

M. Sc. Semester -I

Zoology

Paper-I (B050701T)

Structure and Functions in Invertebrate

1. Organization of Coelom
 - 1.1 Acoelomates
 - 1.2 Pseudocoelomates
 - 1.3 Coelomates: Protostomia and deuterostomia
2. Locomotion
 - 2.1 Flagellar and ciliary movement in Protozoa
3. Nutrition and Digestion
 - 3.1 Patterns of feeding and digestion in lower metazoan
 - 3.2 Filter feeding in Polychaeta, Mollusca and Echinodermata
4. Respiration
 - 4.1 Organs of respiration: Gills, Book, lungs and trachea
 - 4.2 Respiratory pigments
 - 4.3 Mechanism of respiration and Arthropoda
5. Excretion:
 - 5.1 Organs of excretion:
 - 5.1.1 Coelomoducts
 - 5.1.2 Nephridia
 - 5.1.3 Malpighian tubules
 - 5.2 Mechanism of excretion in Annelida and Arthropoda
 - 5.3 Excretion and osmoregulation
6. Nervous system
 - 6.1 Primitive nervous system: Coelenterata & Echinodermata
 - 6.2 Advanced nervous system: Annelida, Arthropoda (Crustacea and Insecta) and Mollusca (cephalopoda)
7. Invertebrate larvae
 - 7.1 Larval forms of free living crustaceans.
 - 7.2 Larval forms of parasitic invertebrates (Trematoda, Cestoda, Neuratoda)

M. Sc. Semester -I
Zoology
Paper-II (B050702T)
Molecular Cell Biology

1. Biomembrances

1.1 Molecular Composition

1.2 Transport across cell membrane: Diffusion, Active transport, uniports, symports and antiports

1.3 Membrane potential

1.4 Phagocytosis and pinocytosis

2. Cytoskeleton

2.1 Microfilaments, intermediate filaments and microtubules structure and dynamics.

2.2 Microtubules and Mitotic apparatus

2.3 Cell movements - intracellular transport, role of kinesin and dynein

3. Cilia and Flagella

4. Cell-Cell signalling

4.1 Cell surface receptor

4.2 Second messenger system

4.3 Signalling from plasma-membrane to nucleus

5. Cell Cycle

5.1 Cyclins and cyclin dependent kinases

5.2 Regulation of cdk cyclin activity

6. Intracellular protein traffic

6.1 Protein synthesis on free and bound polysomes

6.2 Uptake into ER

6.3 Membrane, Protein, Golgi, Sorting post-translational modification

7. Apoptosis

Definition, mechanism and significance.

M. Sc. Semester -I
Zoology
Paper-III (B050703T)
Toxicology

1. Environmental Toxicology

1.1 Introduction

1.2 Classification of Environmental Toxicants

1.3 Heavy metals (Mercury, Lead, Cadmium, Arsenic, Chromium, Copper and Zinc)

1.4 Pesticides - Classification

2. Translocation of Toxicants

2.1 Membrane Barrier

2.2 Absorption of Toxicants

2.3 Site of Absorption

2.4 Distribution of Toxicants: Storage depots

2.5 Biotransformation of Toxicants

3. Xenobiotics

3.1 Process of Accumulation

3.2 Process of elimination

4. Toxicity Tests

4.1 Acute, sub acute & chronic toxicity tests

4.2 Explanation of lethal doses (LD50 and LC50)

4.3 Dose-response curve

5. Specific Toxicity Tests

5.1 Eye

5.2 Skin

5.3 Teratogenic

6. Antidotal Procedure.

M. Sc. Semester -I
Zoology
Paper-IV (B050704T)
Biostatistics, Tools, and Techniques in Biology

1. Measure of central tendency (Mean, Median, and Mode)
2. Measure of dispersion (SD, SEM)
3. Chi square Test
4. Theory of Probability : Additional Theorem, Multiplication
5. Principle of Microscopy
 - 5.1 Light Microscope
 - 5.2 Phase Contrast Microscope
 - 5.3 Fluorescent Microscope
 - 5.4 Scanning electron Microscope
 - 5.5 Transmission electron Microscope
6. Polymerase Chain reaction (PCR) and its application
7. Principle and Procedure of cryopreservation technique
8. Principle of Chromatography, Paper Chromatography, Thin layer Chromatography (TLC), Ion exchange Chromatography, Affinity Chromatography, Column Chromatography
9. Electrophoresis ; Principle of Electrophoresis, Agarose gel and Polyacrylamide gel Electrophoresis
10. Centrifugation ; Basic Principle of Centrifugation, type of Centrifugation high speed Centrifugation, Ultracentrifugation (Preparative UC, and Analytical UC)

