



बिलासपुर विश्वविद्यालय, बिलासपुर (छत्तीसगढ़)

पाठ्यक्रम

एम.एससी. (पूर्व/अंतिम) जूलॉजी

M.SC. PREVIOUS (ZOOLOGY)

PAPER – I

INVERTEBRATE STRUCTURE & FUNCTION, MINOR PHYLA, ANIMAL BEHAVIOUR POPULATION ECOLOGY

UNIT-I

MINOR PHYLA:

- (i) Organisation and general characters of Phoronida, Brachiopod and Acanthocephalan.

LOCOMOTION:

- (i) Flagella and Colliery movement in Protozoa.
- (ii) Hydrostatic movements in coelenterates, Annelid and Echinodermata.

NUTRITION & DIGESTION:

- (i) Patterns of feeding and digestion in lower metazoan.
- (ii) Filter feeding in polychaeta, mollusca and Echinodermata.

RESPIRATION:

- (i) Organs of Respiration, gills, lungs and trachea.
- (ii) Respiratory pigments.
- (iii) Mechanism of Respiration in invertebrate phyla.

UNIT-II

EXCRETION-

- (i) Organs of excretion, Coolum, Coelomoduct, Nephridia and malpighian tubules.
- (ii) Mechanism of excretion.

NERVOUS SYSTEM:

- (i) Primitive nervous system: Coelenterate and Echinodermata.
- (ii) Advanced nervous system : Annelid, arthropod, (Crustacean & Insect) and mollusca (Cephalopodan)

INVERTEBRATE LARVAE:

- (i) Larval forms of free living invertebrates. (Crustacean & Echinodermata)
- (ii) Larval Forms of parasites invertebrates.

UNIT-III ANIMAL BEHAVIOUR:

- (i) Innate behaviour
- (ii) Neural and hormonal control of behaviour.
- (iii) Learning & memory: conditioning Habituation, insight learning association learning.
- (iv) Neural Mechanism of learning. Biological rhythms.
- (v) Social behaviour (Organisation) in Insects and Primates.

UNIT-IV POPULATION ECOLOGY:

- (i) Population Growth: Exponential growth, logistic growth model, stochastic and time lag models of population growth.
- (ii) Demography: Life tables, net reproduction rates, reproductive value.
- (iii) Population regulation : Extrinsic and intrinsic mechanism
- (iv) Model's of prey – Predatory dynamics.
- (v) Role of predation in nature.



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M.SC. PREVIOUS (ZOOLOGY) PAPER – II

UNIT-I

BIOSTATISTICS-

- Probability distribution and their properties.
- Hypothesis testing.
- Analysis of frequencies.
- Analysis of Variance
- Correlation
- Regression
- Probability theory

UNIT-II

BASIC MATHEMATICS-

- Matrices and Vectors.
- Exponential Functions.
- Mathematical Modelling
- Properties of Models
- Cycling of Nutrients in an ecosystem
- Eutrophication model
- Optimal Clutch Size in birds
- Morphogenesis

UNIT-III

ADOPTATION ENVIRONMENTAL PHYSIOLOGY-

- Levels of adaptation
- Mechanism of adaptation
- Significance of body size, Physiological adaptation to different environments, namely.
- Marine
- Extreme aquatic and extreme terrestrial environments.
- Freshwater
- Terrestrial life

UNIT-IV

STRESS PHYSIOLOGY-

- Adaptation, acclimation and acclimatization.
- Concept of homeostasis
- Endothermic and physiological mechanism of regulation of body temperature
- Osmoregulation in aqueous and terrestrial environments.
- Physiological response to Oxygen deficient stress.
- Physiological response to body exercise, meditation, yoga and effects.



