Biology

Paper - First

No. of Questions : 150 Time : 03 Hours

1. DIVERSITY IN PLANTS & ANIMALS.

(a) DIVERSITY IN PLANTS

- General concept of microorganisms. Morphology, structure, reproduction and life cycle of bacteria and viruses.
- Structure, reproduction and life cycle and economic importance of fungi.
- Classification of fungi with characteristic features of Myxomycotina, Mastigomycotina, Oomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.
- Concept of disease, symptoms of plant diseases, methods of infection.
- Brief account of structure, disease cycle and control methods of damping off, wilt, root rot, stem rot, powdery and downy mildews, rust, smuts, leaf spots and leaf blights.
- Economic importance of microbes.
- Classification and Economic importance of algae.
- Salient features of Protochlorophyta, Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta and Cyanophyta.
- General account of various life cycles in algae.
- General account of morphology, structure, reproduction and life history of bryophytes.
- Classification and economic importance of bryophytes.
- Classification and Economic importance of pteridophytes.
- Morphology and life history of Psilophytopsida, Psilotopsida, Lycopsida, Sphaenopsida and Pteropsida.
- Classification and Economic importance of Gymnosperms.
- Morphology and life history of Pteridospermales, Bennetitales, Cycadales, Gingkoales, Coniferales, Taxales, Ephedrales, Welwitschiales and Gnetales.
- Important systems of classification of Angiosperms (Bentham and Hooker, Hutchinson and Cronquist).
- Role of anatomy, embryology, cytology, phytochemistry and palynology in taxonomy.
- Distinguishing features of Ranunculaceae, Magnoliaceae, Rutaceae, Fabaceae, Rosaceae, Apiaceae, Asteraceae, Primulaceae, Asclepiadaceae, Lamiaceae, Verbenaceae, Convolvulaceae, Acanthaceae, Solanaceae, Amarnthaceae, Euphorbiaceae, Orchidaceae, Cyperaceae and Poaceae with their economic importance.

(b.) DIVERSITY IN ANIMALS

- General characters and classification the following phyla up to classes: Protozoa, Porifera, Coelenterata, Platyhelmenthes, Aschehelmenthes, Annelida, Arthropoda, Mollusca, Echinodermata and Chordata.
- Locomotion in Protozoa.
- Canal system in Porifera,
- Polymorphism in Coelenterata,
- Parasitic adaptations in Helmenthes
- Social life in insects.
- Affinities of Hemichordata, Cephalochordata, Urochordata.
- Parental care in Amphibians.
- Poisonous & non poisonous snakes.
- Migration in birds.
- General Characters of Prototheria , Metatheria and Eutheria with affinities.

2. EVOLUTION AND BEHAVIOUR

- Lamarckism and Darwinism, adaptations, struggle, fitness and natural selection; Mendelism; The evolutionary synthesis, evidences of organic evolution.
- Origin of basic biological molecules; abiotic synthesis of organic monomers and polymers; concept of Oparin and Haldane; experiment of Miller (1953); the first cell; evolution of prokaryotes; origin of eukaryotic cells; evolution of unicellular eukaryotes; anaerobic metabolism, photosynthesis and aerobic metabolism.
- Geological time scale, major events in the evolutionary time scale; origins of unicellular and multi cellular organisms; major groups of animals; major fossil records, evolution of horse, elephant and man.
- Concepts of neutral evolution,

3. PLANT AND ANIMAL PHYSIOLOGY

(a) PLANT PHYSIOLOGY

- Plant water relations: diffusion, osmosis, water potential and its components, plasmolysis, imbibition and absorption of water, root pressure and ascent of sap.
- Water loss in plants: Transpiration and its significance, factors affecting transpiration, mechanism of stomatal opening and closing, guttation.
- Mineral Nutrition- Essential elements, macro and micro nutrients, criteria of essentiality of elements, role of essential elements, mineral deficiency symptoms, transport of ions across cell membrane, active and passive transport.
- Photosynthesis in plants.
- Aerobic and anaerobic respiration, glycolysis, Krebs cycle (Citric acid cycle) , oxidative phosphorylation, electron transport system, fermentation, RQ.
- Nitrogen fixation, nitrate and ammonium assimilation; amino acid biosynthesis.

- Plant Growth Regulators – Physiological effects and mechanism of auxins, gibberellins cytokinins, ethylene, abscissic acid, polyamines, jasmonic acid; hormone receptors and vitamins.
- Photoperiodism and its significance.
- Biosynthesis of terpenes, phenols, nitrogenous compounds and their role.
- Responses of plants to biotic and abiotic stresses.

(b) ANIMAL PHYSIOLOGY

- Comparative anatomy of heart; myogenic & neurogenic heart, cardiac cycle, cardiac output, stroke volume, blood pressure, hormonal and neural regulation of heart.
- Morphological types of neurons, origin and physiology of transmission of nerve impulse.
- Types of nitrogenous wastes in animals, physiology of urine formation in mammals.
- Types of enzymes and vitamins and their significance in human physiology.
- Endocrine glands, their secretions and functions.
- Physiology of digestion in man.

4. ECOLOGY

- Types, structure and functions of ecosystems(Aquatic, terrestrial).
- Energy flow, and nutrient cycling (N, P, C,O) food chain, food web and ecological pyramids.
- Population Ecology: Characteristics, population growth curve, population regulation, demes and dispersal.
- Community ecology: Structure and organization, attributes, nomenclature.
- Ecological Succession : Types, mechanism, changes involved in succession.
- Environmental Pollution : Air, Water, noise, nuclear (sources, effects and mitigation).
- Biodiversity: Genetic, species and ecosystem, Value of biodiversity, causes of depletion of biodiversity and its conservation (intrinsic and extrinsic conservation).