M. Sc. Semester -II
Zoology
Paper-I (B050801T)
Molecular Biology

1. DNA Replication

- 1.1 Prokaryotic and Eukaryotic DNA replication
- 1.2 Enzymes and accessory proteins involved in DNA replication

2. Transcription

- 2.1 Prokaryotic: RNA polymerase, Initiation, Elongation, and Termination
- 2.2 Eukaryotic: RNA polymerase, promoter, enhancer element, initiation of termination, RNA Polymerases I, II, III
- 2.4 Transcriptional and post - transcriptional gene silencing

3. Post transcriptional Modification in RNA

- 3.1 5' - capping
- 3.2 3' - end generation and polyadenylation
- 3.3 Splicing, Editing
- 3.4 Nuclear Export of mRNA
- 3.5 mRNA Stability

4. Recombination and Repair

- 5.1 Hybrid DNA models involving single stranded breaks (Holiday model)
- 5.2 Hybrid DNA models involving double stranded breaks
- 5.3 Mismatch repair and post meiotic segregation in Heteroduplex region
- 5.4 Enzymes and proteins involved in recombination
- 5.5 DNA repair mechanism

M. Sc. Semester -II
Zoology
Paper-II (B050802T)
General Endocrinology

1. Hormones

- 1.1 Chemistry, biosynthesis, transport and clearances
- 1.2 Feedback mechanism of hormone secretion
- 1.3 Hormone assay (ELISA and RIA)
- 1.4 Mechanism of hormone action

2. Hypothalamus-hypophysial Axis:

- 2.1 General organization
- 2.2 Neurohypophysis: octapeptide hormones
- 2.3 Adenohypophysis: Tropic hormone-chemistry, regulation of their secretion and physiology

3. Thyroid gland:

- 3.1 Biosynthesis of thyroid hormones
- 3.2 Regulation of their secretions
- 3.3 Physiological roles of T₄ & T₃ and their disorders

4. Adrenal gland

- 4.1 Cortical & medullary hormones
- 4.2 Regulation of secretions
- 4.3 Physiological roles & disorders

5. Pancreas

- 5.1 General organization
- 5.2 Hormones - Insulin, glucagon and somatostatin
- 5.3 Regulation of their secretion
- 5.4 Physiological roles and disorders

6. Parathyroid gland

- 6.1 Parathyroid hormones, calcitonin and vitamin D
- 6.2 Role in calcium and phosphate metabolism

7. Gonads

- 7.1 Cellular sites and chemistry of sex steroids
- 7.2 Biological action

M. Sc. Semester -II
Zoology
Paper-III (B050803T)
Physiology of Vertebrates

1. Respiration

- 1.1 Respiratory Mechanism
- 1.2 Regulation of respiration

2. Digestion and absorption of protein, carbohydrate and fat

3. Excretion

- 3.1 pattern of nitrogen excretion among different animal groups
- 3.2 Urea Cycle
- 3.3 Urine formation and its regulation
- 3.4 Counter current mechanism
- 3.5 Renal regulation of acid-base balance

4. Circulation

- 4.1 Pace maker and conducting system.
- 4.2 ECG
- 4.3 Hemodynamic: Haematocrit value, inter relationship among blood pressure, blood flow, and resistance to blood flow.

5. Contractile element

- 5.1 types of Muscle
- 5.2 ultra structure of skeletal muscle
- 5.3 molecular organization of myofilament
- 5.4 mechanism of contraction of skeletal muscle
- 5.5 Energetic of contraction

6. Nervous coordination

- 6.1 types of neurons
- 6.2 mechanism of conduction of impulse
 - 6.2.1 resting membrane potential
 - 6.2.2 action potential
- 6.3 structure of synapse
 - 6.3.1 types of synapse
 - 6.3.2 electrical transmission at synapse
 - 6.3.3 chemical transmission
 - 6.3.4 Neurotransmitters

7. Homeostasis

M. Sc. Semester -II
Zoology
Paper-IV (B050804T)
Biochemistry

1. Chemical foundation of biology

1.1 pH, pK, buffers

1.2 Gibbs Donnan Equilibrium and its biological significance.

2. Carbohydrate- classification, structure and clinical significance.

3. Protein

3.1 Primary, secondary, tertiary and quaternary structure.

3.2 Protein folding and denaturation

3.3 Conjugated protein- Structure and function

4. Lipids

4.1 Chemical structure

4.2 Classification

4.3 Biological Significance

4.4 Oxidation

5. Elementary Thermodynamics

5.1 free Energy

5.2 Enthalpy and entropy

5.3 Application of enthalpy and entropy changes in living organism

6. Enzymes

6.1 Structure and mechanism of action

6.2 Temperature coefficient and activation energy

6.3 Enzyme kinetics

6.4 Enzyme specificity

6.5 Enzyme inhibition

M. Sc. Semester -III
Zoology
Paper-I (B050901T)
Comparative anatomy of Vertebrates

1. Chordate

- 1.1 General character of phylum chordate and their classes.
- 1.2 Classification up to orders (except bird)
- 1.3 Affinities of protochordata.

