PET SYLLABUS FOR SUBJECT ZOOLOGY- 2016

The syllabus consists of Section A and Section B as follows:

SECTION A: Research Methodology (50% Weightage)

UNIT I:

Research – Qualities of Research – Components of research Problems Characteristics of a good question , criteria of a problem statement , Difference between hypothesis and problem , Types of hypothesis , Types of error , Characteristics of α and β, Region of rejection , Decision rule – Various steps in scientific research – Types of research – Hypotheses Research Purposes- Research Designs

UNIT II:

Descriptive Statistics: Dealing with numbers- Understanding data, Frequency Distribution, Relative frequency. Dealing with graphs –Type of Graphs, Measure of central tendencies- Mean (Arithmetic mean ,Geometric mean , Harmonic mean and Weighed Mean). Median, mode. Measurement of dispersion or Variability – Measure of dispersion (Distance Deviation measure , Average deviation mean).

UNIT III

Probability: Types of probability, conditional probability, marginal probability, Bayes theorem. Probability distribution – Binominal, Poisson and Normal distribution and their properties, Central limit theorem, The Z score Sampling distribution. Estimate and Confidence Interval- Point Estimation Statistical interval based on a single sample, Confidence interval, precision and sample size. Correlation–Pearson correlation coefficient, Regression analysis. Chi Square tests, T – tests, Analysis of Variance – One factor and multi factor analysis. Design of Experiment – Completely randomized design – with fixed effect, with random effects. Randomized Complete Block Design.

UNIT IV

Principles and application of light, phase contrast, fluorescence, scanning and transmission electronmicroscopy, Cytophotometry and flow cytometry, fixation and staining. Application of immunological techniques. Principles and applications of gel-filtration, ion-exchange and affinity chromatography, Thin layer and gas chromatography, High pressure liquid chromatography (HPLC), Electrophoresis and electrofocussing, Ultracentrifugation (velocity and

buoyant density). 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.

UNIT V

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 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 spectroscopy.

SECTION B: Core Subject – Zoology. **(50% Weightage)**

UNIT I : Cell and Developmental Biology :

Structure and function of cells and intracellular organelles (of both prokaryotes and eukaryotes), Mechanism of cell division including (mitosis and meiosis) and cell differentiation; Cell-cell interaction, Dosage compensation and Structure of pro and eukaryotic cells, Membrane structure and function, Intracellular compartments, Structure and organization of membranes, Glyco-conjugates and proteins in membrane systems, ion transport/Na/K ATPase/Molecular basis of signal transduction in bacteria and animals, Model membranes, Leptosomes. protein sorting, secretory and endocytic pathways, Cytoskeleton, Nucleus, Mitochondria and chloroplasts and their genetic organization, cell cycle, Structure and organization of chromatin, polytene and lamphrush chromosomes, Dosage compensation and sex determination and sex-linked inheritance.

Antigen : Structure and functions of different clauses of immunoglobulin, 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 mechanism,

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 regulation of early embryonic development in Drosophila, Homeotic genes. Mechanism of sex determination.

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

UNIT II : Biochemistry and Physiology :

Structure of atoms, molecules and chemical bonds, Principles of physical chemistry, Thermodynamics, kinetics, dissociation and association constants, Nucleic acid structure, genetic code, replication, transcription and translation : Structure, function and metabolism of carbohydrates, lipids and proteins, Enzymes and coenzyme, Respiration and photosynthesis. 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 interactions, Primary structure of proteins and nucleic acids, Conformation of proteins and polypeptides (secondary, tertiary, quanternary and domain structure), Reverse turns and Ramachandran plot, Structural polymorphism of DNA, RNA and three-dimensional structure of tRNA, Structure carbohydrates, polysaccharides, glycoproteins and peptido-glycans, Helix-coil transition, Energy terms in biopolymer conformational calculation. Response to stress, Active transport across membranes, Plant and animal hormones Nutrition (including vitamins), Reproduction in plants, microbes, plant and animals, Sensory responses in microbes, plant and animals.

Mammalian organ systems, nutrition, digestion and absorption, Circulation (open and closed circular, lymphatic systems, blood composition and function), Muscular contraction and electric organs, Excretion and osmoregulation: Nerve conduction and neurotransmitter, major sense organs and receptors, Homeostasis (neural and hormonal), Bioluminescence, Reproduction.

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. Energy metabolism (concept of free energy), Thermodynamic principles in biology, Energy rich bonds, Weak interactions, Coupled reactions and oxidative phosphorylations, Group transfers, Biological energy tranducers, Bioenergetics.

Feeding, learning, social and sexual behavior of animals, Parental care, Circadian rhythms, Mimicry, Migration of fishes and birds, Sociobiology, Physiological adaptation at high altitude.

UNIT III : Genetics and Molecular biology :

Principles of Mendelian inheritance, chromosome structure and function, Fine structure of gene and regulation of gene expression, Linkage and genetic mapping, Extra-chromosomal inheritance (episomes, mitochondria and chloroplasts), Mutation, DNA damage and repair, chromosome aberrations, Transposons, Sex-linked inheritance and genetic disorders, Somatic cell genetics, Genome organization (in both prokaryotes and eukaryotes). (Structure of chromatin, coding and non-coding sequences, satellite DNA)

DNA replication, amplification and rearrangements. Regulation of gene expression in pro-and eukaryotes, Attenuation and antitermination, Operon concept, DNA methylation, Heterochromatization, Transposition, Regulatory sequences and transcription factors, Environmental regulation of gene expression. Organization of transcriptional units : Mechanism of transcription of prokaryotes and eukaryotes, RNA processing (capping, polyadenylation, splicing, introns and exons), Ribonucleoproteins, Structure of mRNA, Genetic code and protein synthesis.

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

UNIT IV : Evolutionary and Environmental biology :

Origin of life (including aspects of prebiotic environment and molecular evolution), Concepts of evolution, Theories of organic evolution, Mechanisms of speciation, Hardy-Weinberg genetic equilibrium, genetic polymorphism and selection, Origin and evolution of economically important microbes, plants and animals. Classification and comparative anatomy of protochordates and chordates, Origin, evolution and distribution of chordate groups : Adaptive radiation.

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

Concept and dynamics of ecosystem, components, food chain and energy flow, productivity and biogeochemical cycles, Types of ecosystems, Population ecology and biological control, Community structure and organization, Environmental pollution, Sustainable development, Economic importance of microbes, plants and animals.

Ecosystem dynamics and management: Stability and complexity of ecosystems, Speciation and extinction, 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.

Interactions between environment and biota, Concept of habitat and ecological niches, Limiting factors, 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 V: Systematic, Biodiversity and Parasitology:

Species concept, Biological nomenclature theories of biological classification, Structural biochemical and molecular systematics, DNA finger printing, numerical taxonomy, Biodiversity, characterization, generation, maintenance and loss, Magnitude and distribution of biodiversity, economic value, wildlife biology, conservation strategies, cryopreservation.

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 non-chordates, Larval forms and their evolutionary significance.

Important human and veterinary parasites (protozoans and helminthes), Life cycle and biology of *Plasmodium, Trypanosoma, Ascaris, Wuchereria, Fasciola, Schistosoma* and *Leishmania*, Molecular, cellular and physiological basis of host-parasite interactions.

Arthropods and vectors of human diseases (mosquitoes, lice, flies, and ticks), Mode of transmission of pathogens by vectors, Chemical biological and environmental control of arthropod vectors, Biology and control of chief insect pests of agricultural importance, Plant host-insect interaction, insect-pest management, useful insects, Silkworm.