EWING CHRISTIAN COLLEGE
PRAYAGRAJ

(An Autonomous Constituent P.G. College of Allahabad University)

DEPARTMENT OF ZOOLOGY

Choice Based Credit System Syllabus of P.G. (Zoology)

SEMESTER I

Paper I: Non-Chordata

UNIT I
Protozoa: Nutrition, Reproduction, Locomotory organs and locomotion
UNIT II
Porifera: Canal System, Skeletal system
UNIT III
Cnidaria: Metagenesis in Obelia, Polymorphism: Polypoid and medusoid form
UNIT IV
Platyhelminthes: Evolution of Parasitism, Tegument and tegumental organs
UNIT V
Annelida: Metameric segmentation, Trochophore larva- Structure and significance

Paper II: Non-Chordata

UNIT I
Arthropoda: Mouth parts and mode of feeding, Crustacean larvae-Structure and significance.
UNIT II
Insect Metamorphosis and its hormonal control,
UNIT III
Mollusca: Archimollusca (Ancestral Mollusca), Segmentation and Molluscan ancestry,
UNIT IV
Cephalopoda - Nervous system and sense organs
UNIT V
Echinodermata: Symmetry, Larval form and its significance

Paper III:Chordata

UNIT I
Chordata: Origin of Chordates, Origin of Gnathostomes
Pisces: Ostracoderms and Devonian fishes
UNIT II

Lung fishes (Dipnoi) and their peculiar features:
Amphibia: Origin of Tetrapoda
UNIT III
Reptilia: Origin of Reptiles, Mesozoic Reptiles, Skull of reptiles and its significance in classification of Reptilia
UNIT IV
Aves: Origin of Birds, Palate of BirdsUNIT V
Mammalia: Origin and evolution of Mammalia, Characteristic features-Montremes, Marsupials and Placentals

Paper IV:Evolution

UNIT I
Concept of organic evolution: Evolution of Protein and Nucleic Acid
Facts and theories of evolution: during pre- and Darwin era.
UNIT II
Evolution: a new synthesis: Developments and concept of synthetic theory,
Elemental forces of evolution, Mutation, Selection (types of selection, selection coefficient, selection in natural population), Genetic drift: Changes in gene frequency in small population;
Migration
UNIT III
Population genetics: Gene frequencies in Mendelian population, Hardy-Weinberg equilibrium,
Conditions forthe maintenance of genetic equilibrium
UNIT IV
The nature of reproductive isolation, genetic basis of isolating mechanisms
Concepts of species and models of speciation: allopatric and sympatric speciation
UNIT V
The polytypic species, subspecies and intraspecies categories
The role of hybridization in evolution: Definition and immediate effect of hybridization.

Paper V:Biostatistics

UNIT I
Population sample, random sample, tabular and graphical representation of data
UNIT II
Mean and standard deviation of grouped and ungrouped data
UNIT III
Binomial, Poisson and Normal distribution
UNIT IV
Tests of significance- t, F, Chi- square test, test for goodness of fit
Analysis of Variance
UNIT V
Correlation
Linear regression

SEMESTER II

Paper I:Ecology

UNIT I

Population growth: Exponential and logistic patterns of population growth, Intrinsic rate of natural increase [r], its determination and importance in population ecology.

UNIT II

Lotka- Volterra Model of interspecific competition. Modern concepts of Niche. Niche parameters. Niche overlap.

Biodiversity: Measures of species diversity. Global diversity patterns and mechanisms.

UNIT III

Law of thermodynamics as they relate to ecological energetic.

Food webs

UNIT IV

Biogeochemical cycles: Nitrogen, Phosphorous and Sulphur cycles in terrestrial and aquatic ecosystems.

Community organization and its dynamics. Energy flow models.

UNIT V

Ecological succession, its types and concept of climax.

Ecology of various habitats.

Remote sensing, Practical applications of ecology.

Paper II:Methodology & Instrumentation

UNIT I

Fluorescence and Electron Microscopy (SEM & TEM) with principles and working.

UNIT II

General laboratory methods, Autoradiography, radioactive labeling and counting i.e. liquid scintillation

UNIT III

Principles of chromatography and electrophoresis, centrifugation and ultracentrifugation

UNIT IV

UV- VIS Absorption Spectrophotometry, Spectroflurometry

UNIT V

Hydrobiological techniques for determination of inorganic ions in water (Na^+, K^+, Ca^{++}, Li^+, SO_4^-, PO_4^-, and Cl^-)

Instruments: Flame Photometer, Nephelometer.