2. Comparative anatomy of integuments & its derivatives;

- 2.1 General structure of skin,
- 2.2 Structure of glands, scales, feathers & hairs.

3. Comparative anatomy of

- 3.1 heart
- 3.2 Aortic arches
- 3.3 Portal systems (only in amphibian)-
 - 3.3.1 Hepatic portal system,
 - 3.3.2 Renal portal system.

4. Structural organization of respiratory organs;

- 4.1 Gills,
- 4.2 Lungs,
- 4.3 Air sacs

5. Comparative anatomy of Kidney in vertebrates.

6. Comparative anatomy of brain in amphibian & mammal.

7. Jaw suspensorium.

M. Sc. Semester -III
Zoology
Paper-II (B050902T)
Molecular Cytogenetic

1. Biology of Chromosomes

- 1.1 Molecular anatomy of eukaryotic chromosomes
- 1.2 Metaphase Chromosome: Centromere, Kinetochore, Telomere
- 1.3 Heterochromatin and Euchromatin
- 1.4 Giant Chromosomes: Polytene and Lampbrush chromosomes.

2. Sex Chromosomes in Drosophila and Humans

3. Human Cytogenetic

- 3.1 Karyotype & nomenclature of metaphase chromosome band
- 3.2 Chromosome anomalies and disease
- 3.3 Types of Chromosome anomalies
- 3.4 Common Syndrome caused by aneuploidy, Mosaicism, deletion and duplication
- 3.5 Fragile site and X-linked mental retardation
- 3.6 Chromosomal abnormalities and malignancy
- 3.7 Gene Mapping in human: physical mapping by linkage analysis.

**4. Microbial Genetics: Bacterial transformation, transduction, conjugation & sex
duction.**

5. Genome Analysis:

- 5.1 C-value paradox, various models of prokaryotic genomes, viral genomes, and eukaryotic genomes.
Organization of genes in organelle genomes
- 5.2 Transposable elements in prokaryotes. Roles of transposable elements in genetic regulation.
- 5.3 Genome analysis –Human

(POPULATION GENETICS, EVOLUTION & ANIMAL BEHAVIOUR)

1. Neo - Darwinism
 - 1.1. Hardy Weinberg law of genetic equilibrium
 - 1.2. A detailed account of destabilizing forces
 1. Natural selection
 2. Mutation
 3. Genetic drift
 4. Migration
 5. Meiotic drive
2. Qualifying genetic variability
 - a. Genetic structure of natural populations
 - b. Phenotypic variation
3. Molecular population genetics
 - a. Patterns of change in nucleotide and amino acid sequences.
 - b. Emergence of non- Darwinism - neutral hypothesis.
4. Genetics of speciation
 - a. Phylogenetic and biological concept of species.
 - b. Mechanism of reproductive isolation .
 - c. Models of specification (allopatric , sympatric , parapatric)
5. Origin of higher categories.
 - a. Phylogenetic gradualism & punctuated equilibrium.
 - b. Micro & macro evolution.
6. Innate behavior.
7. Introduction to internal control of behavior.
 - a. Sign stimuli
 - b. Neural & hormonal control
 - c. Genetic control
8. Biological rhythms
 - a. Circadian and circannual rhythms.
 - b. Orientation and navigation.

M. Sc. - Part - II

Semester – III

ZOOLOGY

**(PAPER – IV)
(B050904T)**

(BIOLOGY OF VERTEBRATE IMMUNE SYSTEM)

- 1. Innate and acquires immunity**
- 2. Cells and organs of immune system.**
 - a. t- lymphocytes , b- lymphocytes, natural killer cells, mononuclear phagocytes.
 - b. Primary and secondary lymphoid organs.
- 3. Antigen and antibodies**
 - a. Structure and functions of antibody
 - b. Antigen antibody reaction.
 - c. Classes and subclasses of antibody.
 - d. Monoclonal antibodies.
- 4. Major histocompatibility complex (MHC)**
 - a. MHC Haplolytes
 - b. Class I AND CLASS II
 - c. Cellular distribution
 - d. Disease susceptibility
 - e. Disease susceptibility
- 5. Cytokines**
 - a. Structure and function
 - b. Cytokine receptors
- 6. Complement system**
 - a. The function of complement
 - b. The complement components
 - c. Complement deficiencies
- 7. Immunization**
 - a. Active and passive immunization
 - b. Whole- organism vaccine
 - c. DNA vaccine
 - d. Recombinant vaccine

Microbiology

1. Morphology and Ultrastructure of bacteria, morphological types, Cell wall of archaea-bacteria, gram-negative, gram-positive, eubacteria, L-forms, antigenic properties.

