

B.S.C. I Zoology Hons. ✓ ①

# ZOOLOGY HONS. THEORY Syllabus

## PAPER - I [honours]

Time (3) three Hours: Full Marks 75

In all ten questions are to be set, out of which number 1 and 2 shall consist of objective (1 x 15 marks) and Short answer (3 x 5 marks), requiring questions respectively and both shall span over the whole syllabus. Four questions are to be set from each group. The students would be required to answer five questions of which questions numbered 1 and 2 shall be compulsory. The students shall answer not more than two questions from any group.

### Group - A

#### DIVERSITY AND EVOLUTION OF NON-CHORDATA PROTISTA TO PSEUDOCOELOMATES

##### Kingdom Protista

General characteristics and classification up to classes; Life cycle, pathogenicity and prophylaxis of *Plasmodium vivax*, *Trypanosoma gambiense* and *Entamoeba histolytica*; Locomotion and Reproduction in Protista

##### Phylum Porifera

General characteristics and classification up to classes; Canal system in sponges

##### Phylum Cnidaria

General characteristics and classification up to classes; Metagenesis in *Obelia*; Polymorphism in Cnidaria; Corals and coral reefs

##### Phylum Ctenophora

General characteristics and evolutionary significance ✓

##### Phylum Platyhelminthes

General characteristics and classification up to classes; Life cycle, pathogenicity and prophylaxis of *Schistosoma haematobium* and *Taenia solium* Parasitic adaptations

##### Phylum Nematelminthes

General characteristics and classification up to classes; Life cycle, pathogenicity and prophylaxis of *Ascaris lumbricoides* and *Wuchereria bancrofti* Parasitic adaptations

### Group - B

#### COELOMATE NON-CHORDATA

##### Phylum Annelida

General characteristics and classification up to classes; Evolution of Coelom, Metamerism; Excretion in Annelida

##### Phylum Arthropoda

General characteristics and classification up to classes; Vision in Arthropoda; Respiration in Arthropoda; Moulting in insects, Metamorphosis in Insects; Social life in insects (bees and termites)

##### Phylum Onychophora

General characteristics and evolutionary significance

##### Phylum Mollusca

General characteristics and classification up to classes; Respiration in Mollusca; Torsion and detorsion in Gastropoda; Pearl formation in bivalves; Evolutionary significance of trochophore larva

##### Phylum Echinodermata

General characteristics and classification up to classes; Water-vascular system in Asterozoa; Larval forms in Echinodermata; Evolutionary significance (Affinities with Chordates)

Note: Classification to be followed from "Barnes, R.D. (1982). *Invertebrate Zoology*, V Edition"  
Holt Saunders International Edition"

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**PAPER II [honours]**

Time (3) three Hours: Full Marks 75

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**Group – A****PERSPECTIVES IN ECOLOGY****Introduction to Ecology**

Relevance of studying ecology, History of ecology, Autecology and synecology, levels of organization, Laws of limiting factors, detailed study of temperature and light as physical factors.

**Population**

Unitary and Modular populations, Unique and group attributes of population: Density, natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal and dispersion; Exponential and logistic growth, equation and patterns, r and K strategies, Population regulation - density-dependent and independent factors; Population interactions, Gause's Principle with laboratory and field examples, Lotka-Volterra equation for competition and Predation, functional and numerical responses

**Community**

Community characteristics: Dominance, diversity, species richness, abundance, stratification; Ecotone and edge effect; Ecosystem development (succession) with example; Theories pertaining to climax community

**Ecosystem**

Types of ecosystem with one example in detail, Food chain, Detritus and grazing food chains, Linear and Y-shaped food chains, Food web, Energy flow through the ecosystem, Ecological pyramids and Ecological efficiencies. Nutrient and biogeochemical cycle with one example of Nitrogen cycle

**Biodiversity Conservation**

Types of biodiversity, its significance, loss of biodiversity, Conservation strategies, Application of ecology in wild life conservation

**Group – B****PHYSIOLOGY : LIFE SUSTAINING SYSTEMS****Digestive System**

Structural organization, histology and functions of gastrointestinal tract and its associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Role of gastrointestinal hormones on the secretion and control of enzymes of Gastrointestinal tract

**Respiratory System**

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen in the blood oxygen- hemoglobin and myoglobin, dissociation curve and the factors influencing it; Carbon monoxide poisoning; Carbon dioxide transport in the blood; buffering action of blood and haemoglobin Control of respiration