Paper III:Animal Physiology

UNIT I

Ultrastructure of Muscle and its contraction

Nerve conduction and neurotransmitters

UNIT II

Major sense organs and receptors, electric organs

Excretion and osmoregulation
UNIT III
Homeostasis- neural and hormonal
Reproduction- Male and female reproductive physiology
UNIT IV
Bioluminescence
Active transport across membranes
UNIT V
Endocrinology: Glands, hormonal secretions and functions
Stress Physiology: High altitude and deep sea physiology
Signal transduction

Paper IV: Biochemistry

UNIT I
Thermodynamics: Elementary knowledge, oxidation-reduction,
Electrolytes: Concepts of buffer, Handerson-Hasselbach equation
UNIT II
Carbohydrates: Chemistry, Glycolysis, Kreb's cycle, oxidative phosphorylation, gluconeogenesis,
Hexose monophosphate pathway, glycogen metabolism, peptidoglycan,
UNIT III
Amino acid: Chemistry, properties and metabolism
Proteins; Structure-Primary, secondary, tertiary and quaternary structure, Ramchandran plot, protein isolation, Solubilities and protein targeting
UNIT IV
Lipids: chemistry, metabolism of fatty acid and cholesterols
Nucleic acids: Chemical nature, biosynthesis of nucleotides
UNIT V
Enzymes: Kinetics, inhibition, mechanism of action, Michaelis and Menton equation, isoenzymes
allosteric enzymes, ribozymes, Abzymes
Vitamins (fat and water soluble) and coenzymes: Structure and functions

Paper V:Biodiversity and Wild Life

UNIT I
Animal Taxonomy and Diversity Ecology
and Evolutionary BiologyConservation
Biology Quantitative Biology
UNIT II
Genomics and Biodiversity
Molecular Tools for diversity studies-Significance of Molecular Tools in Diversity and Conservation Studies- Barcoding, RT-PCR.
UNIT III
Wildlife habitat and species populationsThreat

of species extinction

Wildlife Health and Population Management; Wildlife Health; Population Management- Capture and Handling of Wild Animals

UNIT IV

Principles of forest management, forest and wildlife as natural resources. Conservation and sustainable development.

Over-exploitation of wildlife natural resources

UNIT V

Concept of conservation with special reference to forest and wildlife management

a) Conservation verses preservation
b) Conservation Genetics-Genetic management of threatened species
c) National Park tour, Wetland tour, High Altitude Techniques tour, and
d) Management and Conservation Practice
e) Values of biodiversity and conservation ethics
f) Significance of ecological restoration in conservation
g) Role of zoos, aquariums and botanic gardens in conservation, Concept of stakeholders. Internationalconservation bodies; IUCN, UNDP, FAO, WWF

SEMESTER III

Paper I:Formal and Experimental Embryology

UNIT I

Descriptive embryology with particular reference to frog and chick

Egg types; Cleavage Patterns; Fate maps; Morphogenetic movement and formation of germ layers;

Gastrulation in amphibian and birds

UNIT II

Organizer concept: Properties and physiology of organizer; Primary Organizer and Primary Induction, neurulation . Secondary Induction: Development and patterning of vertebrate limb, proximal- distal and dorso- ventral axis formation, Involvement of pattern forming genes

UNIT III

Metamorphosis in frogs, hormonal regulation

Regeneration (Epimorphic/Morphallactic)

Regeneration of the amphibian limb

Regeneration in Hydra

UNIT IV

Foetal membranes: Placentation in animals: Types and functions

Teratogenesis: environmental assaults on development; teratogenic agents; teratological abnormalities

UNIT V

Experimental Embryology: Basic Concepts

Standard techniques and methods of experimental embryology:

Experiments on the analysis of early development and differentiation (Experiments of Spemann and Mangold) vital dyeing, extirpation, isolation, transplantation

Role of nucleus, cytoplasm and yolk

Paper II:Animal Behaviour

UNIT I
Definition and general mechanism of animal behaviour
Major contribution of scientists: In classical ethology and modern behavioural biology
UNIT II
Modern concepts of animal behaviour: Ethological, Psychological and Evolutionary
Methods of study of animal behaviour: In wild and laboratory environment, Neuroanatomical, Neurophysiological and Neurochemical approach
UNIT III
Development of behaviour: Innate and Learned; Comparative account on characteristics of instinct and learning; Types of fixed action patterns (FAPs); Neuro-genetic mechanism of instinct
UNIT IV
Learning and Memory: Classification or forms of learning and memory, Neural mechanisms of learning and memory
UNIT V
Evolution of behaviour, Hormones and behaviour, Motivation and behaviour