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PAPER- III

ENDOCRINOLOGY AND GAMETE BIOLOGY

UNIT- I

AIMS AND SCOPE OF ENDOCRINOLOGY

- Discovery of hormones
- Classification of hormones
- Hormones as messengers
- General Principles of hormonal action and Neuroendocrine system
- Nature of Hormone action
- Hormones and homeostasis
- Hormonal regulation of carbohydrate, nitrogen and lipid metabolism

UNIT- II

BIOSYNTHESIS AND SECRETION OF HORMONES-

- Biosynthesis of Steroid hormones de-novo
- Biosynthesis and Amino acid derived small size hormones (example T₄, epinephrine etc.)
- Biosynthesis and simple peptide hormones pre and pro hormones.
- Metabolism of hormones
- Hormones and Behaviour
- Hormones and Reproduction
- Seasonal breeders
- Continuous breeders

UNIT- III

HETEROGAMY IN EUKARYOTES-

- Comparative account of differentiation of gonads in a mammal and invertebrate.

Leyding Cells-

- Morphology
- Differentiation
- Function and its regulation in Spermatogenesis
- Morphological basis in Rodents
- Morphological basis in any invertebrate

Fertilization

- Prefertilization events
- Biochemistry of fertilization
- Post fertilization events.
- Collection and cryopreservation of gametes and embryos
- Ovarian follicular growth and differentiation Morphology, Endocrinology, Cogenesis and Vitellogenesis
- Ovulation
- Biology of Sex determination and differentiation a comparative account



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Unit- IV

Multiple ovulation and embryo transfer technology (MOET)

- In Vitro acolyte maturation
- Super ovulation
- In vitro fertilization – assisted reproduction technologies
- Embryo sexing and cloning
- Screenings for genetic disorders
- GIFT etc
- Cloning of animals by Nuclear transfer
- GAMETE Specific antigens
- Surgical Methods
- Hormonal Methods



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M.SC. PREVIOUS (ZOOLOGY)

PAPER- IV

MOLECULAR CELL BIOLOGY AND TOOLS & TECHNIQUES FOR BIOLOGY

UNIT-I

INTRODUCTION- EXPERIMENTAL SYSTEMS IN CELL BIOLOGY

Bio membranes

- Molecular Composition and arrangement, Functional Consequences.
- Transport Across cell membrane diffusion, active transport and pumps, uni-ports, seaports and anti-ports

Cytoskeleton-

- Micro filaments and microtubules structure and dynamics
- Microtubules and mitosis
- Cell movements intercellular transport role of kinesis and dyeing, signal transduction mechanisms.

Cell-Cell Signalling

- Cell Surface receptors
- Second messenger system
- Signalling from plasma membranes to nucleus

Cell-cell adhesion and Communication

- Ca⁺⁺ dependent haemophilic cell-cell adhesion
- Ca⁺⁺ independent homophiles cell-cell adhesion

Cell Matrix adhesion:

- Integrins
- Collagens

UNIT-II

GENOME ORGANIZATION

- Chromosomal Organization of genes and non-coding DNA
- Morphological and functional elements of eukaryotic chromosomes

Intercellular Protein Traffic –

- Protein synthesis on free and bound polysome
- Uptake into ER
- Biogenesis of Mitochondria and nuclei
- Trafficking mechanisms

Biology of cancer

Biology of aging

Apoptosis-definition, mechanism and significance



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UNIT-III

TOOLS AND TECHNIQUE FOR BIOLOGY-

- Principles and uses of analytical instruments, Balances, Ohmmeter Colorimeter, Spectrophotometers, Ultracentrifuge, Microscopy: Principle of light microscopy, phase contrast microscopy, electron microscopy, Microbiological Techniques.
- Media Preparation: Inoculation and growth monitoring Microbial assays.

Cell Culture techniques –

- Design and functioning of tissue culture laboratory
- Culture media preparation and cell harvesting methods

UNIT-IV

CRYOTECHNIQUES –

- Cryopreservation for Cells, tissue organisms
- Cryorechniques for microscopy
- Molecular separation by chromatography, electrophoresis precipitation etc
- Organelle separation by centrifugation etc
- Immunological techniques; based on antigen antibody interaction
- Organ ablations (e.g. Ovariectomy adrenolectomy etc.)
- Indwelling catheters



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M.Sc. (FINAL) ZOOLOGY

PAPER- I

BIOSYSTEMATICS, TAXONOMY AND POPULATION GENETICS

UNIT-I

Definition and basic concepts of biosystematics and Taxonomy

- Historical resume of systematic
- Importance and applications of biosystematics in biology
- Material basis of biosystematics different attributes
- Trends in biosystematics- Concepts of different conventional and newer aspects
- Chemotaxonomy
- Cytotaxonomy
- Molecular taxonomy

