

KASHI NARESH UNIVERSITY BHADOHI-221304

Website: knub.ac.in

Syllabus for Entrance Examination of

Doctor of Philosophy (Ph. D.)

In

ZOOLOGY

Non-Chordata

Unit 1 – Protozoa, Porifera and Coelenterata

Protozoa-Locomotion- locomotory organelles and methods of locomotion, Nutrition- Holozoic, Holophytic, Saprozoic and Myxotrophic nutrition, Reproduction- Asexual and sexual, Protozoa and soil fertility, Protozoa and Diseases

Porifera-Skeleton-Spicules and spongin fibers, Canal System-Types and functions of canal system, economic importance of poriferans

Coelenterata-Origin of Metazoa, Polymorphism- Basic forms and patterns, Importance of polymorphism, Corals-coral polyp, coral skeleton, types of corals, coral reefs. General organization and affinities of Ctenophora

Unit 2- Platyhelminthes and Aschehelminthes

Parasitism in Platyhelminthes and Aschehelminthes, Parasitic adaptations in Trematodes and Cestodes-Morphological and physiological adaptations, larval stages of Trematoda and Cestoda, Phytonematodes, Economic importance of Helminths.

Unit 3 - Annelida and Arthropoda

Segmental organs, Filter feeding, Coelom and Metamerism. Larval forms of crustacean, Parasitism in crustacea, Respiration in Arthropods, General organization in Onychophora, Economic importance of Arthropoda

Unit 4- Mollusca and Echinodermata

Respiration in Mollusca, Torsion in Gastropods, Water vascular system and Larval forms in Echinodermata.

Chordata

Unit 1

Origin of Chordates; Origin of Agnatha and Gnathostomes; Pisces: Ostracoderms and Devonian (the age of fishes);

Unit 2

Dipnoi (Lung fishes) and their peculiar features; Amphibia: Origin of Tetrapoda

Unit 3

Origin and Evolution of Reptiles, Mesozoic reptiles, Extinct reptiles, Origin of birds, Flightless birds, Flight adaptations.

Unit 4

Mammals: Origin and evolution of Mammals; Characteristic features of Monotremes, Marsupials and Placentals; Aquatic mammals.

Environmental Biology

Unit 1- Population Ecology

Characteristics of Population, Population size and exponential growth, Population dynamics, Competition, Population Interactions

Unit 2- Ecosystem

Nature of Ecosystem, Ecosystem services, Productivity, Food webs and Energy flow through ecosystems, Biogeochemical cycles, Types of niche and Biomes

Unit 3- Environment

Environmental stress, Global warming, Acid Rain, Environmental toxicants-their uptake and bioaccumulation and biotransformation (Ecotoxicology), Xenobiotics, Bio-indicators and Biomarkers

Unit 4- Biodiversity and Conservation

Levels of Biodiversity, Indian Biodiversity & Its Distribution; Significance; Threats to biodiversity; IUCN categories of threat; Ex-situ and in-situ conservation strategies; International and national conservation policies and legislation, Biodiversity Hotspots; Keystone species, Indicator Species

Animal Physiology and Immunology

Unit 1- Digestion and Excretion

Physiology of Digestion- Digestion and Absorption of Proteins, Carbohydrates and lipids

Physiology of Excretion- Excretory products, Biosynthesis of Urea, Structure and functional mechanism of nephron

Unit 2- Circulation and Respiration

Physiology of Circulation- Patterns of Circulation among mammals, Physiological categories of Heart, Haemodynamics

Physiology of Respiration- Gaseous exchange in terrestrial and aquatic animals, Respiratory pigments

Unit 3- Nerve Conduction and muscle contraction

Physiology of nerve conduction-Resting and action potential, Synaptic transmission

Physiology of Muscle Contraction- Structure and Mechanism of Contraction of skeletal muscles

Unit 4-Immunology

Structure and functions of MHC (MHC I & MHC II); endogenous and exogenous pathways of

antigen processing and presentation, humoral and cell-mediated immune responses, hypersensitivity and autoimmunity, generation of antibody diversity, hybridoma technology

Biochemistry

Unit 1- Bioenergetics

Elementary thermodynamics- First law and second law of thermodynamics, Cell as an open thermodynamic system, Calculation of free energy change during biological oxidation-reduction reactions

Unit 2 - Carbohydrates and lipids

Structure, general properties and biological significance, Metabolic pathways- Glycogenesis and Glycogenolysis, HMP shunt, Oxidative phosphorylation, Beta oxidation of fatty acids

Unit 3- Amino Acids and proteins

Structure, properties and metabolism, Ramachandran plot, protein isolation, solubilities and protein targeting

Classification and significance of Vitamins

Unit 4- Enzymes

Kinetics, inhibition, mechanism of action, Michaelis and Menton equation, Allosteric enzymes, isoenzymes, Ribozymes, Abzymes.