Paper III:Biotechnology

UNIT I
Recombinant DNA technology: Introduction, Restriction endonucleases and applications, other useful enzymes for molecular cloning, steps in gene cloning, identification and isolation of desired gene.
UNIT II
Cloning vectors, screening and selection of recombinant DNA clones, gene probes as diagnostic. tools, biosynthesis of insulin, somatostatin and growth hormone
UNIT III
Tissue culture, hybridoma technology and monoclonal antibodies: Cell culture, organ, cultures, culture media, embryonic stem cell transfer, targeted gene transfer, in vitro fertilization in humans, embryo transfer in cattle, applications of embryo transfer technology, animal cloning
UNIT IV
Environmental biotechnology: Bioconversions, pollution control, microbial enhancement of oil recovery, microbial mining and metal recovery, sewage treatment
UNIT V
Health care biotechnology: gene replacement therapy
Miscellaneous: An introductory knowledge of biosensors, biochips, DNA fingerprinting, Immobilized enzymes, bioenergy, genomic DNA libraries

Paper IV:Molecular Biology

UNIT I

Molecular analysis of eukaryotic DNA- overall composition, reassociation kinetics, kinetic analysis of eukaryotic DNA,
Nucleotide polymerases, DNA replication, repair and mispair mechanisms
UNIT II
The basic transcription apparatus, promoters, enhancers, termination and antitermination
Organisation of eukaryotic genes-globin gene, IgG, r DNA, histone gene
UNIT III
Genetic code, protein synthesis, translation, m-RNA processing and organization of interrupted genes, Ribonucleoproteins, organelle genomes.
UNIT IV
Structure and life cycles of bacteriophage T2 or T4 virulent and temperate phages,
phage mutants and their importance
RNA phages, tumour viruses and their life cycles, retroviruses,
Topoisomerases, gyrases, methylases, nucleases
UNIT V
Molecular biology of cancer: Oncogenes, chemical carcinogenesis
Genetic and metabolic disorders, Principles and methods of gene targeting, gene silencing

Paper V: Entomology: Morphology and Embryology

UNIT I
General structure of Head, Thorax and abdomen
UNIT II
Structure and functions of insect cuticle.
Structure and functions of the fat body.
UNIT III
Structure of insect egg. Blastoderm formation, germ band, blastokinesis and three germ layers.
UNIT IV
Various types of larvae and pupae, significance of pupal instar in insects.
UNIT V
Metamorphosis.
Pheromones

SEMESTER IV

Paper I: Bioinformatics

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

Sequence alignment (Global & Local), Algorithms used (Dynamic & Heuristic) - Needleman Wunsch, Smith Waterman BLAST, FASTA

UNIT III

Trees: Rooted and unrooted trees

Species Tree and Gene Tree: Homology, Homoplasy, Orthology, Paralogy and Xenology

Trees Construction Methods: Maximum Parsimony, Maximum Likelihood, Branch and Bound

UNIT IV

Fitch- Margoliash method and distance based methods.

Distance based methods: Least squares, Neighbor joining, UPGMA

UNIT V

Bootstrapping and split decomposition; Concepts and its application in tree construction

Application of Phylogeny; Evolutionary study, Pedigree analysis.

Elective
Entomology

Paper II: Insect Physiology

UNIT I

Alimentary canal and digestion in insects.

UNIT II

Structure and function of Malpighian tubules.

UNIT III

Structure and function of insect spiracle. Respiration in aquatic and endoparasitic insects.

UNIT IV

Composition and function of haemocytes.

Diapause.

UNIT V

Endocrine glands and insect hormones.

Paper III: Taxonomy and Economic Entomology

UNIT I

Modern classification of insects with special reference to that of different economically important orders (Lepidoptera, Diptera, Coleoptera).

UNIT II

Biology, nature and extent of damage and control of pests of paddy, sugarcane and cotton

UNIT III

Pests of stored products.

UNIT IV

Beneficial insects- honeybee

UNIT V

Beneficial insects- silkworm.

Paper IV: Toxicology

UNIT I
Study of different types of insecticides- Organophosphates, carbamates, botanical insecticides.
Methods of application of insecticides
UNIT II
Hazards of insecticides, precautions and antidotes, fumigants.
UNIT III
Principles of biological control-parasites, predators and pathogens affecting insect pests and the efficacy in controlling the insect pests.
UNIT IV
Principles and components of integrated pest management (IPM), Chemosterilants.
UNIT V
Autocides including 3^{rd} and 4^{th} generation pesticides.

Paper V: Project / Seminar Presentation