Dimensions of speciation and taxonomic characters

- Mechanisms of speciation panmictic and apodictic species.
- Species concepts species Category, different species concepts sub species and other infra specific categories.
- Theories of biological classification, hierarchy of categories

Taxonomic characters- Different kinds, Origin of reproductive isolation biological mechanism of genetic incompatibility

UNIT-II

Procedure keys in taxonomy –

Taxonomic procedures- taxonomic collections, preservation, curation process of identification

Taxonomic keys- different kinds of Taxonomic keys their merits and demerits

- Process of typification and different Zoological types
- International Code of Zoological Nomenclature (ICZN) – its operative principles interpretation and application of important rules, Zoological nomenclature, formation of scientific names of various taxa

Evolution of biodiversity indices-

- Similarity and dissimilarity index
- Association Index
- Population genetics and Evolution-

UNIT-III

Concepts of evolution and theories of organic evolution with and emphasis on Darwinism

- Neo-Darwinism
- Hardy-Weinberg Law of genetic Equilibrium
- A detailed account of destabilizing forces (i) Natural-selection (ii) Mutation (iii) Genetic drift (iv) Migration (v) Meiotic drive Genetic of speciation
- Patterns and mechanisms of reproductive isolation
- Models of speciation (Allopathic, Sympatric, Para Patrice)



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Molecular Evolution-

- Gene evolution
- Assessment of molecular variation Origin of Higher Categories.
- Major trends in the origin of higher categories Micro and Macroevolution.

Molecular Phylogenetics

- How to construct Phylogenetic trees
- Amino acid Sequence and phylogeny
- Molecular clocks

UNIT-IV

Quantifying genetic variability

- Genetic Structures of natural populations
- Phenotypic Variation

Molecular Population genetics-

- Patterns of change in nucleotide and amino acid sequences
- Emergence of Non Darwinism-Neutral Hypothesis
- Genetic and quantitative traits in population
- Analysis of quantitative traits
- Quantitative traits and natural selection
- Genotype environment interactions
- Inbreeding depression and heterocyst

Population genetics and ecology

- Met populations
- Why small populations become extinct
- Conservation of genetic resources in diverse taxa



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PAPER- II

(VERTEBRATE ANATOMY, PHYSIOLOGY, IMMUNOLOGY, BIOMOLECULES & METABOLIC REGULATION)

UNIT-I COMPARATIVE ANATOMY OF VERTEBRATES:

- (i) **Circulation:** General Plan of circulation, Evolution of Heart and Evolution of aortic arches.
- (ii) **Respiration:** Comparative account of respiratory organs, gills and lungs and respiratory pigments.
- (iii) **Skeletal system:** Comparative account of jaw suspensorium and limb girdles in Vertebrate series.
- (iv) Types of palate in Birds
- (v) Evolution of Primogenital system in vertebrate series
- (vi) Comparative anatomy of Brain in relation to its functions.

UNIT-II- PHYSIOLOGY

- (i) Comparative physiology of Digestion
- (ii) Pattern of nitrogen excretion among different Chordate groups
- (iii) Receptor physiology: Photoreception and Phonoreception
- (iv) communication among animals: Bioluminescence, Pheromones
- (v) Chromatophores and regulation of their function
- (vi) Osmoregulation in different vertebrate groups

UNIT-III IMMUNOLOGY-

- (i) Innate and Acquired immunity
- (ii) Organisation and structure of lymphoid organs.
- (iii) Cells of immune system and their differentiation
- (iv) Antigen: Antibodies interactions in vitro and in vivo
- (v) Structure and function of different antibodies
- (vi) Cytokines: Structure and functions

UNIT-IV BIOMOLECULES AND METABOLIC REGULATORS-

(i) Concept of molecules:

- a) Saccharine: General properties and structure of Monosaccharide's (glucose & Fructose), Di-saccharine (Lactose & Sucrose), Polysaccharides.
- b) Amino acids: Occurrence, biological importance and general chemistry
- c) Proteins: Occurrence, structure and biological importance of primary, secondary, tertiary and quaternary proteins.
- d) Biological significance and properties of fats: Phospholipids and steroids
- e) Primary and secondary structure of nucleic acids

(ii) Enzymes:

- a) Classification and nomenclature of enzyme
- b) Regulation of enzyme activity by non-genetic mechanism and competitive inhibition of enzyme activity
- c) Immobilised enzymes and their application



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**M. Sc. (FINAL)
GROUP– ENTOMOLOGY
PAPER– III
(MORPHOLOGY AND PHYSIOLOGY OF INSECTS)**

UNIT-I

1. Cephalisation and theories about cephalisation
2. Head capsule, type of antennae and types of mouth parts
3. Thorax, legs in locomotion and functional modification of legs
4. Integument – sclerotization and moulting
5. Wing venation– General and in the orders– Lepidoptera, Diptera, Hymenoptera, Coleopterans & Heteroptera

UNIT-II

1. Digestive system and physiology of digestion
2. Excretory organs, excretion and osmoregulation
3. Respiratory structure and respiration
4. Respiratory adaptation in aquatic and end parasitic insects
5. Circulation, Haemocytes and blood coagulation

UNIT-III

1. Nervous System – Principle modification
2. Photoreception, mechanoreceptor and chemoreception
3. Sound producing structure and sound production
4. Endocrine structure and functions
5. Bioluminescence, reproduction and metamorphoses and Diapauses

UNIT-IV

1. Internal and External Organisation of reproductive organs
2. Endocrine control of reproduction and metamorphoses
3. Development – Embryonic and post embryonic
4. Types of larvae
5. Types of pupae



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ENTOMOLOGY

PAPER-IV

(TAXONOMY, ECONOMIC ENTOMAL & PEST CONTROL)

UNIT- I

1. History of insect classification, Basis of Classification
2. Brief Concept of all insect orders.
3. Characters and classification up to principal families of following orders –
 - (a) Thysanura
 - (b) Collembolan
 - (c) Orthoptera
 - (d) Hemisphera
 - (e) Mallophaga
 - (f) Lepidoptera
 - (g) Dipteral
 - (h) Hymenoptera
 - (i) Coleopteran(Insect Classification as per Essig's college Entomology)

UNIT- II

Classification, Life-Cycle, Control measures, and Economic importance of the following-

- a) Important pests of paddy
- b) Important pests of sugarcane
- c) Importation pests of pulses in the field e.g. Gram, Pea, Archer
- d) Important pests of Vegetables – Bringer, Cabbage, Cauli flower, Lady-finger and Cucumber.

UNIT- III

- a. Classification, Life-Cycle, economic-importance and control measures of stored-Grain pests, namely–Sitophilus oryzae; Corcyra Cephalonia; Tregederma granaries; Tribolium castaneum; Callosobruchus chinensis, Sitona Ceratella.
- b. Life cycle, Bionomics, Damage potential and control measures of Aphids and its phases.
- c. Phases of the locust– Schistocerca gregaria; phase theory of locust.
- d. Social life in Insects
- e. Parasitism in Insects

UNIT- IV

Pest Control

- a) Physical and cultural control
- b) Chemical control
- c) Biological control
- d) integrated pest control



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M. Sc. (FINAL) SPECIAL GROUP ICHTHYOLOGY PAPER-III FISH BIOLOGY

UNIT-I

1. Classification– Evolutionary classification proposed by Berg & Romer
2. Agatha- Ostracoderms – Classification, & Affinities Cyclostomes – Classification General Organisation, Development & Affinities.
3. Holocephali & Dipnoi– General organisation, distribution and affinities
4. Teleostomi– Character's Crossopterygian, Latimeria calumnies, Actinopterygii, Telesis, Provisional classification of teleports.
5. Evolution and Phylogeny– Agatha, Gnathostomata, evolution of cartilaginous fishes & lungfishes