Biology

Paper - Second

No. of Questions: 150 Time: 03 Hours

1. CYTOLOGY AND GENETICS

- Composition, structure, function and metabolism of carbohydrates, lipids, proteins, nucleic acids, vitamins and pigments.
- Classification of enzymes, enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis, isozymes and coenzymes.
- Primary, secondary and tertiary structures of proteins.
- Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport.
- Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, structure & function of cytoskeleton and its role in motility.
- Structure of chromosomes and giant chromosomes.
- Mitosis and meiosis, cell cycle, regulation and control of cell cycle.
- Unit of replication, enzymes involved, extrachromosomal replicons, DNA damage and repair mechanisms.
- Structure of nucleic acids: Helix (A, B, Z).
- RNA synthesis and processing.
- Mendelian principles: Dominance, segregation, independent assortment. Inheritance and variation.
- Concept of gene: Allele, multiple alleles, pseudo alleles.
- Extension of Mendelian principles : Codominance, incomplete dominance, gene interactions, linkage and crossing over, sex linkage, sex influenced characters; mutation, its types and causes.
- Extra chromosomal inheritance: Inheritance of mitochondrial and chloroplast genes, maternal inheritance.
- Structural and numerical alterations of chromosomes: Deletion, duplication, inversion, translocation, ploidy.
- Recombination: Homologous and non-homologous recombination including transposition.

2. BIOTECHNOLOGY

- Different types of microorganisms.
- Brief idea of techniques and scope of genetic engineering.
- Gene cloning: concept and basic steps, application of bacteria and viruses in genetic molecular biology of *E.coli* and bacteriophages in the context of their use in genetic engineering.
- Plant cell, tissue and organ cultures, tissue culture techniques, collection and storage of germplasm (cryopreservation), application of plant tissue culture. Transgenic plants.
- Bio fertilizers and biological control in fields.

- Elementary idea of Genetically Modified Food Crops, Nano biotechnology, PCR, RTPCR, Gene library, Gene Bank.
- Types of Molecular markers and their role.

3. METHODS IN BIOLOGY

- Molecular Biology and Recombinant DNA methods: Analysis of RNA, DNA and proteins by one and two dimensional gel electrophoresis, Isoelectric focusing gels.
- Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems. Expression of recombinant proteins using bacterial, animal and plant vectors. Isolation of specific nucleic acid sequences.
- Generation of genomic and cDNA libraries in plasmid, phage, cosmid, BAC and YAC vectors.
- Protein sequencing methods, detection of post translation modification of proteins. DNA sequencing methods, strategies for genome sequencing. Methods for analysis of gene expression at RNA and protein level, large scale expression, such as micro array based techniques.
- Isolation, separation and analysis of carbohydrate and lipid molecules, RFLP, RAPD and AFLP techniques.
- Statistical Methods: Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric, confidence interval; errors; levels of statistics; significance, regression and correlation; t-test; analysis of variance; X^2 test.
- Microscopic techniques: Visualization of cells and subcellular components by light microscopy, resolving powers of different microscopes, microscopy of living cells, scanning and transmission microscopes.
- Methods in field biology: Methods of estimating population density of plants, ranging patterns through direct, indirect and remote observations, sampling methods in the study of behaviour, habitat characterization: ground and remote sensing methods.

4. REPRODUCTION AND DEVELOPMENT IN PLANTS AND ANIMALS

(a) REPRODUCTION AND DEVELOPMENT IN PLANTS

- Pollination, fertilization and development of endosperm.
- development of embryo in plants
- Seed formation.
- Structure of ovule
- Megasporogenesis development and organization of embryo-sacs.

(b) REPRODUCTION AND DEVELOPMENT IN ANIMALS

- Gametogenesis, fertilization and early development in frog, chick and mammals, blastula formation, gastrulation and formation of germ layers in animals. Zygote formation embryogenesis.

- Development of eye, brain and heart in chick.
- Classification of placenta, physiology and functions of placenta in mammals.
- Types of metamorphosis and its hormonal control in animals.
- Extra embryonic membranes in chick.

5. APPLIED BIOLOGY

- Fibre yielding plants, medicinal and aromatic plants.
- Important timber - yielding plants and non-timber forest products (NTFPs) such as bamboos, gums, tannins, dyes, resins, beverages and ornamental plants.
- Intellectual Property Rights.
- Microbial fermentation and production of small and macro molecules.
- Application of immunological principles, vaccines, diagnostics. Tissue and cell culture methods for plants and animals.
- Transgenic plants and animals, molecular approaches in diagnosis and strain identification.
- Genomics and its application to health and agriculture, including gene therapy.
- Aims, objectives and basic techniques of plant breeding.
- Crop improvement methods- plant introduction, selection, acclimatization, hybridization, vegetative propagation and grafting.
- Hybridization: Interspecific and inter-generic, pure line, back cross hybridization, self- incompatibility system.
- Breeding in plants and animals, including marker – assisted selection
- Common parasites and pathogens of humans and domestic animals.
- Sericulture, apiculture, lac culture, vermiculture, pearl culture and fish culture.
- Insects used in medicines, bio-control and food.
- Integrated pest management.