

Syllabus- Zoology

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Unit I: Animal Biology

1. Principles of Animal classification. Taxonomic procedures – Taxonomic collections, preservation, curation and process of identification. International Code of Zoological Nomenclature (ICZN). General characters and classification.
Major Phyla -Protozoa, Porifera, Cnidaria, Acnidaria, Platyhelminthes, Annelida, Arthropoda, Mollusca, Echinodermata and Hemichordata.
Minor Phyla – Mesozoa, Rotifera and Aschelminthes.
2. Origin of Life and Origin of Metazoa. Body plans and Symmetry.
 - a. **Protozoa** – Type study - Amoeba, Entamoeba, Trypanosoma, Euglena and Paramecium. Locomotion, Nutrition and Reproduction. Structure, life history and pathogenicity of *Plasmodium vivax*.
 - b. **Porifera** – Histology, Spicules, Canal system, Reproduction and larval forms.
 - c. **Cnidaria** – Type study - Hydra, Obelia, Sea Anemone, Aurelia. Polymorphism in Cnidaria, Mesenteries in Sea Anemone. Structure of Corallite, Coral reefs, conditions necessary for coral growth, types and theories.
3.
 - a. **Platyhelminthes** – Structure and reproduction, Mode of infection, disease caused and control measures of *Taenia solium*, *Fasciola hepatica*, *Schistosoma haematobium*, *Ascaris*, *Wauchereria bancrofti* and *Ancylostoma*. Parasitic adaptations.
 - b. **Annelida** –Type study - Earthworm, Nereis and Leech - Externals, digestive system, respiratory system, circulatory system, excretory system and reproductive system. Tubiculous Annelids. Parasitic adaptations.
4. **Onychophora** - Peripatus – Salient features and Significance.
Arthropoda – Type study - Cockroach, Prawn and Scorpion.
Respiration, Circulation and Excretion. Larval forms, Metamorphosis and Endocrine control.
Economic importance of Insects – Silkworm, Honeybees and Lac insects.
Parasites – Bedbug, Head louse, Ticks, Mites, Mosquitoes.
Pests – Weevil, Beetles, Locusts, Cockroach and Biological control. Trilobita.
5.
 - a. **Mollusca** – Type study - Pila and Fresh water mussel. Types and Structure of Shells, Torsion in Gastropoda, respiration in Mollusca, foot in Mollusca. Neopalina.
 - b. **Echinodermata** – Type study - Star fish, Brittle star, Sea Urchin and Sea lily. Water vascular system in star fish and corona of sea urchin. Larval forms and Evolutionary significance.

6. **General characters and classification.**
Protochordata – Hemichordata – Salient features and Phylogenetic significance.
Cephalochordata – Amphioxus - Detailed study.
Urochordata – Ascidia - Detailed study and retrogressive metamorphosis.
Cyclostomata – Salient features, Petromyzon and Myxine, ammocoete larva and its significance.
7. **Pisces** – General characters, distinctive features of chondrichthyes and Osteichthyes, Scoliodon – Detailed study. Caudal fin in fishes, Parental care in fishes. Dipnoi.
Amphibia – Origin of Amphibia. Type study – Frog: Externals, digestive, respiratory, skeletal, nervous, circulatory, excretory and reproductive system. Metamorphosis. Parental care.
8. **Reptilia** - General characters and classification. Evolution of Arcades and Fossae and its significance, Chelonia, Rhyncocephalia, Crocodilia and Squamata.
 Poisonous and Non-poisonous snakes, snake venom – types, composition and importance. Poison apparatus.
Aves - General characters and classification. Salient features of Archaeornithes and Neornithes. Paleognathae, Neognathae and impennae. Palate in birds. Foot and beak in birds. Migration in birds. Radio collar technique and Ringing technique.
9. **Mammals** - General characters and classification. Prototheria, Metatheria, Eutheria – orders Cetacea, Chiroptera, Carnivora, Rodentia, Proboscidea, Artiodactyla, Perissodactyla and Primata. Dentition in Mammals.
 Type study – Rabbit: Externals, digestive, respiratory, circulatory and Urinogenital system.
Integument derivatives - Scales, feathers, horns, hoof, claws, nail, and hair.
10. **Comparative anatomy of Vertebrates.**
 Skeletal system – Skull, Vertebrae, Girdles and limb skeleton.
 Circulatory system – Heart and aortic arches.
 Nervous system – Brain, Cranial nerves, Spinal nerves and Sense organs.
 Urinogenital system – Evolution of Kidney and reproductive ducts.

