

Syllabus of Ph.D. Entrance Examination

17. ZOOLOGY

- 1. Microbiology, Biotechnology and Instrumentation:** Kinds of Microorganisms: Viruses, Bacteriophages, Rickettsiae, Bacteria, Fungi, Slime moulds etc. Environmental Microbiology: Microbiology of air, water, soil and Bioremediation. Microbiology of food: Microbial contamination and spoilage of industrial and domestic food, sources of food poisoning and food preservation. Antibiotics: History of Penicillin, Classification of Antibiotics, Non-medical uses of antibiotics. Biotechnology: Scope and importance, Restriction enzymes in cloning, Techniques used in recombinant DNA technology (agarose and polyacrylamide gel electrophoresis, PEGE, Southern, Northern and Western Blotting, dot blots and slot blots); Cloning vectors for recombinant DNA (Plasmids, Phages, Cosmids, Viruses and Transposons), Transgenic plants and animals. Instrumentation: Elementary knowledge of the functioning and application of the following equipments: Microscopy: Light and phase contrast, Interference, Fluorescence and electron microscopy. Microtomy: Routine paraffin microtomy, Spectrophotometry. Chromatography and Electrophoresis. Centrifugation
- 2. Animal Diversity I:** General classification, characters, habits and habitats of non-chordate phyla. Protozoa: Locomotion and reproduction in protozoa. Porifera: Canal system. Coelenterata: Polymorphism in Coelenterata, coral reefs. Helminthes: Life cycle of *Wuchereria* and *Schistosoma*. Annelida: Segmental organs, Adaptive radiation in Polychaeta. Arthropoda: Crustacea (Larval forms); Onychophora (General characters and affinities); Insecta

(social life in honey bee and termites). Echinodermata: Water vascular system.

- 3. Animal Diversity II:** Classification upto orders, characters, habits and habitats of chordates. Origin and evolution of chordates, General organisation, classification and affinities of Protochordata and cyclostomata, Ratitae: Distribution and affinities, Dentition in mammals, General characters, distribution and affinities of Prototheria and Metatheria.
- 4. Biological Chemistry and Physiology (With emphasis on Vertebrates):** Carbohydrates, Proteins and Lipids: Chemical structure, classification and sources of biochemically significant and metabolism. Enzymes: Nomenclature and classification, mechanism of enzyme action, factors influencing enzyme activity. Vitamins: Chemical structure, source and deficiency state of fat soluble and water soluble vitamins. Nutrition: Digestion, absorption and assimilation of various food stuffs. Respiration: Respiratory surfaces in different groups and gaseous exchange , Respiratory pigments, Transport of oxygen and Carbon dioxide. Circulation: Haemopoiesis, Heart beat and its regulation and cardiac out put, Blood flow through arteries, veins and capillaries (pulse and blood pressure) including regulation, coronary circulation and coronary occlusion. Excretion and osmoregulation: Functions of kidney, Types of nitrogenous wastes in different animal groups and their excretion, Renal excretion in vertebrates (urine formation in a mammal in particular). Nervous Co-ordination : Structure of neuron , nature , origin and propagation of nerve impulse , Synaptic transmission, Chemistry and functions of neurotransmitters. Muscle physiology: Structure, kinds and characteristics of muscles.

- 5. Cytogenetics:** Chemistry of gene: Structure of nucleic acids (A, B, C and Z-DNAs, RL model of Sasisekharan; supercoiling; genetic and non-genetic RNAs), DNA – replication (evidence for semi conservative replication); DNA repair (excision repair, mismatch repair and SOS repair), DNA repair and genetic disease in humans, Genetic Code: Properties of genetic code, Mutation and genetic code, Wobble hypothesis, New genetic codes in mitochondria and ciliate protozoa. Gene Function (Regulation of gene expression): Fine structure of gene; Benzer's analysis of r-II locus by deletion and complementation mapping; Operons in bacteria (lac and trp operons in *E. coli*); General introduction to complexities of gene regulation in eukaryotes, organisation of typical eukaryotic gene.
- 6. Genetics; Chromosome mapping:** Chromosome mapping in *Drosophila* (single and double crossing over), human chromosomes (Somatic cell genetics). Sex determination: Chromosome theory of sex determination, Balance theory of sex determination (X/A ratio in *Drosophila*), Hormonal and environmental control of sex, Dose compensation in *Drosophila* and man. Sexuality and recombination in Bacteria and Viruses: Three modes of transfer of genetic material (Transformation, transduction and conjugation), Sexual conjugation in bacteria (F^+ , F^- and HFR strain), F^- and sexduction. Multiple Alleles : Multiple alleles and isoalleles (Skin colour in rodents, eye colour in *Drosophila*, blood group in humans).
- 7. Ecology:** Basic concepts, Rationale and approach. Habitats: Freshwater (Lakes) and Marine (Estuary). Environmental factors: Laws of limiting factors, namely temperature. Eutrophication of freshwater ecosystems: Causes, consequences and control measures. Functioning of

ecosystems: Energy flow, productivity, trophic structure and ecological efficiencies. Ecology of communities: Namely dominance, various types of diversity indices, Ecotone and niche concept.

8. Evolutionary Biology, Taxonomy and Animal Behaviour:

Evolutionary Biology: Synthetic theory of evolution., Micro, macro and mega evolution., Isolation and Variation. Species and speciation. Genetic drift (Sewell –Wright effect). Hardy-Weinberg law. Taxonomy, Introduction to systematics and taxonomy and its significance in Zoology. Modern approaches in taxonomy. Concept of zoological classification. Species concept. Rules of zoological nomenclature. Collection, preservation and identification of insects and other specimens. Animal Behaviour Innate Behaviour and Learned Behaviour Communication: Chemical communication, Visual and Auditory communication. Migratory Behaviour: Mechanisms of navigation and homing in fish and birds. Social Behaviour: Types of social acts, Parental care. Biological Rhythms: Kinds of biological rhythms, Biological clock, Circadian rhythms and their control.

9. Mammalian Endocrinology: Classification and chemical nature of hormones, Complete knowledge of the generalized mechanisms of action (at molecular level) of protein and steroid hormones. Molecular structure, origin, release and transport of sex hormone. Microanatomical and histological structure of mammalian Pituitary, hypothalamo- hypophysial system, Pineal, Thyroid, Parathyroid, Endocrine Pancreas and Adrenal glands, and the molecular structure , synthesis , storage, control of release, transport, denaturation and physiological actions of their hormones.

10. Developmental Biology: Fertilization: Mechanism of fertilization , early and late changes in egg organisation caused by fertilization . Cleavage and Blastulation: Patterns of cleavage, determinate and indeterminate cleavage, influence of yolk on cleavage, metabolic changes during cleavage, morulation and blastulation in frog , chick and rabbit. Gastrulation: Fate maps, morphogenetic movements in frog , chick and rabbit. Development and functions of the foetal membranes in mammals. Organogenesis: Development of brain, eye and heart in chick. Metamorphosis: Kinds of metamorphosis, Physiological and biochemical changes during metamorphosis, hormonal control of metamorphosis.