UNIT-II

1. Skin and scales– Structure and function, cosmoid scale Gadoid scale, Bony ridge scales, modification uses of scales, colouration, sources of colour, colour changes, significance.
2. Fins and Locomotion– Median fins, caudal fins, paired fins, origin of paired fins, locomotion.
3. Migration– Migration, Advantages of migration, factors influencing migration
4. Food & Alimentary canals– Food of fishes, feeding habits, modification of alimentary canal, taste buds & mucus secreting cells.
5. Respiration– Accessory respiratory organs and air bladder
6. Excretion and osmoregulation– Structure of kidney Histology, Osmoregulation in fresh water fishes in marine fishes, in diadromous fishes control of osmoregulation

UNIT- III

1. Blood vascular system - Structure of heart, working of heart, heart in teleports, Arterial system, venous system
2. Reproduction and development Endocrine glands
3. Nervous system
4. Sense organs

UNIT- IV

1. Weberian ossicles- Structure, Functions & Homologies
2. Electric organs- Structure in different fishes and their function
3. Deep sea fishes- Physical character's fish fauna of deep sea, adaptive modifications
4. Hill stream fishes- Origin, modifications
5. Parental care in fishes



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M. Sc. (FINAL)
SPECIAL GROUP: ICHTHYOLOGY
PAPER- IV
(INDIAN FISHERIES)

UNIT-I

1. Introduction
2. Colouration in Fishes - Physical colour's Chemical colour's mixed colour's factor's (Temperature, stimulation, light) Adaptive significance.
3. Common diseases of Fishes and their care - Skin Para sites and diseases, Diseases of gills, Diseases caused by Bacteria and Viruses.
4. Economic value of Fishes - Fish as human food, as food of cattle, fishmanure, fish glue and isinglass fish leather
5. Luminous organs

UNIT-II

1. Fresh water fishes of Chhattisgarh and their culture
2. Maintenance of nursery rearing and stocking ponds
3. marine fisheries - coastal fisheries, deep sea and off shore fisheries
4. Fishing methods in sea water - Crafts of east coast, crafts of west coast, other methods (Electrifishing, light fishing)
5. Revere and cold water fisheries

UNIT-III

1. Reservoir fisheries - Distribution of reservoir fisheries
2. Lustring fisheries - Lake types, principal lakes, fisheyes
3. Estuarine fisheries
4. Fish farming
5. Principal cultivable fishes

UNIT-IV

1. Larvivorius fishes
2. Exotic & Transplanted fishes
3. Plankton its role in fisheries and pollution of water
4. Preparation and maintenance of Aquarium
5. Induced Breeding



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**M. Sc. (FINAL)
SPECIAL GROUP
CYTOLOGY AND CYTOGENETICS
PAPER - III**

(CELL BIOLOGY AND GENERAL AND MICROBIAL GENETICS)

UNIT-I

Principal of cellular Organization and Function

1. History of cell biology - its history and present perspective with special reference to molecular biology
2. Cytoplasm vascular system including endoplasmic reticulum and Golgi complex
3. Ribosome structure biogenesis function and polyribosome's
4. Liposome structure and function
5. Liposome and diseases
6. Mitochondria and its function

UNIT-II

Cell cycle and cell nucleus

1. Cell cycle
2. Structure of Chromosomes, C-value paradox, detailed account of eukaryotic genome
3. DNA structure
4. Different kinds of RNA structure and function
5. Special types of chromosomes: Structure and function
6. Structure of protein: Protein Size, shape and determination of protein conformation

UNIT-III

Allelic and Non-allelic interactions of genes & cytogenetic

1. Mendel's Laws of inheritance and Interaction of genes
2. Cytogenetic implications and consequences of structural changes and numerical alteration of chromosomes
3. Human cytogenetic techniques in human chromosome analysis Human cerotype, Numerical and structural abnormalities of human chromosomes, Syndromes
4. Linkage maps

UNIT-IV

Microbial Genetics and extra nuclear inheritance

1. Bacterial Transformation, Transduction, Conjugation
2. Bacterial Chromosome
3. Bacteriophages: Type structure and morphology of T4 phage
4. Extra nuclear Inheritance
5. Nucleo-Cytoplasmic interaction



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PAPER-IV

**MOLECULAR-BIOLOGY, DEVELOPMENTAL BIOLOGY
& BIOINFORMATICS**

UNIT-I

Molecular Biology

1. Genetic code
2. DNA replication: Prokaryotic and eukaryotic DNA replication
3. Enzymes and accessory proteins involved in DNA replication
4. Molecular cytogenetic techniques: DNA finger printing. Flow cytometry
Karyotyping, Molecular markers in genome analysis RFLP.

