

**UNIVERSITY OF NORTH BENGAL**

**Department of Zoology**

**SYLLABUS for M. Phil Entrance Test  
2018-19**

**(ZOOLOGY)**

# SYLLABUS FOR M. Phil ENTRANCE TEST IN ZOOLOGY (2018-19)

## Non-chordates

Source of nutrition, types and structure of feeding organs, Feeding patterns in non-chordates, locomotory structures; hydrostatic movement in Cnidaria, Annelida and Echinodermata, Significance of segmentation with reference to locomotion, Respiratory pigments in non-chordates, Mechanism of respiration by gills, book lungs and tracheae, excretory products, structures and mechanisms of excretion in non-chordates, Osmoregulation in non-chordates Primitive and advanced type of Nervous system, Trend of neural evolution in Non-chordates Non-chordate larva: Types, structure and organization of non-chordate larval forms, Evolutionary significance of larval forms

## Chordates

Basic vertebrate body plan and characteristics, Mechanics of body support and movement, Ectothermic and Exothermic mode of life, Functional and evolutionary significance, cranial kinesis, intracranial mobility in feeding mechanisms; digestion in chordates, Respiratory system and its functional requirements; ventilator mechanisms in chordates, Heart and circulation in mammals; structure and evolution of portal system, structure and function of kidney in mammals, Aerodynamics and energetics of flying and gliding, Auditory system : Evolutionary changes and adaptive advantage, Evolution of cerebrum.

## Biochemistry

Protein structure and function, Kinetics, function, inhibition and regulation; Ribozymes and Deoxyribozymes, Carbohydrates : Structure and functions, Lipids : Storage lipids, Structural lipids in membranes, Lipids as signals, cofactors and pigments, Bioenergetics : Principle of bioenergetics, glycolysis and its regulation, Citric acid cycle and its regulation, oxidation of fatty acids, oxidative phosphorylation, electron-transfer reactions in mitochondria, Biosynthesis of carbohydrates, amino acids and nucleotides, Bio-transformations: Principle of detoxifications, Detoxifying enzymes, Phase I and Phase II reactions.

## Cell Biology

Eukaryotic Chromosome, Centromere, Telomere, Sequence organization of Non-coding DNA in Eukaryotes, Phases and Cell Cycle Control, Check points and regulation, Transcription and translation in Eukaryotes,  $Ca^{2+}$  dependent and  $Ca^{2+}$  independent cell-adhesion molecules, ECM, Integrins, Connexins, Apoptosis : Definition and features of apoptotic cells, apoptotic pathway: Receptor mediated and Mitochondria mediated pathways, Apoptosis and Disease,

## Genetics

Concept of Cistron, Benzer's experiment, Modern view of gene, Concept of homologous recombination, Site Specific Recombination: Ser/Tyr recombinase & mechanism of action, Microbial Transformation, Conjugation, Sexduction and Transduction, Operon, Trp operon, IS elements, transposons (Prokaryotes and eukaryotes), Retero elements, LINES and SINES, Gene mapping: Three point test cross, Southern hybridization, Northern hybridization In situ

hybridization, FISH, Somatic Cell hybridization and gene mapping, Molecular Marker: RFLP, RAPD, AFLP, and SNP.

### **Immunology**

Properties and Overview of Immune Responses, Cells and Tissues of the Immune System, Antigen, Antibody: Structural Features of Antibody molecule, Synthesis, assembly and expression of Ig molecules, Antibody diversity, BCR and B cell activation, TCR and T cell activation, Cytotoxicity, Complement, Cytokines, Interferons, Concept of Major Histocompatibility Complex of mouse and human, Antigen processing and presentation, MHC restriction, Concept of tolerance and autoimmunity, Hypersensitivity

### **Ecology**

Biotic community concept, ecological dominance, Community analysis, species diversity, ecotone and edge effects, Growth patterns, dynamics, life table, survivorship curve Doubling time, natality, mortality, age distribution, intrinsic rate of natural increase, oscillation, regulation, dispersal, concept of meta-populations, Characteristics, limiting factors, nutrient status, classifications of fresh water organisms, fresh water biota, lentic communities, lotic communities, zonation of rivers/ streams and wet lands. Terrestrial environment, terrestrial biota, bio-geographic regions, structure of communities, soil subsystem and vegetation subsystem

### **Insect Biology**

Insect Classification – Major order with characters and examples, trophic adaptations in insects Reproductive strategies in insects, Insect development and metamorphosis, Concept of pest status and classification of Pesticides, Introduction to major pests and vectors of medical, veterinary and agricultural importance from India, Influence of climate and environment change on insect & mite pests, Concept of integrated pest management

### **Aquaculture and Fisheries**

Aquaculture: Definition, scope and importance; Aquaponics; Aquaculture, Monoculture; Polyculture/ Composite fish farming; Integrated fish farming; Cage culture; Pen culture; Raceway culture; Water Recirculating System; Extensive, Intensive, Semi-intensive and Traditional systems of fish farming, Design, criteria (soil & water) and construction of aqua farms, Management aspects of cultivable fish ponds (Nursery, rearing and stocking), Basic cultural aspects of Ornamental fishes; Air-breathing fishes; Freshwater prawns and their prospects, Hypophysation technique; Concept of Bundh breeding and Synthetic Hormones (Ovaprim, WOVA-FH, etc.), Hybridization in Fishes; Basic concepts of selective breeding, androgenesis, gynogenesis, polyploidy, Viral, bacterial, fungal, protozoan, helminths and crustaceans – their symptoms and control remedies, Ideas on Air-embolism, Sunburn, Water quality parameters of significance to fish/prawn health, Definition and Characteristics of coldwater bodies, Adaptations of coldwater fishes, Major genera of coldwater fishes, Mariculture- Definition, scope and fisheries (Pearls and Edible Oysters).