Unit – II: Biochemistry, Histology, Endocrinology and Physiology.

1. **Biochemistry of Macromolecules:**
 - a. Proteins – Classification, Structure and Metabolism (structure of Haemoglobin). Biological importance of Proteins.
 - b. Carbohydrates – Definition, Classification and Metabolism. Biological importance of Monosaccharides, Disaccharides and Polysaccharides – Homo and Heteropolysaccharides. Diabetes mellitus.
 - c. Lipids – Classification and Metabolism. Biological importance of Phospholipids, Neutral lipids and Glycolipids. Saturated and unsaturated fatty acids. Clinical importance and lipid profile.
 - d. Nucleic acids – Classification and Structure of DNA and RNA. Clover leaf model of t-RNA
 - e. Enzymes – Classification, Properties and importance. Mechanism of enzyme action – Induced fit theory.
 - f. Vitamins and their role.
2. Glycolysis, Krebs cycle, Electron transport chain (ETC), Oxidative Phosphorylation and energy budget.
3. **Homeostasis – Osmoregulation** in shark, marine and fresh water teleosts, terrestrial mammals (Kangaroo rat and Camel). Osmoconformers and Osmoregulators.
Thermoregulation – Ectotherms, Endotherms and Heterotherms. Poikilotherms and Homeotherms. Thermogenesis and its regulation. Hibernation and Aestivation. Law of Q₁₀. Antioxidants and their role.
Digestion - Digestion, absorption, energy balance, BMR, digestive disorders.
Respiration – External and Internal respiration. Physiology of respiration. Respiratory pigments. Transport of Oxygen, Oxygen dissociation curve – Bohr's effect. Transport of Carbon di-oxide – Chloride shift, respiratory quotient. pH and buffers. Respiratory disorders.
4. **Circulation** – Functions and Regulations of Human heart. Blood pressure. Composition of Human blood. Blood clotting – Schematic Cascade reaction. Echocardiogram (ECG), cardiac disorders. Lymphatic system.
Nitrogen excretion – Ammonotelism, Ureotelism and Uricotelism. Ornithine cycle. Physiology of Urine formation in Man. Micturition. Counter current multiplier system. Kidney stones, Kidney failure and dialysis.
5. **Muscle contraction** – Types of Muscles. Ultrastructure of skeletal muscle, contractile and regulatory proteins. Mechanism of Muscle contraction. Neuromuscular junction and relaxation. Sliding filament theory.
6. **Nervous coordination** – Ultrastructure of neuron, Glial cells, Synapse. Axonic and Synaptic transmission of nerve impulse. Electroencephalogram (EEG) and disorders of nervous system. Sense organs - Vision, hearing, olfactory and tactile response.
7. **Histology**– Histology of Mammalian organs – Skin, Lung, Liver, Spleen, Pancreas, Stomach, Intestine, Kidney, Pituitary, Thyroid, Adrenal, Testis and Ovary.
8. **Endocrinology** –Structure, biosynthesis and role of hormones of Pituitary, Thyroid, Adrenal, Pancreas, Testis and Ovary.
9. **Neurohormones** – Neurotransmitters and neuromodulators. Hypothalamic releasing factors and their actions.