**Excretory System**

Structure of kidney and its histological details, Renal blood supply; Mechanism formation and its regulation, Regulation of acid-base balance

**Blood**

Components of blood and their functions; Structure and functions of haemoglobin; Haemopoiesis; Haemostasis and Coagulation of blood; Disorders of blood

**Heart**

An outline structure of heart; Coronary circulation; structure of conducting and working myocardial fibers. Origin and conduction of cardiac impulses functions of AV node; Cardiac cycle; Cardiac output and its regulation-Frank-Starling Law of the heart, nervous and chemical regulation of heart rate; Blood pressure and its regulation; Electrocardiogram

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**Group – A**

# DIVERSITY AND DISTRIBUTION OF CHORDATA

General characters of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata

Dipleurula concept and the Echinoderm theory of origin of chordates  
Introduction to Vertebrate

### Advanced features of vertebrates over Protochordata

### General characters and classification of cyclostomes up to class Pisces

General characters of Chondrichthyes and Osteichthyes and classification up to order; Migration, Osmoregulation and Parental care in fishes

Origin of *Tetrapoda* (Evolution of terrestrial ectotherms); General characters and classification up to order; Parental care in Amphibians

General characters and classification up to order; Affinities of *Sphenodon*; Poison apparatus and Biting mechanism in snakes

General characters and classification up to order; Principles and aerodynamics of flight, Flight adaptations; *Archaeopteryx*-- a connecting link; Migration in birds

General characters and classification up to order; Affinities of Prototheria; Adaptive radiation with reference to locomotory appendages

Zoogeographical realms, Theories pertaining to distribution of animals, Plate tectonic and Continental drift theory, Distribution of vertebrates in different realms

## EVOLUTIONARY BIOLOGY

Historical Overview, Chemogeny, Biogeny, RNA World, Major Events in History of Life  
Introduction to Evolutionary Theories

Lamarckism, Darwinism, Neo-Darwinism

Fossils as direct evidences, Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse as an example, Molecular evidences (Globin gene families as an example), Molecular clock concept

Organic variations; Isolating Mechanisms; Natural selection (Examples; Industrial melanism, Pesticide/Antibiotic resistance); Types of natural selection (Directional, Stabilizing, Disruptive), Sexual Selection, Artificial selection

Organic variations; Isolating Mechanisms; Natural selection (Examples; Industrial melanism, Pesticide/Antibiotic resistance); Types of natural selection (Directional, Stabilizing, Disruptive), Sexual Selection, Artificial selection

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**Principles of population genetics**

Concept of gene pool, Gene frequencies – equilibrium frequency (Hardy-Weinberg equilibrium), Shift in gene frequency without selection – Genetic drift, Mutation pressures and Gene flow Shifts in gene frequencies with selection

**Species Concept**

Biological species concept (Advantages and Limitations); Sibling species, Polymorphic species, Polytypic species, Ring species; Modes of speciation (Allopatric, Sympatric)

**Evolution above species level**

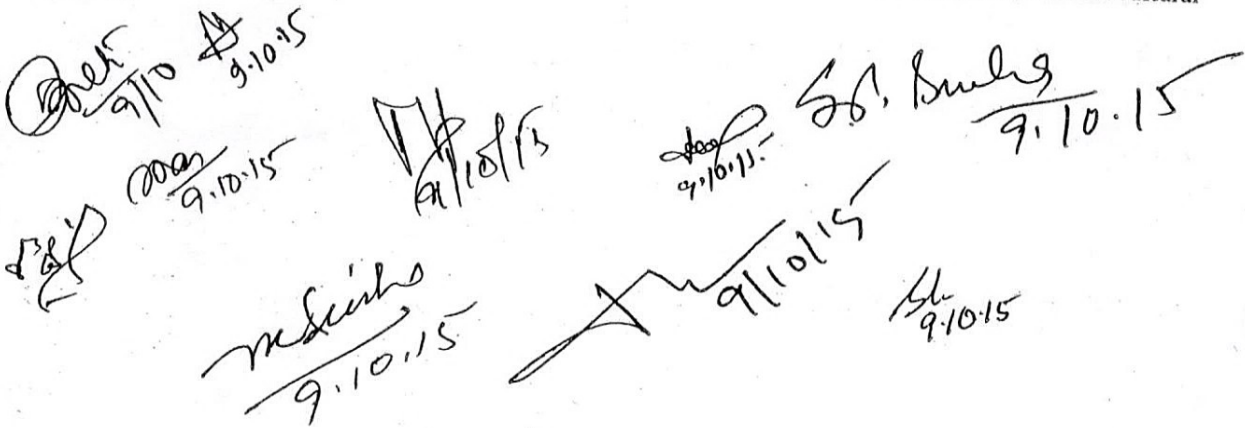
Macro-evolutionary Principles (example: Darwin's Finches); Convergence, Divergence, Parallelism

