



PROF. RAJENDRA SINGH (RAJU BHAIYA) UNIVERSITY, PRAYAGRAJ

DOCTORAL ENTRANCE TEST (DET)

(SESSION : 2022-2023 ONWARDS)

DET Syllabus

ZOOLOGY

Unit-I

Principles of taxonomy as applied to the systematics and classification of the animal kingdom Classification and interrelationship amongst the major invertebrate phyla; Minor invertebrate phyla, Functional anatomy of the nonchordates; Larval forms and their evolutionary significance.

Classification and comparative anatomy of protochordates and chordates; Origin, evolution and distribution of chordates groups: Adaptive radiation.

Histology of mammalian organ systems, nutrition, digestion and absorption; Circulation (open and closed circular, lymphatic systems, blood composition and function); Muscular contractor and electric organs; Excretion and osmoregulation: Nerve conduction and neurotransmitters major sense organs and receptors; Homeostatic (neural and hormonal); Bioluminescence Reproduction.

Unit-II

Gametogenesis in animals: Molecular events during fertilization, Cleavage patterns and fate maps, Concepts of determination, competence and induction, totipotency and nuclear transfer experiments: Cell differentiation and differential gene activity: Morphogenetic determinants in egg cytoplasm; Role of maternal contributions in early embryonic development: Genetic regulations of early embryonic development in Drosophila; Homoeotic genes.

Unit-III

Feeding, learning, social and sexual behaviour of animals; Parental care; Circadian rhythms; Mimicry; Migration of fishes and birds; Sociobiology; Physiological adaptation at high altitude. Important human and veterinary parasites (protozoans and helminthes); Life cycle and biology of Plasmodium, Trypanosome, Ascaris, Wuchereria, Fasciola, Schistosoma and Leishmania; Molecular, cellular and physiological basis of host - parasite interactions.

Arthropods and vectors of human diseases (mosquitoes, ice, flies and ticks); Mode of transmission of pathogens by vectors; Chemical, biological and environmental control of anthropoid vectors: Biology and control of chief insect pests of agricultural importance; Plant host-insect interaction, insect post management; useful; silkworm.

Unit-IV

The law DNA constancy and C-value paradox; Numerical, and structural changes in chromosomes; Molecular basis of spontaneous and induced mutations and their role in evolution; Environmental mutagenesis and toxicity testing; Population genetics.

Unit-V

Structure of pro- and eukaryotic cells; membrane structure and function; intracellular compartments, protein sorting, secretory and endocytic pathways; Cytoskeleton; Nucleus; Mitochondria and chloroplasts and their genetic organisation; cell cycle; Structure and organisation of chromatin, polytene and lampbrush chromosomes; Dosage compensation and sex determination and sex-linked inheritance.

Interactions between environment and biota; Concept of habitat and ecological niches; Limiting factor; Energy flow, food chain, food web and trophic levels; Ecological pyramids and recycling biotic community-concept, structure, dominance, fluctuation and succession; N.P.C. and S cycles in nature.

Unit-VI

Ecosystem dynamics and management; Stability and complexity of ecosystems; Speciation and extinctions; environmental impact assessment; Principles of conservation; Conservation strategies; sustainable development.

Physico-chemical properties of water; kinds of aquatic habitats (fresh water and marine): Distribution of and impact of environmental factors on the aquatic biota; Productivity, mineral cycles and biodegradation in different aquatic ecosystems; Fish and Fisheries of India with respect to the management of estuarine, coastal water systems and man-made reservoirs: Biology and ecology of reservoirs.

Structure, classification, genetics, reproduction and physiology of bacteria and viruses (of bacteria, plants and animals); Mycoplasma protozoa and yeast (a general account). Microbial fermentation: Antibiotics, organic acids and vitamins; Microbes in decomposition and recycling processes; Symbiotic and asymbiotic N₂-fixation; Microbiology of water, air, soil and sewage: Microbes as pathological agents in plants, animals and man; General design and applications of a biofermenter, Biofertilizer.

Unit-VII

Antigen: Structure and functions of different classes of immunoglobulins; Primary and secondary immune response; Lymphocytes and accessory cells; Humoral and cell mediated immunity: MHC; Mechanism of immune response and generation of immunological diversity; Genetic control of immune response. Effector mechanisms: Applications of immune response, Effector, mechanisms: Applications of immunological techniques.

Enzyme Kinetics (negative and positive cooperativity): Regulation of enzymatic activity; Active sites; Coenzymes: Activators and inhibitors, isoenzymes, allosteric enzymes; Ribozyme and abzyme.

