ALIGARH MUSLIM UNIVERSITY, ALIGARH

FACULTY OF LIFE SCIENCE

SYLLABUS FOR

M.Sc. (Zoology)

Animal Diversity:

General characters and classifications: Protozoa (Protista), Porifera, Cnidaria, Platyhelminthes, Nematoda, Annelida Arthropoda, Mollusca and Echinodermata. Life cycle: *Plasmodium sp.*, *Trypanosoma sp.*, *Obelia sp.*, *Fasciola sp.*, *Caenorhabditis sp*. Cell types and canal system in Sponges. Digestive system: *Periplaneta sp.*, *Pheretima sp.* and *Pila sp*. Respiratory system: *Periplaneta sp.* and *Pila sp*. Excretory system of *Pheretima sp*. Nervous system of *Pila sp*. Water vascular system of *Asterias* sp. (Starfish). Reproductive system: *Periplaneta* sp. and *Pheretima sp*. Affinities and systematic position of Hemichordata.

General characters and classification of Phylum Chordata up to orders. Retrogressive metamorphosis in Urochordata. Lung fishes. Migration and Locomotion in fishes Parental care and Neoteny in Amphibians. Poisonous and Non-poisonous snakes. Poison apparatus and biting mechanism. Aerial adaptation in birds. Flight muscles and flight mechanism. Migration in birds. Egg laying, Marsupial and Aquatic mammals. Social organisation in Primates. Digestive, Circulatory and Urinogenital system of *Scoliodon, Uromastix* and *Oryctolagus.*

Evolutionary Biology and Animal Behaviour:

Concept of evolution. Types of micro and macro evolution. Origin of life: Theories of Spontaneous generation, Biogenesis, and Bio-chemical origin of life. Embryological and physiological evidences of evolution. Fossils: Formation, types and dating. Geological time scale. Homology and Analogy. Lamarckism and Neo-Lamarckism. Darwinism and Neo-Darwinism. Genetic drift, Mutation. Natural selection and their types. Types of speciation. Evolution of primates. Origin and evolution of Man.

Animal Behaviour: history and scope. Feeding, territorial, reproductive and defensive behaviour. Innate and Learning behaviour, habituation, socialbehaviour and Altruism. Allelomimetic and maladaptive behaviour in Animals.Biological clocks and biological rhythms. Neural and Hormonal control of behaviour, Communication in animals.

Biochemistry, Animal Physiology and Endocrinology:

Classification and nomenclature of carbohydrates. Synthesis and breakdown of glycogen. Characteristics and Nomenclature of Enzymes. Competitive and Non-competitive inhibition of enzymes. Classification and properties of amino acids. Primary, secondary, tertiary and quaternary structure of proteins. Types of saturated

and unsaturated fatty acids. Biosynthesis of saturated fatty acids. Mobilization of stored fats and β-oxidation. Carnitine shuttle and ketogenesis.

Macro- and micronutrients: significance and nutritional requirement. Physiology of digestion and assimilation. Blood composition, blood groups, and physiology of coagulation. Cardiac cycle. Breathing and gaseous exchange. Muscle contraction. Physiology of excretion, osmoregulation and thermoregulation. Nervous system; generation and conduction of nerve impulses; synaptic transmission and reflex action; structure and function of major sensory organs and sensory pathways. Reproductive cycles and their hormonal regulation; implantation, pregnancy, and parturition.

Endocrine glands:classification, synthesis, transport andmechanism of action of hormones. Hypothalamo-hypophyseal integration. Adenohypophyseal and neurohypophyseal hormones: structure and biological role. Synthesis, secretion, physiological functions and disorders of the hormones of thyroid, parathyroid, pancreas, adrenal and gonads. Hormones of the gastrointestinal tract, Pineal gland, ultimobranchial body, corpuscles of stannius, urophysis.

Applied Zoology:

Fish culture including polyculture of Indian major carps. Induced breeding in commercially important carps. Types of fish ponds and management of fish farms. Edible species of prawn, lobster and molluscs. Farming of prawn and pearl oyster. Sericulture, Apiculture, Lac culture and Vermiculture, and the diseases and natural enemy complex associated with them. Commercial breeds of poultry, their farming practices, and common diseases. Breeds of cattle and buffaloes. Dairy farming, dairy products, pasteurization techniques and their advantages. Processing of animal products like meat, leather, and wool. Pharmaceuticals from animals, management, and processing of animal by-products.

Developmental Biology and Reproductive Technologies:

History and basic concepts of Developmental Biology. Reproduction: Types and significance. Gametogenesis. Types of egg. Egg membranes. Fertilization. Planes and patterns of cleavage. Fate maps. Blastulation. Gastrulation. General account of tubulation. Fate of germ layers. Extra embryonic membranes. Placenta. Metamorphosis. Growth. Regeneration. Ageing. Teratogenesis. Amniocentesis. Infertility. Apoptosis.

Scope of reproductive technologies. Induced release of gametes. Assessment of sperm function; Superovulation. *In vitro* oocyte maturation. Cryopreservation of gametes and embryo. *In vitro* fertilization and embryo transfer. Different methods of contraception.

