

SYLLABUS FOR LAB ASSISTANT (ZOOLOGY)

- UNIT I Protista, Parazoa and Metazoa**
 General characteristics and Classification up to classes
 Morphological study of *Euglena*, *Amoeba* and *Paramecium*
 Life cycle and pathogenicity of *Plasmodium vivax*
 Mode of locomotion and Reproduction in Protista
- UNIT II Porifera**
 General characteristics and Classification up to classes
 Reproduction and development in sponges: sycon, leucosolenia.
 Structural organization of sycon.
 Canal system and spicules in sponges
- UNIT III Cnidaria**
 General characteristics and Classification up to classes
 Metagenesis in *Obelia*
 Reproduction in Aurelia
 Polymorphism in Cnidaria
 Corals and coral reefs
- UNIT IV Ctenophora and Platyhelminthes**
 General characteristics and Evolutionary significance of Ctenophora
 General characteristics and Classification up to classes of Platyhelminthes
 Life cycle and pathogenicity of *Fasciola hepatica*
- UNIT V Nemathelminthes**
 General characteristics and Classification up to classes
 Life cycle, and pathogenicity of *Ascaris lumbricoides* and *Ancylostomaduodenali*
 Parasitic adaptations in helminthes

PRINCIPLES OF ECOLOGY

- UNIT I Introduction to Ecology**
 Concept of Species; sympatric and Allopatric
 Law of limiting factors: Liebig's law of minimum and Shelford's law of tolerance.
 History of ecology, Autecology and synecology, Levels of organization, Laws of limiting factors, Study of physical factors
- UNIT II 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

UNIT III Community
Community characteristics: species richness, dominance, diversity, abundance, vertical stratification, Ecotone and edge effect; Ecological –Aquatic and terrestrial. Theories pertaining to climax community

UNIT IV Ecosystem
Types of ecosystems 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 Biogeochemical cycle of Nitrogen and Carbon.

UNIT V Applied Ecology
Wildlife Conservation and Management: Strategies, Threats, Acts, Methods.
Human modified ecosystem

NON-CHORDATES II: COELOMATES

UNIT I Introduction to Coelomates
Evolution and types of coelom and metamerism, Significance of Coelom and Metamerism, Level of organization.

UNIT II Annelida and Onychophora
General characteristics and Classification of Annelida up to classes
Excretion in Annelida. Locomotion in Annelida, Economic importance of Annelida
General characteristics and Evolutionary significance of Onychophora

UNIT III Arthropoda
General characteristics and Classification up to classes
Vision and Respiration in Arthropoda
Metamorphosis in Insects
Social life in bees and termites

UNIT IV 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

UNIT V Echinodermata
General characteristics and Classification up to classes
Water-vascular system in Asteroidea
Larval forms in Echinodermata
Affinities with Chordates

CELL BIOLOGY

- UNIT I Overview of Cells and Plasma Membrane**
 Prokaryotic and Eukaryotic cells, Virus, Viroids, Mycoplasma, Prions
 Various models of plasma membrane structure
 Transport across membranes: Active and Passive transport, Facilitated transport
 Cell junctions: Tight junctions, Desmosomes, Gap junctions
- UNIT II Endomembrane System**
 Structure and Functions: Endoplasmic Reticulum, Golgi Apparatus, Lysosomes
 Protein sorting and Transport system(ER, Golgi Apparatus, Lysosome)
- UNIT III Mitochondria, Peroxisomes and Cytoskeleton**
 Mitochondria: Structure, Semi-autonomous nature, Endosymbiotic hypothesis
 Mitochondrial Respiratory Chain, Chemi-osmotic hypothesis; Peroxisomes;
 Cytoskeleton: Structure and Functions: Microtubules, Microfilaments and Intermediate filaments
- UNIT IV Nucleus**
 Structure of Nucleus: Nuclear envelope, Nuclear pore complex, Nucleolus
 Chromatin: Euchromatin and Hetrochromatin and packaging (nucleosome)
- UNIT V Cell Division and Cell Signaling**
 Mitosis, Meiosis and their significance, Cell cycle and its regulation and check points, GPCR and Role of second messenger (cAMP)