2. Classification and properties of pathogenic bacteria –

2.1. Vibrio

2.2. Salmonella

2.3. Mycobacteria

3. General properties of viruses-

3.1. Virus-host interaction

3.2. Pox viruses

3.3. Herpes viruses

3.4. Adeno viruses

3.5. Hepatitis viruses

3.6 Human immuno deficiency viruses

4. Laboratory control of antibacterial therapy. Methods of drug susceptibility testing.

5. Cell culture of microorganisms –

5.1 Culture media

5.2. Sterilization, aseptic technique

5.3. Methods of streaking

5.4. Viable count procedure

6. DNA sequencing methods, Dideoxy and Chemical methods

7. Industrial products derived from microbes, Industrial enzymes – Amylase, Proteinase, Amino acids production, Glutamic acid and lysine.

Production of antibiotics – Penicillin and Streptomycin.

8. Food borne infection and intoxications of Brucella, Clostridium, Shigella, Bacillus. |

M. Sc. Semester -IV
Zoology
Paper-II (B0501002T)
Gamete Biology

- 1. Testis;**
 - 1.1 Spermatogenesis-
 - 1.1.1 Formation of spermatids.
 - 1.1.2 Spermatogenesis.
 - 1.2 Structure of sperm,
 - 1.3 Formation & regulation of Leydig cells,
 - 1.4 Semen composition
 - 1.5 Y-specific probes.
- 2. Ovary;**
 - 2.1 Ovarian follicular growth & its differentiation,
 - 2.2 Oogenesis & their endocrine control,
 - 2.3 Ovulation & ovum transport in mammal.
- 3. In vitro fertilization technique;**
 - 3.1 Process of IVF & ET technology in human.
 - 3.2 Application of ET technology;
 - 3.2.1 GIFT,
 - 3.2.2 Test tube baby.
 - 3.2.3 Embryonic stem cell transfer,
 - 3.2.4 Totipotency.
- 4. Teratogenesis.**
- 5. Pregnancy and lactation;**
 - 5.1 hormonal factor in pregnancy,
 - 5.2 Role of prolactin & oxytocin in lactation.
- 6. Contraception technology**
 - 6.1 Gamete specific antigen,
 - 6.2 Surgical method,
 - 6.3 Hormonal method &
 - 6.4 Physical method.

M. Sc. Semester -IV
Zoology
Special Paper-I (B0501003T)
Functional Morphology of Teleost fishes

1. Digestive system

- 1.1 Alimentary canal & its modification
- 1.2 Physiology of digestion

2. Respiratory System

- 2.1 Structure of gill
- 2.2 Mechanism of respiration
- 2.3 Transport of respiratory gases (O₂ & CO₂)
- 2.4 Accessory respiratory organs in fishes

3. Excretion & Osmoregulation

- 3.1 Structure of kidney
- 3.2 Excretion of nitrogenous wastes
- 3.3 Hydro mineral balance

4. Swim bladder

- 4.1 General organization & circulation
- 4.2 Gas secretion
- 4.3 Functions of swim bladder

5. Sensory receptors

- 5.1 membranous labyrinth
- 5.2 lateral line organs

6. Overview of endocrine glands in fishes: gonadal hormones and their role in reproduction.

M. Sc. Semester -IV
Zoology
Special Paper-II (B0501004T)
Fishery Biology and Ecology

Fishery Biology

1. Outline Survey of principal fisheries of India

- 1.1 fresh water riverine fishery
- 1.2 Estuarine fishery
- 1.3 Marine fishery

2. Spawning:

- 1.1 Natural spawn & their collection
- 1.2 Artificial spawning
- 1.3 Hatcheries: Formulation & operation

3. Management & fertilization of fishery ponds

- 3.1 Different types of ponds.
- 3.2 Physical & chemical condition of water & soil.
- 3.3 Pond biota & their control
- 3.4 Eradication of weeds & predatory fishes.
- 3.5 Pond stocking
- 3.6 Composite fish culture.

4. Induced breeding

5. Larvivorous fishes & public health.

6. Outline survey of fish diseases & their control.

Fish Ecology

7. Adaptation of fishes to different modes of life with special reference to

- 7.1 Deep sea fishes
- 7.2 Hill stream fishes

8. Plankton in relation to fish production

9. Pollution of fishery water

10. Interrelationship between fishes & their biotic & abiotic environments.

10.1 Biotic factors

- 10.1.1 Intraspecific inter-relationship among fishes
- 10.1.2 Interspecific inter-relationship among fishes

10.2 Abiotic factors

Density, pressure, salinity, temperature, pH, salt content in water, oxygen & other gases in water.