orbanalis); Tomato (Spodoptera litura); Lady’s finger (Earias fabia).

UNIT – V: Pest Control Methods
Principles of Insect control: Prophylactic measures, Cultural, Mechanical, Physical and Biological methods – Parasites and predators – Chemical methods: Pesticides, Classification, Mode of action, Toxicity, Insecticide resistance to environmental safety
– Non conventional methods, Use of insect growth regulators (IGR), Repellents, Antifeedants, Pheromones and Chemosterilants. Integrated Pest Management.

**Course Outcomes:**

- Familiarize with the classification of insects
- Familiarize with the digestive, respiratory and circulatory system of Insects
- Familiarize with the excretory, nervous and reproductive system of insects
- Gain knowledge on the insect pests and their management
- Gain knowledge on the pest control methods

**Textbooks**


**References**


CLASS: II – M.Sc., Zoology

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**Course Educational Objectives:**
- To understand the Indian wildlife and its conservation
- To understand Ethology
- To understand the ecology selected endangered animals in India
- To learn the wildlife census techniques
- To understand human-animal conflicts

**UNIT – I: Wildlife of India**
Wildlife concept – Wildlife wealth of India – Threats to Indian wildlife (habitat loss, Mining activities, Forest fires, construction of road and railways, poaching and illegal wildlife trade) – Read Data Book and IUCN Red List of threatened animals – Aims and objectives of wildlife conservation – History of wildlife conservation in India – Necessity for wildlife conservation.

**UNIT - II: Biome and Ethology of wildlife**
Biome: Concept; Definition; Characteristic features; Types in India (Alpine Tundra, Grassland, Forest, Desert, Aquatic) – Communications and signaling: Modes of communications; Biological significance – Territory: Size; Defense strategies – Courtship displays: Stages involved in successful courtship; Biological significance – Mate selection: Influencing factors and benefits; Types.

**UNIT – III: Corridors and Bio-Ecology**

**UNIT – IV: Wildlife census techniques**

**UNIT – V: Human wildlife conflicts & Acts and convention**
Human wildlife conflicts in India – Causes, consequences, and mitigation – Scenario, Mitigation strategies, and challenges: Human-Elephant conflict; Human-Tiger conflict; Human-Leopard conflict – Important acts related to wildlife conservation – Important
convention for wildlife conservation – Government organisations and institutes in conservation initiatives.

Course Outcomes:
- Gain knowledge about Indian wildlife and its conservation
- Familiarize with Ethology
- Gain knowledge about the ecology selected endangered animals in India
- Familiarize with the wildlife census techniques
- Gain knowledge about human-animal conflicts

Textbooks

References
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A dissertation should be submitted.
Extra credit papers (self study)

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ORNITHOLOGY

Objective: To make the students understand the various aspects of Ornithology.

UNIT - I
Classification of Birds upto orders with examples – fossil birds – origin and evolution of birds.
Habitat ecology of Indian birds: Coastal birds – Inland water birds – Birds of high altitudes and deserts.
Status and Distribution: Distribution of birds in India – Endangered birds of India and their conservation.

UNIT - II
Methods: Morphometric measurements – methods used in food habit studies.
Feeding ecology: Insectivores – Frugivores – Nectarivores – Graminivores – Carnivores and Scavengers – Perch related variables and time activity budget studies with suitable example.

UNIT - III
Territory: Functions of Territory – Types of Territory – Sizes and shapes of Territory – Defense of Territory – Site Fidelity.

UNIT - IV
Parental Care: Feeding – Nest sanitation – Brooding the young – Defense of young.
Feathers and Moult: Types – Functions – Growth – Moult.
UNIT - V

Text Books

Reference Books:
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<td>Max Marks</td>
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**PARASITOLOGY**

Unit-I: Introduction to Parasites
1.1 Introduction to parasites of man, scope and definition of parasites/parasitology
1.2 Animal Association, Types of Parasites and Hosts
1.3 Interrelationship between Host and Parasites responses and hosts to parasitic infection
1.4 Mode of transmission of parasite, Host specificity and parasitic adaptation

Unit-II: Protozoa and Cestoda
Classification, Geographical distribution, Morphology, Life-cycle, Transmission, Pathogenicity, Treatment and Prophylaxis of:
2.1 Protozoan parasites: Entamoeba Sps, Trypanosoma Sps., Leishmania Sps.
2.2 Intestinal flagellates: Giardia Sps, Trichomonus Sps.
2.3 Cestodes: Taenia Sps, Diphilabothrium Sps.
2.4 Classification of Parasitic Protozoans and parasitic cestodes

Unit-III: Trematoda and Nematoda
Classification, Geographical distribution, Morphology, Life-cycle, Transmission, Pathogenicity, Treatment and Prophylaxis of:
3.1 Trematodes: Schistosomo Sps, Faciola Sps, Echinococcus Sps.
3.2 Nematodes: Wuchereria Sps, Ancylostoma Sps, Dracunculus Sps.
3.3 Plant & Soil nematodes: Cyst nematode, citrus nematode
3.4 Biodiversity & Taxonomic overview of Helminth Parasites

Unit-IV: Immunology, Genetics & Molecular Biology of Parasites
4.1 Trypanosoma: Diploid & Sexual stage, Molecular characteristics of surface coat, Variable surface glycoprotein (VSG) and VSG gene expression.
4.3 Platyhelminthes: Inseminative behaviour, parthenogenesis and polyspermy, sex determination, sex linked inheritance in Schistosomes.
4.4 Nematoda: chromosome germ line limited DNA & chromatin diminution in Ascaris.

**REFERENCE BOOKS:**
8. Parasitology – by Chandler and Chands