**Extinction**

Background extinction, Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

**Origin and Evolution of Man**

Paleontological evidences (from *Dryopithecus* to *Homo sapiens*); Note on molecular evidences; Note on cultural evolution


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- Center: A signature with "9/10/15" below it.
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**PAPER IV [honours]**

Time (3) three Hours: Full Marks 75

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**Group - A**

**PHYSIOLOGY - CONTROLLING AND COORDINATING SYSTEM**

**Tissues and Glands**

Structure, location, function and classification of Epithelial tissue, Connective tissue Muscular tissue, Nervous tissue and glands

**Bone and cartilage**

Structure and types of bones and cartilages, Ossification, bone growth, resorption

**Nervous System**

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; types of synapsis, Synaptic transmission and, Neuromuscular junction; Reflex action and its types -reflex arc; Physiology of hearing and vision

**Muscle**

Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor Unit, summation and tetanus

**Reproductive System**

Histology of male and female reproductive systems, Puberty, Physiology of male and female reproduction; Methods of contraception (depicted through flow chart)

**Endocrine System**

Functional Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenals; hormones secreted by them and their mechanism of action, Classification of hormones; Regulation of their secretion; Mode of hormone action; Signal transduction pathways utilized by steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system, Placental hormones.

**Group - B**

**COMPARATIVE ANATOMY OF VERTEBRATES**

**Integumentary System**

Structure, functions and derivatives of integument

**Skeletal System**

Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches

**Digestive System**

Alimentary canal and associated glands

**Respiratory System**

Skin, gills, lungs and air sacs; Accessory respiratory organs

**Circulatory System**

General plan of circulation, evolution of heart and aortic arches

**Urinogenital System**

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

**Nervous System**

Comparative account of brain; Autonomic nervous system, Spinal cord, Cranial nerves in mammals

**Sense Organs**

Classification of receptors: Brief account of visual receptors, chemo-receptors and mechanoreceptors

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**PAPER IV [honours]**

Time (3) three Hours: Full Marks 75

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**Group - A**

**PHYSIOLOGY - CONTROLLING AND COORDINATING SYSTEM**

**Tissues and Glands**

Structure, location, function and classification of Epithelial tissue, Connective tissue Muscular tissue, Nervous tissue and glands

**Bone and cartilage**

Structure and types of bones and cartilages, Ossification, bone growth, resorption

**Nervous System**

Structure of neuron, resting membrane potential, Origin of action potential and its propagation across the myelinated and unmyelinated nerve fibers; types of synapsis, Synaptic transmission and, Neuromuscular junction; Reflex action and its types -reflex arc; Physiology of hearing and vision

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Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor Unit, summation and tetanus

**Reproductive System**

Histology of male and female reproductive systems, Puberty, Physiology of male and female reproduction; Methods of contraception (depicted through flow chart)

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Functional Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenals; hormones secreted by them and their mechanism of action, Classification of hormones; Regulation of their secretion; Mode of hormone action; Signal transduction pathways utilized by steroidal and non-steroidal hormones; Hypothalamus (neuroendocrine gland) - principal nuclei involved in neuroendocrine control of anterior pituitary and endocrine system, Placental hormones.

**Group - B**

**COMPARATIVE ANATOMY OF VERTEBRATES**

**Integumentary System**

Structure, functions and derivatives of integument

**Skeletal System**

Overview of axial and appendicular skeleton, Jaw suspensorium, Visceral arches

**Digestive System**

Alimentary canal and associated glands

**Respiratory System**

Skin, gills, lungs and air sacs; Accessory respiratory organs

**Circulatory System**

General plan of circulation, evolution of heart and aortic arches

**Urinogenital System**

Succession of kidney, Evolution of urinogenital ducts, Types of mammalian uteri

**Nervous System**

Comparative account of brain; Autonomic nervous system, Spinal cord, Cranial nerves in mammals

**Sense Organs**

Classification of receptors: Brief account of visual receptors, chemo-receptors and mechanoreceptors