DIVERSITY OF CHORDATA

- UNIT I Introduction to Chordates and Protochordata**
 General characteristics and outline classification of chordate. General characteristics of Hemichordata, Urochordata and Cephalochordata; Study of larval forms in protochordates; Retrogressive metamorphosis in Urochordata.
- UNIT II Origin of Chordata and Agnatha**
 Echinoderm theory of origin of chordates. Theories of Chordate Ancestry
 External morphology, habit and habitat of petromyzon. Advanced features of vertebrates over Protochordata. General characteristics and classification of cyclostomes up to class.
- UNIT III Pisces and Amphibia**
 General characteristics of Chondrichthyes and Osteichthyes, classification of Pisces up to order; Migration, Osmoregulation and Parental care in fishes. Origin of *Tetrapoda*(Evolution of terrestrial ectotherms); General characteristics and classification of Amphibia up to order; Parental care in Amphibians.

UNIT IV

Reptilia and Aves

General characteristics and classification of Reptilia up to order; Affinities of *Sphenodon*; Poison apparatus and Biting mechanism in snakes. General characteristics and classification of Aves up to order, *Archaeopteryx* – a connecting link; Principles and aerodynamics of flight, Flight adaptations and Migration in birds

UNIT V

Mammals and Zoogeography

General characters and classification of mammals up to order; Affinities of otheria; Adaptive radiation with reference to locomotory appendage. Distribution of vertebrates in different Zoogeographical realms

ANIMAL PHYSIOLOGY: CONTROLLING AND COORDINATING SYSTEMS

UNIT I

Tissues Bone and Cartilage

Structure, location, classification and functions of epithelial tissue, connective tissue, muscular tissue and nervous tissue. Structure and types of bones and cartilages, Ossification, bone growth and resorption

UNIT II

Nervous System

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

UNIT III

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

UNIT IV

Reproductive System

Histology of testis and ovary; Physiology of male and female reproduction; Puberty, Methods of contraception in male and female

UNIT V

Endocrine System

Histology of endocrine glands - pineal, pituitary, thyroid, parathyroid, pancreas, adrenal; Hypothalamus (neuroendocrine gland) - neuroendocrine control of anterior pituitary and endocrine system.

FUNDAMENTALS OF BIOCHEMISTRY

UNIT I

Carbohydrates

Structure and Biological importance: Monosaccharides, Disaccharides, Polysaccharides and Glycoconjugates

UNIT II

Lipids

Structure, properties and functional significance of saturated and unsaturated fatty acids, Tri-acylglycerols, Phospholipids, Glycolipids, Steroids

UNIT III Proteins
Amino acids: Structure, Classification and General properties of α -amino acids; Physiological importance of essential and non-essential α -amino acids
Proteins: Bonds stabilizing protein structure; Levels of organization in proteins; Denaturation; Introduction to simple and conjugate proteins

UNIT IV Nucleic Acids
 Structure: Purines and pyrimidines, Nucleosides, Nucleotides, Nucleic acids Cot
 Curves: Base pairing, Denaturation and Renaturation of DNA
 Types of DNA and RNA, Complementarity of DNA, Hypo-Hyperchromaticity of DNA

UNIT V Enzymes
 Nomenclature and classification; Cofactors; Specificity of enzyme action; Isozymes; Mechanism of enzyme action; Enzyme kinetics; Factors affect ingrate of enzyme catalyzed reactions; Multi-substrate reactions; Enzyme inhibition; Regulation of enzyme action

COMPARATIVE ANATOMY OF VERTEBRATES

UNIT I Integumentary System and Skeletal System
 Structure, functions and derivatives of integument
 Overview of axial and appendicular skeleton

UNIT II Digestive System and Respiratory System
 Alimentary canal and associated glands, dentition
 Skin, gills, lungs and air sacs; Accessory respiratory organs