Unit –III: Cell and Molecular Biology, Genetics and Evolution

- 1. Ultrastructure of animal cell.** Ultrastructure and functions of plasma membrane, fluid-mosaic model. Origin, Ultrastructure and functions of Endoplasmic reticulum, Mitochondria and Golgi body. Lysosomes – Structure, Polymorphism, enzymes and functions. Ribosomes – Distribution, types, chemical composition, dissociation and reconstitution. Microfilaments and Microtubules. Cell Surfaces and junctions. Cilia, Flagella and Centrioles. Transport across cell membranes.
- 2. Nucleus** – Ultrastructure, Nucleoplasm and Chromatin fibers. Nucleolus – Ultrastructure and functions. Chromosomes – Number, Size and types. Morphology. Euchromatin and Heterochromatin. Karyotype and Ideogram. Giant chromosomes. Chromosomal aberrations.
- 3. Cell division** – Cell cycle. Amitosis, Mitosis and Meiosis. Mitotic apparatus. Crossing over and its significance. Synoptonemal complex. Biology of cancer, AIDS.
- 4. Genetic code** and properties, Protein synthesis – DNA transcription, RNA synthesis, Post-transcriptional modification. RNA splicing. Concept of gene, jumping genes, split genes, Gene regulation – Operon concept.
- 5. Genetics** – Mendelism, Nature and Nurture – Human twins, Huntington's chorea, PTC test, interaction of genes – supplementary factors, complementary factors, Epistasis, multiple factors, lethal genes, multiple alleles, isoalleles, Pseudo alleles and position effect. Norm of Reaction, Phenocopy, Pleotropism, Penetrance and expressivity. Cytoplasmic inheritance.
- 6. Linkage and Crossing over**, Genetic mapping of chromosomes. Three-point test cross, Sex linked inheritance, Sex determination, Effect of hormones and environment in sex determination, Y linked inheritance, Human Syndromes, Gynandromorphs and intersexes.
- 7. Gene Mutation** – types and causes. CIB technique, Mutagens. Disorders in Man, Sickle cell anemia, Thalassemia. Inborn errors of Metabolism, albinism, alkaptonuria and Phenylketonuria. Eugenics, Euthenics and Euphenics.
- 8. Biotechnology** – Tissue culture, transgenic plants and animals, DNA fingerprinting, Recombinant DNA technology. Stem cells and gene therapy. Human Genome Project. Techniques, analysis, applications, ethical, legal and social issues.
- 9. Evolution** – Lamarckism, Darwinism, Neo-Darwinism. Gene Pool, Mendelian Population, Migration and Immigration, Mutations, Meiotic drive, Genetic drift, Founder's Principle. Bottle neck phenomena. Hardy-Weinberg's law. Evidences for organic evolution. Speciation – Isolating mechanisms, Allopatry, Sympatry, Sexual selection and Co-evolution. Evo-devo concept (Evolution and Development concept)
- 10. Adaptations** – Aquatic, arboreal, Volant and desert adaptations. Coloration and mimicry.

Unit – IV: Developmental Biology, Environmental biology, Immunology and Palaeontology