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**Paper -V [honours]**

Time (3) three Hours: Full Marks 100

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**Group - A****BIOCHEMISTRY OF METABOLIC PROCESSES****Biomolecules**

Structures and properties of important mono-, di- and polysaccharides; fatty acids, triglycerides and steroids; and amino acids

**Carbohydrate Metabolism**

Glycolysis, Citric acid cycle, pentose phosphate pathway, Gluconeogenesis, Shuttle systems (Malate-aspartate shuttle, Glycerol 3-phosphate shuttle), Glycogenolysis, Glycogenesis

**Lipid Metabolism**

$\beta$ -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis and its regulation

**Protein Metabolism**

Catabolism of amino acids: Transamination, Deamination, Urea cycle; Fate of C-skeleton of Glucogenic and Ketogenic amino acids

**Intermediary metabolism**

Inter-relationship of carbohydrates, lipid and protein metabolism

**Enzymes**

Introduction, kinetics, mechanism of action, inhibition, allosteric enzymes

**Oxidative Phosphorylation**

Oxidative phosphorylation in mitochondria, Respiratory chain, ATP synthase, Inhibitors and Uncouplers

**Group - B****CELL BIOLOGY****Overview of Cells**

Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions

**Plasma Membrane**

various models of plasma membrane structure. Transport across membranes, Cell junctions: Occluding junctions (Tight junctions), Anchoring junctions (desmosomes), Communicating junctions (gap junctions) and Plasmodesmata

**Endomembrane System**

The Endoplasmic Reticulum, Golgi Apparatus, Mechanism of vesicular transport, Lysosomes, Polymorphism of lysosomes

**Mitochondria and Peroxisomes**

Structure of mitochondria, Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis, Semi- autonomous nature of mitochondria, endosymbiotic hypothesis, Peroxisomes

**Cytoskeleton**

Structure and functions of intermediate filament, microtubules and microfilaments

**Nucleus**

Ultra structure of nucleus, Nuclear Envelope - Structure of nuclear pore complex, Chromosomal DNA and its packaging, Structure and function of Nucleolus

**Cell Cycle**

Cell cycle, Regulation of cell cycle

**Cell Signaling**

Signaling molecules and their receptors

**Apoptosis**

Extrinsic (Death Receptor) Pathway and Intrinsic (Mitochondrial) Pathway

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PAPER -VI [honours]

Time (3) three Hours: Full Marks 100

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**PRINCIPLES OF GENETICS**

**Group - A**

**Mendelian Genetics and its Extension**

Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked inheritance

**Linkage, Crossing Over and Chromosomal Mapping**

Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization

**Mutation**

Gene mutations, Chromosomal mutations: Deletion, duplication, inversion, translocation, aneuploidy and polyploidy; Induced versus spontaneous mutations; Backward and forward mutations; Suppressor mutations; Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached X method, DNA repair mechanisms

**Sex Determination**

Chromosomal mechanisms of sex determination; Sex-linked, sex-influenced and sex-limited characters

**Extra-chromosomal Inheritance**

Criteria for extra-chromosomal inheritance, Antibiotic resistance in *Chlamydomonas* Mitochondrial mutations and Maternal effects

**Quantitative Genetics**

Polygenic inheritance and Transgressive variation

**Group - B**

**DEVELOPMENTAL BIOLOGY**

**Introduction**

History and basic concepts: Epigenesis, preformation, Mosaic and regulative development; Discovery of induction, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division, Reliability of development: Redundancy and negative feed-back

**Early Embryonic Development**

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization: Changes in gametes, monospermy and polyspermy; Planes and patterns of cleavage; Early development of frog and chick up to gastrulation; Fate maps; Embryonic induction and organizers

**Late Embryonic Development**

Fate of Germ Layers; Extra-embryonic membranes in birds; Implantation of embryo in humans, Placenta (Structure, types and functions of placenta)

**Post Embryonic Development**

Metamorphosis: Changes, hormonal regulations in amphibians; Regeneration: Modes of regeneration, epimorphosis, morphallaxis and compensatory regeneration (with one example each); Ageing: Concepts and models

**Implications of Developmental Biology**

Teratogenesis: Teratogenic agents and their effects on embryonic development; *In vitro* fertilization, Stem cell culture, Amniocentesis

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**PAPER VII [honours]**

Time (3) three Hours: Full Marks 100

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**GROUP- A****MOLECULAR BIOLOGY****Nucleic Acids**