UNIT III Circulatory System and Urinogenital System
 General plan of circulation, evolution of heart and aortic arches
 Succession of kidney, Evolution of urinogenital ducts

UNIT IV Nervous System
 Comparative account of brain
 Autonomic nervous system, Spinal cord, Cranial nerves in mammals

UNIT V Sense Organs
 Classification of receptors
 Brief account of visual and auditory receptors in man

ANIMAL PHYSIOLOGY: LIFE SUSTAINING SYSTEMS

UNIT I Physiology of Digestion
 Structural organization and functions of gastrointestinal tract and associated glands; Mechanical and chemical digestion of food; Absorptions of carbohydrates, lipids, proteins, water, minerals and vitamins; Hormonal control of secretion of enzymes in Gastrointestinal tract.

UNIT II Physiology of Respiration

Histology of trachea and lung; Mechanism of respiration, Pulmonary ventilation; Respiratory volumes and capacities; Transport of oxygen and carbon dioxide in blood; Respiratory pigments, Dissociation curves and the factors influencing it; Carbon monoxide poisoning; Control of respiration

UNIT III Renal Physiology

Structure of kidney and its functional unit; Mechanism of urine formation; Regulation of water balance; Regulation of acid-base balance

UNIT IV Blood

Components of blood and their functions; Structure and functions of haemoglobin
Haemostasis: Blood clotting system, Kallikrein-Kininogen system, Complement system & Fibrinolytic system, Haemopoiesis
Blood groups: Rh factor, ABO and MN

UNIT V Physiology of Heart

Structure of mammalian heart; Coronary circulation; Structure and working of conducting myocardial fibers. Origin and conduction of cardiac impulses Cardiac cycle; Cardiac output and its regulation, nervous and chemical regulation of heart rate. Electrocardiogram, Blood pressure and its regulation

BIOCHEMISTRY OF METABOLIC PROCESSES

UNIT I Overview of Metabolism

Catabolism vs Anabolism, Stages of catabolism, Compartmentalization of metabolic pathways, Shuttle systems and membrane transporters; ATP as "Energy Currency of cell"; coupled reactions; Use of reducing equivalents and cofactors; Intermediary metabolism and regulatory mechanisms

UNIT II Carbohydrate Metabolism

Sequence of reactions and regulation of glycolysis, Citric acid cycle, Phosphate pentose pathway, Gluconeogenesis, Glycogenolysis and Glycogenesis

UNIT III Lipid Metabolism

β -oxidation and omega -oxidation of saturated fatty acids with even and odd number of carbon atoms; Biosynthesis of palmitic acid; Ketogenesis

UNIT IV Protein Metabolism

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

UNIT V Oxidative Phosphorylation

Redox systems; Review of mitochondrial respiratory chain, Inhibitors and un-couplers of Electron Transport System

MOLECULAR BIOLOGY

UNIT I Nucleic Acids and DNA Replication

Watson and Crick model of DNA; DNA as a genetic material. DNA Replication in prokaryotes and eukaryotes, Semi-conservative, bidirectional and semi discontinuous replication, RNA priming, replication of telomeres