Comparative anatomy:

Comparative anatomy of integuments and their derivatives in vertebrates. Visceral arches, axial and appendicular skeleton, pelvic and pectoral girdles in vertebrates. Comparative anatomy of brain and heart, and their development in different vertebrates. Jaw suspensions in vertebrates and dentition in mammals. Circulatory, respiratory, and digestive systems in vertebrates. Types and developmental stages of kidney and their

ducts in anamniotes and amniotes. Comparative accounts of testes and ovaries from fishes to mammals.

Genetics, Molecular Biology and Animal Biotechnology:

Mendelian Laws. Gene interaction. Linkage and crossing over. Penetrance and expressivity. Chromosome structure and types. Chromosomal abnormalities (Structural and Numerical). Sex determination and sex-linked inheritance. Dosage compensation. Genomic imprinting. Cytoplasmic inheritance. Karyotype and Human genetic disorders. Pedigree analysis. Single gene disorders. Transposons. Hardy-Weinberg Law and its applications. Genetic polymorphism.

Structure and types of Nucleic acids. Conformational changes in DNA and RNA. Chromosomes and genes. repeat sequences. Packaging of DNA. Replication, enzymes and proteins. DNA repair system. Mutations. Transcription, translation, post transcriptional and translational modification. Regulation of gene expression in Prokaryotes and Eukaryotes.

Recombinant DNA technology and applications. Restriction endonucleases- types and classification. Cloning vectors characteristics and types. cDNA and genomic library. VNTR, RFLP, Molecular probes and labelling of nucleic acids. DNA fingerprinting. Gene transfer methods. Transgenic animals. Knockout mice, Green fluorescent proteins, Genome editing- CRISPR/Cas9, TALEN, ZEN, Vaccines and Therapeutics, Hybridoma. Stem cells- types and characteristics. Tissue regeneration and repair, Cell reprogramming.

Cell Biology, Histology and Immunology: General organisation of prokaryotic and eukaryotic cells. Plasma membrane: structure, function and models. Structure and function of nucleus and extra-nuclear cell organelles. Cell cycle: mitosis and meiosis. General classification and types of animal tissues. Structural organisation and functions of epithelial tissue and its modifications (surface and glandular modifications). Basement membrane. Cell junctions. Structure, organisation and functions of connective, muscular and nervous tissue. Muscle-tendon-bone attachment. Degeneration and regeneration of neurons.

Cells of the immune system. Organs of the immune system. Cell mediated and Humoral immunity. Major histocompatibilty complex, Antigen presentation. Complement system and its activation. Immunoglobulins: classes, structure and, function. Immunoprecipitation reaction techniques. Immuno-diffusion, rocket and counter current immunoelectrophoresis. ELISA, ELIspot, Immunoblotting. Monoclonal and polyclonal antibody production.

Ecology and Environmental Toxicology:

Definition and scope of ecology. Climatic factors: temperature, light and precipitation. Major biomes: animals' adaptations to extreme climatic conditions. Biogeographical zones and Island biogeography. Ecosystem types (terrestrial and aquatic), energy flow, and biogeochemical cycles. Primary productivity. Trophic levels, feeding guilds, food chains/food web, keystone species. Ecosystem stability, resilience, modelling, and simulation. Sampling methods. Population characteristics: survivorship curves, life

tables, growth patterns, regulating factors, dispersal, metapopulations, and life-history strategies. Human population and carrying capacity. Community characteristics, species interactions, Niche and its types, competitive exclusion, predator–prey dynamics (Lotka-Volterra model), Succession.

Environmental Toxicology: Definition, History and Scope. Air Pollution: Types, effects and control. Photochemical smog and Acid Rain. Water Pollution: Types, Effects, and Remediation. Solid Waste: Sources, effects, and management. Bio-indicators of pollution. Noise Pollution: Effects and Control. Environmental Carcinogens: Exposure and Effects. Radioactive Pollution and Safe disposal of Radioactive waste. Pesticide adverse effects and their mode of action. Nanotoxicology and Endocrine Disruptors. Toxicokinetics and Toxicodynamics; Bioconcentration and Biomagnification. Sublethal and lethal effects of toxicants from the individual to ecosystem level.

Biosystematics, Biodiversity and Climate change:

Classification and Systematics in Biological Sciences. Levels and recent trends in taxonomy. Species Concepts. Reproductive Isolation and Speciation. Classification approaches: Phenetic, Cladistic and Phylogenetic. Taxonomic characters and phylogenetics: Plesiomorphy, Symplesiomorphy, Apomorphy, Synapomorphy and homoplasy. Dichotomous Key, criteria and taxonomic publications. International Code of Zoological Nomenclature (ICZN): Principles and history of rules. Type Concepts. Law of Priority and their rules of application.

Basic concept and importance of biodiversity. α, β, γ diversity. Factors for the decline of biological diversity. Forest: Types and associated fauna. Biodiversity documentation: Red data book, Threatened and Endangered animals of India. Hotspots of India, Protection and conservation biodiversity. Role of government, NGOs, Public and educational institution in conservation programs. Global Warming: Greenhouse effect, depletion of ozone layer and mitigation. Climate Change. Solar flux at earth's orbit, Planetary energy balance and Seasonal variability.