Biosystematics, Evolution and Animal Behaviour

Unit-1

Definition and basic concepts of biosystematics and Taxonomy and its applications in biology; Taxonomic terms: phenon, taxon and category: α , β and γ taxonomy; trends in biosystematics: concepts of different conventional and newer aspects – chemotaxonomy, cytotaxonomy, ethotaxonomy, molecular taxonomy and numerical taxonomy. Speciation, type of lineage changes; Code of Zoological Nomenclature (ICZN), its operative principles; history of rules of Zoological nomenclature

Unit-2

Reflexes and complex behavior; orientation; Fixed action pattern (FAP); mechanism, deprivation experiment, controversies; FAP characteristic and evolutionary feature; learning and instincts, conditioning, habituation, sensitization.

Unit-3

Innate releasing mechanism; key stimuli, stimulus filtering; Homeostasis and behavior; motivational system, physiological basis of motivation; Hormones and pheromones influencing animal behavior; Aggression; Altruism; Communication; Navigation.

Unit-4

Study of Fossils: types and significance; Theories of Evolution: Synthetic theory of Evolution; Zoogeography and Evolution; Mechanisms of evolution - Natural selection, genetic drift, gene flow, and mutation; Adaptive radiation and convergent evolution; Coevolution and evolutionary arms races; Human evolution.

Developmental Biology and Endocrinology

Unit 1- Gonads and Gametogenesis

(i) Sex differentiation in vertebrates (ii) Comparative account of differentiation of gonads in mammals, (iii) Spermatogenesis in vertebrates (iv) Endocrinology of ovary, oogenesis and vitellogenesis in vertebrates, superovulation.

Unit 2- Fertilization, Embryogenesis and Organogenesis

(i) Mechanism of Fertilization: in vivo and in vitro, (ii) Patterns of Cleavage (iii) Patterns of Gastrulation in frog and chick (iv) Development of Brain in vertebrates

Unit 3

(i) Hormones and Reproduction-Seasonal and continuous breeders (ii) Differentiation of cells during embryonic development (iii) Mechanism of Induction during Organogenesis, Primary organizers

Unit 4

Hormones as messengers and their types, Structure and functioning of Pituitary, Pancreas, Adrenal Glands. Structure and function of Thyroid, Parathyroid, and Gonads; Nature and action of peptide and steroid hormones; Catecholamines; Biosynthesis and secretion of Hormones.

Economic Zoology

Unit 1- Aquaculture

Marine, riverine and lacustrine fishes; Some food fishes of India: *Wallago*, *Anguilla*, *Harpodon*, *Notopterus*, *Channa*, *Clarias*, *Labeo*, *Catla*, *Cirrhinus*, *Barbus*; Fish culture in India: Culture of Carps.

Unit 2- Domestication of animals

Animal husbandry and Poultry: Important breeds of cattle in India, Exotic breeds, cattle breeding, artificial insemination, feeding and management of dairy stock, dairy products, poultry industry in India, important poultry breeds, poultry farming, disease of fowl.

Unit-3- Apiculture and Sericulture

Apiculture: Importance of Bee keeping, Apiculture, *Apis* species, bee hive, social life of honey bee, properties of honey

Sericulture: Mulberry and non-mulberry Sericulture (tasar, munga and eri sericulture); lifecycle of silk moth; physical and chemical properties of silk.

Unit 4- Vermiculture

Introduction, ecology and distribution of earthworms: Vermiculture and vermicomposting methods: chemical composition of waste based vermicompost: Economics of vermiculture and vermicomposting: species of earthworms for vermicomposting; use of earthworm in land improvement and reclamation.