Salient features of DNA double helix: Watson and Crick model of DNA, DNA denaturation and renaturation; DNA topology - linking number and DNA topo-isomerases, Cot curves, Structure of RNA, tRNA and DNA and RNA associated proteins

**DNA Replication**

DNA Replication in prokaryotes and eukaryotes, mechanism of DNA replication, Role of proteins and enzymes in replication, Licensing factors, Semi-conservative, bidirectional and semi-discontinuous replication, RNA priming, Replication of circular and linear *ds-DNA*, replication of telomeres

**Transcription**

RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors, regulation of transcription

**Translation**

Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes: Ribosome structure and assembly in prokaryotes, fidelity of protein synthesis, aminoacyl tRNA synthetases and charging of tRNA; Proteins involved in initiation, elongation and termination of polypeptide chain; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation

**Post Transcriptional Modifications and Processing of Eukaryotic RNA**

Structure of globin mRNA; Split genes: concept of introns and exons, splicing mechanism, alternative splicing, exon shuffling, and RNA editing

**Gene Regulation**

Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon and *trp* operon; Transcription regulation in eukaryotes: Activators, repressors, enhancers, silencers elements; Gene silencing, Genetic imprinting

**Regulatory RNAs**

Ribo-switches, RNA interference, miRNA, siRNA

**GROUP- B****IMMUNOLOGY****Overview of Immune System**

Historical perspective of Immunology, Early theories of Immunology, Haematopoiesis, Cells and organs of the Immune system

**Innate and Adaptive Immunity**

Anatomical barriers, Inflammation, Cell and molecules involved in innate immunity, Adaptive immunity (Cell mediated and humoral), Passive: Artificial and natural Immunity Active: Artificial and natural Immunity, Immune dysfunctions

**Antigens**

Antigenicity and immunogenicity, Immunogens, Adjuvants and haptens, Factors influencing immunogenicity, B and T-Cell epitopes

**Immunoglobulins**

Structure and functions of different classes of immunoglobulins, Antigen-antibody interactions, Immunoassays, Polyclonal sera, Monoclonal antibodies, Hybridoma technology

**Major Histocompatibility Complex**

Structure and functions of endogenous and exogenous pathway of antigen presentation

**Cytokines**

Properties and functions, Cytokine-based therapies

**Complement System**

Components and pathways of complement activation

**Hypersensitivity**

Gell and Coombs' classification and Brief description of various types of hypersensitivities

**Vaccines**

Types of vaccines: Recombinant vaccines and DNA vaccines

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**PRACTICAL [B.Sc.II] [Honours]**

**Time- 3 (Three) Hours: Full Marks – 50**

Practical will include: - 1. Spotting – 10, 2. Mounting – 5, 3. Practical record – 5, 4. field works – 5  
5. Two Experiments – 20, and 7. viva-voce – 5.

**DIVERSITY AND DISTRIBUTION OF CHORDATA**

**Protochordata**

*Balanoglossus*, *Herdmania*, *Branchiostoma*, Colonial Urochordata Sections of *Balanoglossus* through proboscis and branchiogenital regions Sections of *Amphioxus* through pharyngeal, intestinal and caudal regions  
Permanent slide of *Herdmania* spicules

**Agnatha**

*Petromyzon*

**Fishes**

*Sphyrna*, *Pristis*, *Torpedo*, *Chimaera*, *Notopterus*, *Mystus*, *Heteropneustes*, *Labeo*, *Exocoetus*, *Echeneis*,  
*Anguilla*, *Tetrodon*/ *Diodon*, *Anabas*, Flat fish

**Amphibia**

*Ichthyophis*/ *Ureotyphlus*, *Necturus*, *Bufo*, *Hyla*, *Alytes*, *Salamandra*

**Reptiles**

*Chelone*, *Trionyx*, *Hemidactylus*, *Varanus*, *Uromastix*, *Chamaeleon*, *Draco*, *Ophiosaurus*, *Bungarus*, *Vipera*,  
*Naja*, *Hydrophis*, *Zamenis*, *Crocodylus*

Key for Identification of poisonous and non-poisonous snakes

**Aves**

Study of six common birds from different orders Types of beaks and claws

**Mammalia**

*Sorex*, Bat (Insectivorous and Frugivorous), *Funambulus*, *Loris*, *Herpestes*, *Hemiechenis*