UNIT-II

Protein synthesis and Genetic regulation

1. Transcription: Prokaryotic and eukaryotic transcription RNA polymerases and transcription factors
2. Translation: prokaryotic and eukaryotic translation
3. Genetic regulation of protein synthesis
4. DNA repair mechanisms
5. DNA recombination

UNIT-III

Development and Bioinformatics

1. Genes and Differentiation
2. Cell Diversification in early animal embryo
3. Bioinformatics: computer analysis of DNA sequence and its biological significance
4. Methods of protein structure prediction

UNIT-IV

Genetic Rearrangements and Genetic engineering

1. Transpose able elements
2. Genetic engineering and genome analysis
3. DNA technology
4. Genes in evolution



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M. SC. (FINAL)
SPECIAL PAPER - PARASITOLOGY
PAPER-III
(GENERAL PARASITOLOGY)

UNIT-I

Bionomics-

Variety in host parasite relationship micro and macro environment of parasites
Aetiology and gynaecology of parasitic helminths Host specificity (Definition and kind of host specificity)

UNIT-II

Path physiology and Immunoparasitology

1. Immunopathology parasitic infection: Immunological control of vector borne and nonfactor borne disease, with reference to Ichthyophthiriasis. Trypanosomiasis, Gundiasis Theitevirosis and coecidiasis
2. Immunodiagnostic and Immunoprophylaxis- diffusion Fluorescent antibody techniques. Serological diagnosis, Diagnostic techniques (Carpological, Urine and blood)

UNIT-III

Protozoology-

Introduction, Classification: host parasitic relationship, pathogenic mechanisms, transmission and life cycle of parasitic Protozoa's - Ichthyophtheria, Giardia, Theileria, Toxoplasma, Cryptosporidium, Leishmania, Trichomonas & Trypanosome.

UNIT-IV

Medical and veterinary Entomology

1. Epidemiology and zootoxic significance of parasitic Arthropods e.g. Ticks, Ixodes, Mites, sarcoptes, demodex, Fleas (Hypodema, Tabanus); Lice (Pulex, Cims) and these
2. Parasitic Toxicities in Arthropods
3. Mechanism at diseases transmission with particular reference to vectors and diseases in India, Vector control Measure.



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M. Sc. (FINAL) PARASITOLOGY PAPER-IV (SYSTEMATICS AND APPLIED PARASITOLOGY)

UNIT-I

General systematic as (a) Platyhelminthes (b) Aschelminthes Evolution of Parasitism in various groups of Helianthus

UNIT-II

Epidemiology, Life cycle, Pathogen city and control of parasitic helianthus e.g.

1. Custodies and Trematodes: Schistocephalus solidus; Ligula intestinal is; Protecephalus, Duthiersia; Hymenolepis; Clonorchis sinensis; Polystomum integrinum.
2. Nematodes: Ancylostoma duodenal; Haemonchus contorts. Trichinella spiralis. Dicrocoelium dendriticum Role of plant Parasitic Nematodes in Agriculture.

UNIT-III

1. Adhesive organs in Parasitic helminths and their significance is systematic
2. Significance of excretory organs in classification of parasites helminths
3. Biology of eggs at parasitic helminths, penetration and growth in definitive hosts, Biology of Hydatid organs.
4. Larval stages of Parasitic helminths, Biology and kind of larvae
5. Role of intermediate hosts in spread of helminthic infections

UNIT-IV

1. Parasitic infection in immune - Compromised host and AIDS patients
2. Laboratory techniques in parasitological - Examination of faeces for ova and cysts; Worm - burden assessment concentration methods; Flootation and sedimentation techniques, stain by cron hactoxyline method Blood, Smear examination, Cultivation of protozoan parasites.