Cytogenetics

Unit-1

Basic concept of Mendelian inheritance, gene interaction, epistasis, complementation test, sex linked inheritance, sex limited and sex influenced trait, cytoplasmic inheritance, genomic imprinting, environment and heredity, pleiotropy, Genetic disease testing and gene therapy

Unit-2

Linkage, crossing over and recombination, recombination frequency, gene mapping, gene mutation, chromosomal mutation and their significance

Unit-3

Bacterial genome, transformation, transduction, conjugation, bacteriophage, Chromosomal organization of DNA in eukaryotes, transposable elements in prokaryotes and eukaryotes, role of transposable elements in genetic regulation

Unit-4

DNA replication in prokaryote and eukaryotes, chromosome and gene, gene expression and regulation-transcription in prokaryotes and eukaryotes, translation in prokaryotes and eukaryotes, uptake in endoplasmic reticulum, trafficking mechanism of protein, operon model-lac operon and trp operon

Biostatistics, Bioinformatics and Bioinstrumentation

Unit 1- Biostatistics

Population sample, random sample, tabular and graphical representation of data; Measures of central Tendencies (Mean, Median, Mode), Standard deviation, Variance, Co-efficient of variance, Analysis of Variance (ANOVA).

Unit 2- Bioinformatics

Biology & IT, Computers in Biology and medicine, Introduction to Genomics and Proteomics etc, Definition and terminology: Cladogram, Dendrogram, Phylogram and Phenogram; Operational taxonomic unit (OUT), Informative sites. Biological sequence data banks (GENBANK, EMBL, PDB)

Unit 3- Biological Techniques

Working principles types and applications of Colorimetry, Spectrophotometry, Centrifugation, Chromatography and Electrophoresis.

Unit 4- Microscopy

Principles and Components of Compound microscope, Phase Contrast Microscope, Electron Microscope (SEM, TEM)

Cytological Techniques

Unit 1

Elementary principles of phase, interference, polarization, electron and Scanning electron microscope

Unit 2

Theory and application of freeze – drying, X-ray diffraction, radio autography, Fluorescent antibody techniques and differential centrifugation. Methods of tissue culture

Unit 3

Theoretical basis of colorimetric and biochemical estimations of nucleic acid, proteins

Unit 4

Chemical basis of fixation and cytochemical localization of proteins, lipids, glycogen, RNA, DNA, phosphatases, Biosynthesis of proteins and Nucleic Acids

Molecular Biology

Unit 1- Gene Action

Chromosomal organization of genes, DNA Replication, Transcription, Genetic code

Unit 2- Intracellular Protein Trafficking

Protein Architecture, Protein synthesis on free/bound polysomes, Uptake into ER, Trafficking mechanism of proteins

Unit 3- Regulation of Gene Action

Regulation of Gene action in prokaryotes and eukaryotes, Operon model- Lac operon and Trp operon

Unit 4- Cell Signaling

Types of Cell Signaling, Second messenger system, Cell surface receptors

Cell Biology- Cellular structure, functions and Regulations

Unit 1- Organization of cell; Ultrastructure and functions of Cell membrane and nuclear membrane, Cellular Organelles: Ultrastructure and Functions of Mitochondria, Golgi complex, Endoplasmic reticulum, Ribosomes, Lysosomes

Unit 2

Cell division and cell cycle; Mitosis and meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle, Mechanism of chiasma formation

Unit 3

Cell transformation and cancer; apoptosis, necrosis and autophagy; Chromosomal changes caused by ultraviolet and ionizing radiations; Carcinogenesis: Cytopathology; Possible somatic and viral causes

Unit 4

Regulation of cellular function; Hormone action: Hormone receptor Interaction; Membrane receptors; Steroid thyroid and epinephrine receptors; Second messengers (cyclic AMP: Cyclic GMP); Interferon.

Unit 5

Genetic code; Genetic recombination, transformation, conjugation and transduction

Unit 6

Thermodynamic principles and steady-state conditions of living Organisms; Organization and methods to study metabolism; Degradation of glucose and nucleotides in animals; Energy metabolism and high energy compounds. Redox potentials; Mitochondrial electron transport chain, Oxidative phosphorylation; Nature of enzymes, Classification and nomenclature of enzymes, Kinetic analysis of enzyme catalyzed reactions.

Unit 7

Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, therapeutic interventions of uncontrolled cell growth.

Principles of Biotechnology

Unit 1-Principles of Gene Manipulation

Recombinant DNA Technology, Selection and identification of recombinant cells, Restriction Enzymes, DNA modifying enzymes, Cloning Vectors, Ligation, Gene transfer techniques, Gene therapy

Unit-2 Applications of Genetic Engineering

Single cell proteins. Biosensors, Biochips. Crop and livestock improvement, development of transgenics, Development of DNA drugs and vaccines, Microbes in human welfare