1. **Developmental Biology** – Gametogenesis, Fertilization and Parthenogenesis.
Eggs and Sperms – types, Cleavage pattern.
Oviparity, Ovo-viviparity and Viviparity in Vertebrates.
2. **Development of**– Amphioxus, Frog and Chick. Organizer phenomena. Foetal membranes. Placenta – Structure and Types.
3. **Human Development** – Graafian follicle, Ovulation, Fertilization, Morula, Blastocyst and Implantation, Gestation and Lactation. Human menstrual cycle, role of male and female reproductive hormones and Placental hormones. Modern trends in Reproduction. MART: Medically Assisted Reproductive technologies –GIFT, SIFT, TEST TUBE BABY etc., Cloning and sperm banks. Family planning devices.
4. **Environmental biology** – Scope and Relevance. Ecological factors – Abiotic and Biotic. Limiting factors. Liebig and Shelford's law of tolerance.
Bio-geochemical cycles – Carbon, Nitrogen, Hydrogen and Phosphorus cycles.
5. **Ecological concepts:** Food chains and Food web, Ecological pyramids.
Laws of thermodynamics and energy flow through ecosystem.
Freshwater, terrestrial, marine and estuarine ecology.
Biological magnification, Global warming, Acid rain and Ozone layer depletion.
Biomes – Grassland, Forest, Tundra and Desert biomes.
6. **Population and Community ecology** – Habitat, Ecological niche, population attributes. Ecotone and edge effect. Ecological succession and Climax community. Bioindicators. Animal association. Interspecific and Intraspecific interactions. Population explosion and control.
7. **Pollution** – Air, Water, Soil and Noise pollution. Radioactive pollution. Sources, effects and control measures.
8. **Zoogeography** – Zoogeographical realms – Major fauna and flora.
Palaeontology – Geological time scale. Fossils – Fossilization, types and its importance.
Evolution of Horse and Man.
9. **Wildlife conservation** – Strategies and Agencies. Wildlife act 1972, CITES (Convention on international trade in endangered species of wild life flora and fauna), Endangered fauna of India, Red Data Book, Wildlife Sanctuaries and National parks in India. Project Tiger, Project Gir and Crocodile breeding project. Zoo Management.
10. **Immunology** – Immunity and immune system, Humoral and cell mediated immunity. Immunoglobulins. B lymphocytes and immune response. Precipitation and agglutination. Autoimmune diseases – Sedromid purporea, systemic leupus, erythematosus, rheumatoid arthritis. Major Histocompatibility complex (MHC) – MHC antigen, T lymphocytes and immune response. Hypersensitivity.

Unit V: Applied Zoology, Ethology, Biological Techniques, Biostatistics, Bioinformatics and Computer application

1. **Applied Zoology:**
 - a. Sericulture – Species of silkworm, rearing and management practices, pests of silkworm, by-products of sericulture.
 - b. Vermiculture and Vermicompost.
 - c. Apiculture- species of honey bee, bee keeping and management practices, bee-products, pests of honey bees.
 - d. Pisciculture – Fish processing and preservation, edible fishes of India and fish products. Pearl culture, Prawn culture.
 - e. Poultry and Dairy.
2. **Ethology** – Taxes, Reflexes, Instincts and motivation. Habituation and Imprinting. Auditory communication in Gryllids (Crickets). Pheromones. Courtship behavior in insects, birds and mammals.
3. Domestication and Behavioral changes. Social behavior in insects and primates.
4. **Biological clock** – Circadian, circannual and circalunar rhythms. Role of Pineal and hypothalamus in Rhythms.
5. **Bioluminescence**—Mechanism and significance.
6. **Biological Techniques:**
 - a. Microscopic techniques- Visualization of cells and sub-cellular components by light microscopy, resolving powers of different microscopes. microscopy of living cells, scanning and transmission microscopes different fixation and staining techniques for EM.
 - b. Histochemistry and Immunotechniques – Microtomy, Detection of molecules using Enzyme-Linked Immuno Sorbent Assay (ELISA), Radioimmunoassay (RIA), immunoprecipitation and fluorescence cytometry.
 - c. Ultracentrifuge, Colorimeter, Chromatography and Spectrophotometer. Detection of molecules in living cells, Polymerase Chain Reaction (PCR), Electrophoresis, Blotting techniques and *in situ* localization by techniques such as Fluorescence *in situ* hybridization (FISH).
 - d. Principle and applications of Micrometry, Endoscopy, autoradiography
7. **Biostatistics**- Bar diagram, Histogram, Frequency distribution—Mean, Median and Mode. Standard deviation and Standard Error. Chi-square test. Analysis of Variance (ANOVA).
8. **Bioinformatics and Computer application**—sequence analysis, gene and protein expression, Structural bioinformatics, biodiversity informatics, data bases, soft wares and tools. Education platforms.