## **Biotechnology**

Recombinant DNA technology: Restriction Endonucleases, Vectors, Cloning strategies, selection of recombinant DNA, DNA sequencing, PCR (basic knowledge), Genomic and cDNA libraries: constructions and screening, Expression Vectors and expression of fusion proteins, Transgenic Animals: production, prospects, advantages and disadvantages, Site directed mutagenesis: strategies and prospects, applications of recombinant DNA technology in human gene therapy, vaccine development, environmental bioremediation and protein engineering.

## **Taxonomy and Biosystematics**

Species and supra- and infra- specific categories, Chemical and Molecular Taxonomy, Phenetics and cladistics, Zoological nomenclature; application of important rules, Application of biosystematics (In war, pest & disease management and resource generation etc)

## **Biodiversity and Wildlife**

Definition and indices of biodiversity, Levels of biodiversity: genetic, species and ecosystem Values and uses of Biodiversity, Megadiversity and hotspots of Biodiversity, Threats to biodiversity, Definition of wildlife, Rationale for wildlife conservation, Classification of wildlife according to severity of threats, CITES, WWF, BLI, IUCN, BNHS, IOBP, WLII, Models of wildlife management and conservation with special emphasis on Eastern Himalayan & Terai Wildlife, *In Situ* and *Ex Situ* conservation: prospects and limitations, Socio-economic perspective of wildlife conservation, Socio-economic perspective of wildlife conservation

## **Development Biology and Gamete Biology**

Induction and competence, Paracrine factors, Cell surface receptors and their signal transduction pathways, Juxtacrine signaling, Early Drosophila development, Anterior-Posterior Polarity, Dorsal-Ventral Polarity, Chromosomal sex determination in Mammals, Drosophila, Environmental sex determination. Biology of sex determination and sex differentiation: a comparative account, Metamorphosis (The hormonal reactivation of development), regeneration, and aging, super ovulation. Hormonal regulation of ovulation, pregnancy and parturition, Development of gonads, Embryonic stem cells.

## **Biophysics**

Principles and uses of Spectrophotometer, Spectrofluorometer, Mass Spectrometry, Fluorescence and Confocal Microscopy, GFP, FISH, GISH, FRET, Principles of Column chromatography, GLC, HPLC, Ion-exchange chromatography, Gel exclusion chromatography, Affinity chromatography, Basic principles, PAGE, Agarose gel electrophoresis, 2-D gel electrophoresis, Sedimentation, Differential and Density gradient centrifugation, Crystallography and X-ray diffraction, Basic idea of NMR

## **Biostatistics**

Biostatistics/Biometry, Definition and utilization in biological studies, Basic concepts of: Terminologies used in biostatistics: Variable, Population, Data, Sample, Estimate, Measures of Central Tendency, Measures of Variation, Graphical representation of data, Hypothesis Testing and Students' "t" distribution, Probability Distribution: Concept of Probability, Binomial

Distribution and Poisson distribution, Simple Linear Regression and Correlation, Chi-Square Test, Analysis of Variance, Models: Definition, Classification, Usefulness.

### **Environmental Physiology**

The nature and levels of adaptation, Fundamental mechanisms of adaptation, Basic concept of stress and strain, stress avoidance, stress tolerance, etc., Concept of homeostasis, Respiratory pigments; Oxygen dissociation curves; Transport of oxygen and carbondioxide; Bohr effect, Root effect & Haldane effect; Physiology of diving birds and mammals, Patterns of circulatory systems in animals; Kinds of blood vessels; Conductive tissue systems of heart in mammals; Cardiac cycle; Concepts of Electro Cardio Gram (ECG); Blood pressure; Concepts of haemodynamics, Concept of excretory organs in animals; Gross anatomy of kidney in mammals; Glomerular Filtration Rate; Tubular reabsorption and secretion, Control of osmoregulation via ADH; Osmorgulation in aquatic and terrestrial animals, Concepts of terminologies used (Endotherm, Ectotherm, Homeotherm, Poikilotherm, Heterotherm, etc; Concept of Temperature Coefficient ( $Q_{10}$ ); Adaptations to cold and heat by aquatic & terrestrial animals; Adaptive Hypothermia and Adaptive Hyperthermia; Thermal Neutral Zone; Thermogenesis, Evaporative cooling.

### **Neurobiology**

Origin and Differentiation of neurons, Electrical potentials of Neurilemma and their molecular basis, Propagation of Nerve impulse along Neuritis and their molecular basis, Synapse: Synaptic transmission and Neuro modulation, Neurotransmitters: Classification, synthesis, release and functions, inactivation of Neurotransmitters, Neuro-endocrine integration: Components, orders and feedback regulation.

### **Evolutionary Biology**

RNA world and origin of life; Evolution of Multigene Family; Acquisition of new genes: Mechanisms , Neutral Hypothesis, Molecular clock; Biological and Phylogenetic species concept, Patterns and Mechanisms of reproductive isolation; Genetic basis of Reproductive isolation Models of Speciation: Allopatric, Parapatric, Sympatric;

### **Population Genetics**

Hardy-Weinberg law – Assumption, Derivation & application in population genetics, Destabilizing forces influencing allele frequencies: Mutation, Selection against recessive and recessive lethal, Selection against dominant, Heterozyote advantage, Migration, Genetic drift, Mutation-Selection Balance, Inbreeding: Measure of inbreeding, inbreeding depression, Heterosis, Genotype- environment interaction, phenotypic variance, Heritability.