**EVOLUTION**

1. Study of fossil evidences from plaster cast models and pictures
2. Study of homology and analogy from suitable specimens/ pictures
3. Demonstration of changing allele frequencies with and without selection
4. Construction of cladogram based on morphological characteristics
5. Construction of phylogenetic tree with bioinformatics tools (Clustal X and Phylip)
6. Interpretation of phylogenetic trees

**CONTROLLING AND COORDINATING SYSTEM**

1. Demonstration of the unconditioned reflex action (Deep tendon reflex such as knee jerk reflex)
2. Preparation of temporary mounts: Squamous epithelium, Striated muscle fibres and nerve cells
3. Examination of sections of Mammalian skin, Cartilage, Bone, Spinal cord, Nerve cell,
4. Pituitary, Pancreas, Testis, Ovary, Adrenal, Thyroid and Parathyroid

**COMPARATIVE ANATOMY OF VERTEBRATES**

1. Study of placoid, cycloid and ctenoid scales through permanent slides/photographs
2. Disarticulated skeleton of Frog, *Varanus*, Fowl, Rabbit
3. Carapace and plastron of turtle /tortoise
4. Mammalian skulls: One herbivorous and one carnivorous animal

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## PRACTICALS [B.Sc. III] [Honours]

Time - 6 (Six) Hours: Full Marks - 100

Practical will include: - 1. Spotting - 20, 2. Mounting - 5, 3. Practical record - 5, 4. field works - 5  
5. Four Experiments - 60, and 7. viva-voce - 5.

### BIOCHEMISTRY

1. Identification of unknown carbohydrates in given solutions (Starch, Sucrose, Lactose, Galactose, Glucose, Fructose)
2. Colour tests of functional groups in protein solutions.
3. Action of salivary amylase under optimum conditions
4. Effect of pH on the action of salivary amylase
5. Effect of temperature on the action of salivary amylase
6. Estimation of total protein in given solutions by Lowry's method

### CELL BIOLOGY

1. Gram's staining technique for visualization of prokaryotic cells
2. Study various stages of mitosis from permanent slides
3. Study various stages of meiosis from permanent slides.
4. Study the presence of Barr body in human female blood cells/cheek cells. (Preparation of permanent slides)

### PRINCIPLES OF GENETICS

1. To study the Mendelian laws and gene interactions and their verification by Chi-square analyses using seeds/beads/*Drosophila*.
2. Identification of various mutants of *Drosophila*
3. To calculate allelic frequencies by Hardy-Weinberg Law
4. Linkage maps based on data from *Drosophila* crosses
5. Study of human karyotype (normal and abnormal).
6. Pedigree analysis of some human inherited traits.
7. Preparation of polytene chromosomes from *Chironomus/Drosophila* larva.
8. To study mutagenicity in *Salmonella/E. coli* by Ames test

### DEVELOPMENTAL BIOLOGY

1. Study of whole mounts and sections of developmental stages of frog through permanent slides: Cleavage stages, blastula, gastrula, neurula, tail-bud stage, tadpole (external and internal gill stages)
2. Study of whole mounts of developmental stages of chick through permanent slides: Primitive streak (13 and 18 hours), 21, 24, 28, 33, 36, 48, 72, and 96 hours of incubation (Hamilton and Hamburger stages)
3. Study of developmental stages (above mentioned) by raising chick embryo in the laboratory.
4. Study of the developmental stages and life cycle of *Drosophila* from stock culture
5. Study of different types of placenta
6. Project report on *Drosophila* culture/chick embryo development

### MOLECULAR BIOLOGY

1. Study of DNA replication using Photographs or slides and special cases e.g. Polyteny using permanent slides of polytene chromosomes
2. Preparation of liquid culture medium (LB) and raise culture of *E. coli*.
3. Estimation of the growth kinetics of *E. coli* by turbidity method.
4. Preparation of solid culture medium (LB) and growth of *E. coli* by spreading and streaking.
5. Demonstration of antibiotic sensitivity/resistance of *E. coli* to antibiotic pressure and interpretation of results.
6. Quantitative estimation of salmon sperm/calf thymus DNA using colorimeter (Diphenylamine reagent) or spectrophotometer (A260 measurement).
7. Quantitative estimation of RNA using Orcinol reaction.

### IMMUNOLOGY

1. Demonstration of lymphoid organs
2. Ouchterlony's double immuno-diffusion method
3. ABO blood group determination
4. Preparation of single cell suspension of splenocytes from chick spleen, cell counting and viability test
5. ELISA/ dot Elisa (using kit)
6. Principles, experimental set up and applications of immuno-electrophoresis, RIA, F

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