Van der Waal's electrostatic, hydrogen bonding and hydrophobic interaction; Primary structure and proteins and nucleic acid; Conformation of proteins and polypeptides (secondary, Tertiary, quaternary and domain structure); Reverse turns and Ramachandran plot; Structural polymorphism of DNA, RNA and three dimensional structure of rRNA; Structure of carbohydrates, polysaccharides, glycoproteins and peptidoglycans; Helix-coil transition; Energy terms in biopolymer conformational calculations.

Glycolysis and TCA cycle: Glycogen breakdown and synthesis; Gluconeogenesis; interconversion of hexoses and pentoses; Amino acid metabolism; Coordinated control of metabolism; Biosynthesis of purines and pyrimidines; Oxidation of lipids; Biosynthesis of fatty acids; Triglycerides; Phospholipids; Sterols.

Unit-VIII

Energy metabolism (concept of free energy); Thermodynamic principle in biology; Energy rich bonds; Weak interactions; Coupled reactions and oxidative phosphorylation; Group transfer;

Biological energy transducers; Bioenergetics.

Fine structure of gene, Eukaryotic genome organisation (structure of chromatin, coding and non-coding sequences, satellite DNA); DNA damage and repair, DNA replication, amplification and rearrangements.

Organization of transcriptional unit; Mechanism of transcription of prokaryotes and eukaryotes; RNA processing (capping, polyadenylation, splicing, introns and exons); Ribonucleoproteins, structure of mRNA; Genetic code and protein synthesis.

Regulation of gene expression in pro and eukaryotes; Attenuation and antitermination; Operon concept; DNA methylation; Heterochromatization; Transposition; Regulatory sequences and transacting factors; Environmental regulation of gene expression.

Biochemistry and molecular biology of cancer; Oncogenes; chemical carcinogenesis; Genetic and metabolic disorders; Hormonal imbalances; Drug metabolism and detoxification; Genetic load and genetic counseling.

Lysogeny and lytic cycle in bacteriophages; Bacterial transformation; Host cell restriction; Transduction; Complementation; Molecular recombination; DNA ligases; Topoisomerases; Gyrase; Methylases; Nucleases; Restriction endonucleases; Plasmids and bacteriophage base vectors for cDNA and genomic libraries. Principles and methods of genetic engineering and Gene targeting; Applications in agriculture, health and industry.

Unit-IX

Cell and tissue culture in plants and animals; Primary culture; Cell line; Cell clones; Callus cultures; Somatic variation; Micropropagation; Somatic embryogenesis; Haploidy; Protoplast fusion and somatic hybridization; Cybrids; Gene transfer methods in plants and in animals; Transgenic biology; Allopheny; Artificial seeds; Hybridoma technology.

Structure and organisation of membranes; Glycoconjugates and proteins in membrane systems; ion transport, Na⁺ / K⁺ATPase; Molecular basis of signal transduction in bacteria, plants and animals; Model membranes; Liposomes.

Principles and application of light phase contrast, fluorescence, scanning and transmission electron microscopy, Cytophotometry and flow cytometry, fixation and staining.

Principles and applications of gel-filtration, ion-exchange and affinity chromatography; Thin layer and gas chromatography; High pressure liquid (HPLC) chromatography; Electrophoresis and electrofocussing; Ultracentrifugation (velocity and buoyant density).

Unit-X

Principles and techniques of nucleic acid hybridization and Cot curves; Sequencing of Proteins and nucleic acids; Southern, Northern and South-Western blotting techniques; Polymerase chain reaction; Methods for measuring nucleic acid and protein interactions.

Principles of biophysical methods used for analysis of biopolymer structure X-ray diffraction, fluorescence, UV, ORD/CD, Visible, NMR and ESR spectroscopy; Hydrodynamic methods; Atomic absorption and plasma emission spectroscopy.

Principles and biophysical methods used for analysis of biopolymer structure, applications of tracer techniques in biology; Radiation dosimetry; Radioactive isotopes and half life of isotopes; Effect of radiation on biological system; Autoradiography; Cerenkov radiation; Liquid scintillation spectrometry.

Principles and practice of statistical methods in biological research, samples and populations; Basic statistics-average, statistics of dispersion, coefficient of variation; standard error; Confidence limits; Probability distributions (binomial, Poisson and normal); Tests of statistical significance; Simple correlation of regression; Analysis of variance.