- UNIT II Transcription**
RNA polymerase and transcription Unit, mechanism of transcription in prokaryotes and eukaryotes, synthesis of rRNA and mRNA, transcription factors
- UNIT III Translation**
Genetic code, Degeneracy of the genetic code and Wobble Hypothesis; Process of protein synthesis in prokaryotes; Inhibitors of protein synthesis; Difference between prokaryotic and eukaryotic translation
- UNIT IV 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, Processing of tRNA
- UNIT V Gene Regulation and DNA Repair Mechanisms**
Transcription regulation in prokaryotes: Principles of transcriptional regulation with examples from *lac* operon and *trp* operon; Transcription regulation in eukaryotes; Pyrimidine dimerization and mismatch repair
- PRINCIPLES OF GENETICS**
- UNIT I Mendelian Genetics and its Extension**
Principles of inheritance, Incomplete dominance and co-dominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, Sex-linked, sex-influenced and sexlimited characters inheritance.
- UNIT II Linkage, Crossing Over and Chromosomal Mapping**
Linkage and crossing over, Cytological basis of crossing over, Molecular mechanisms of crossing over including models of recombination, Recombination frequency as a measure of linkage intensity, Two factor and three factor crosses, Interference and coincidence, Somatic cell hybridization.
- UNIT III Mutations**
Types of gene mutations (Classification), Types of chromosomal aberrations (Classification, figures and with one suitable example of each), Molecular basis of mutations in relation to UV light and chemical mutagens; Detection of mutations: CLB method, attached *X* method.
- UNIT IV Sex Determination and Extra-chromosomal Inheritance**
Chromosomal mechanisms of sex determination in *Drosophila* and Man Criteria for extra-chromosomal inheritance, Antibiotic resistance in *Chlamydomonas*, Mitochondrial mutations in *Saccharomyces*, Infective heredity in *Paramecium* and Maternal effects
- UNIT V Polygenic Inheritance, Recombination in Bacteria and Viruses and Transposable Genetic Elements**
Polygenic inheritance with suitable examples; Conjugation, Transformation and Transduction in Bacteriophage Transposons in bacteria, Transposons in humans

DEVELOPMENTAL BIOLOGY

UNIT I Introduction

Historical perspective and basic concepts: Phases of development, Cell-Cell interaction, Pattern formation, Differentiation and growth, Differential gene expression, Cytoplasmic determinants and asymmetric cell division

UNIT II Early Embryonic Development

Gametogenesis, Spermatogenesis, Oogenesis; Types of eggs, Egg membranes; Fertilization (External and Internal): Changes in gametes, Blocks to polyspermy; Planes and patterns of cleavage; Types of Blastula; Fate maps (including Techniques); Early development of frog and chick upto gastrulation; Embryonic induction and organizers

UNIT III Late Embryonic Development

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

UNIT IV Post Embryonic Development

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

UNIT V Implications of Developmental Biology

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

EVOLUTIONARY BIOLOGY

UNIT I Historical review of evolutionary concept: Lamarckism, Darwinism, Neo-Darwinism
Evidences of Evolution, geological time scale, evolution of horse, Sources of variations: Heritable variations and their role in evolution

UNIT II Population genetics: Hardy-Weinberg Law, Factor influencing H-W equilibrium; Natural selection (concept of fitness, selection coefficient, derivation of one unit of selection for a dominant allele, genetic load, mechanism of working, types of selection, density-dependent selection, Genetic Drift, Role of Migration and Mutation in changing allele frequencies

UNIT III Product of evolution: Micro evolutionary changes (inter-population variations, clines, races, Species concept, Isolating mechanisms, modes of speciation— allopatric, sympatric, Adaptive radiation / macroevolution (exemplified by Galapagos finches

UNIT IV Origin and evolution of man, Unique hominin characteristics contrasted with primate characteristics, primate phylogeny from *Dryopithecus* leading to *Homo sapiens*, molecular analysis of human origin

UNIT V Phylogenetic trees, Multiple sequence alignment, construction of phylogenetic trees, interpretation of trees

BIOLOGY OF INSECTA**UNIT I Introduction and Insect Taxonomy**

General Features of Insects

Distribution and Success of Insects on the Earth

Basis of insect classification; Classification of insects up to orders

UNIT II General Morphology of Insects

External Features; Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

Thorax: Wings and wing articulation, Types of Legs adapted to diverse habitat

Abdominal appendages and genitalia

UNIT III Physiology of Insects

Structure and physiology of Insect body systems - Integumentary, digestive, excretory, circulatory, respiratory, endocrine, reproductive, and nervous system

Sensory receptors

Growth and metamorphosis

UNIT IV Insect Society

Group of social insects and their social life

Social organization and social behaviour (w.r.t. any one example)

UNIT V Insect Plant Interaction and Vectors

Host-plant selection by phytophagous insects, Insects as plant pests

Insects as mechanical and Biological vectors, Brief discussion on houseflies and mosquitoes as important insect vectors

COMMITTED TO EXCELLENCE