

## Syllabus for written examination for PGT (Biology)

### Diversity of living world

Taxonomic aids, keys, specimen management ; Systematic and binomial system of nomenclature; Classification of living organisms( five kingdom classification, major groups and principles of classification within each group) ; General description of monera, protozoa, fungi, algae, bryophytes, pteridophytes, gymnosperms, angiosperms ( major groups of angiosperms upto sub class) ; Botanical gardens ,herbaria, zoological parks and museums .Salient features of animal ( nonchordates up to phylum level and chordates up to class level).

### Structural organisation in plants and animals

Morphology, Anatomy and histology of angiosperms: Root , stem , leaf, flower , inflorescence, fruits and seeds, Tissues : Meristamatic and permanent ( epidermal, ground, vascular). Cambial activity, secondary growth, type of wood. Animal tissues ; Morphology, Anatomy and histology of annelids , insects , amphibians.

### Structural and functional organization of cell

Cell cycle , detailed study of Cell division (mitosis , meiosis) ; Cell death ; Structure and function( metabolism) of carbohydrates, proteins, lipids and nucleic acids ; Enzymology : Classification and nomenclature of enzymes ; Structure ; Mechanism of action, single substrate and bisubstrate enzyme ; Activators and inhibitors of enzymes ; Factors affecting the activity of enzymes.

### Plant physiology

Water relations: Properties of water, water in tissues and cells, Transport of water and solutes( food, nutrients, gases) : Transport across cell membrane ; soil-plant-atmosphere continuum ; Minerals required by plant, their absorbable form, functions, deficiency symptoms, essentiality of mineral, N<sub>2</sub> metabolism, biological fixation ; Cellular Metabolism: Gluconeogenesis, Glycogenesis and glycogenolysis, hormonal regulation ; Oxidation of food, respiratory efficiency of various food components ; transport and detoxification of ammonia , Lipid Metabolism ; Photosynthesis: Basic principles of light absorption, excitation energy transfer, electron transports, cycles ( C<sub>2</sub> , C<sub>3</sub> , C<sub>4</sub> , CAM ), plant productivity, measurement of photosynthetic parameters ; Physiological responses to abiotic stresses ; Sensory photobiology ; Plant growth regulators : Growth , differentiation / de-differentiation and re-differentiation, development ; Physiological affects and mechanism of action of plant growth hormones, Flowering : Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development, vernalisation ; Plant movements.

### Human biology

Morphology, Anatomy, Histology, Physiology, Control and Disorders of Digestion, Respiration, Body fluids and Circulation, Excretion, Skeleton system & muscle, Nervous; Physiology of high altitude.

### Sexual Reproduction

Plants: Structural details of angiospermic flower, development of gametophytes, pollination and its types, agencies of pollination, pollen- pistil interaction, fertilization, Artificial hybridization (emasculation and bagging) development of seed and fruit ; Apomixis and Polyembryony ; Self incompatibility: Structural and biochemical aspects; methods to

overcome incompatibility; Experimental Embryology; Human Reproduction: Morphology, Anatomy, Histology and Physiology of reproduction; Neuro-endocrine control; Sexual behavior in infancy, pre-adolescence, adolescence and of adult; Implantation, Pregnancy and Parturition; Mammary gland and Lactation; Infantile mammary gland, pubertal changes in mammary gland; Structure of adult mammary gland, galactopoiesis, milk let down; Menopause. Senescence – Impact of age on reproduction. Foetal and Embryonic Gonads and Genital ducts; Hormonal basis of sex differentiation; Disorders of sexual differentiation development; Reproductive Health: Problems and strategies, Population explosion – causes and effects, birth control measures- natural methods, physical / barrier, bio-chemical, hormonal, immunological, surgical methods, IUD's, amniocentesis, female feticide, MMR, IMR, MTP, STD's, infertility Disorders of female and female reproductive systems – Sexual dysfunction; Infertility – Causes and curative measures; Reproductive toxicology of environmental and industrial chemicals, drug and alcohol; Medically assisted human reproductive technologies, GIFT, IUT, ZIFT, TET; Embryo culture.

### **Genetics**

Principles of Inheritance and Variation: Mendelian genetics, Inheritance of one gene, two genes, post mendelian inheritance; Recombination frequency, chromosomal theory of inheritance; Drosophila genetics, linkage and recombinations; Mutation: General properties of mutations; Adaptation versus mutation; molecular basis of gene mutation: DNA repair mechanisms; Pedigree analysis; Human karyotype-banding; genetic and environmental basis of sex determination, Y- and X-linked genes; Numerical and Structural abnormalities of human chromosomes and related syndromes; Human metabolic disorders; Molecular Basis of Inheritance: Chemical nature of DNA and RNA, Biological functions of nucleic acids; Search for genetic material, RNA world; Replication; Transcription and processing of RNA, Genetic code; Translation, post-translational modifications; Ribosomes and Proteins; Regulation of Gene expression; DNA Fingerprinting; Gene mapping; Chromosome banding; Restriction enzyme, nucleotide sequence comparisons and homologies; Molecular clocks; Genetics in modern agriculture, animal breeding, medicine, human behaviour; Misuse of genetics; Genetic Counseling; Gene therapy; HGP; Gene Activity in prokaryotes and eukaryotes; Signals for gene control – Hormones and growth factors; Totipotency & Pleuripotency; Stem cell and Gene therapy; Bacterial transformation, transduction and conjugation, Bacterial chromosome; Bacteriophages: Types, structure and morphology; Evolutionary biology: Cosmic evolution – Physical basis of life; Theories of origin of life; Origin of life through biochemical evolution; Experimental evidences for origin of life; The origin of natural selection; Extraterrestrial life; Evolution of the eukaryotic cell: Evolution of the Metazoa; Evolution of chordata and the evolution of the major vertebrate classes; Origin and evolution of man: Population Genetics; Genetic variations; Polymorphism; Gene frequency; Hardy Weinberg equilibrium; Genetic drift, founder effect; adaptive radiations, ecological significance of molecular variations.

### **Biology in Human welfare**

Health and disease; types of diseases, common diseases in humans; Immunology – Innate and Acquired immunity; Passive and active immunization; Organization and structure of lymphoid organ; Cells of the immune system and their differentiation; Lymphocyte traffic; Nature of immune response; Structure and Functions of antibodies: Antigen-Antibody interactions; Humoral immune response; Cell mediated immunity; Immunological memory; Auto-immunity; Allergies; HLA system in human: MHC haplotypes; Transplantation types and problems; Immunodeficiency disorders; etiology of HIV; types, genetics and biochemistry of cancer; Drugs and alcohol abuse, Addiction, drug dependence, ill effects, prevention, its abuse in adolescents and its management; Strategies for food production and enhancement; Animal husbandry, management of farm animals, breeding strategies ( natural and artificial)

and their types, economic importance of each ; Plant breeding, method of release of new variety, HYV of common cereals and pulses, bio-fortification, SCP ; Tissue culturing, somatic hybridization; Microbes in Human Welfare: Technology associated and use of Microbes in household, industries, medicine, bio-active molecules, sewage treatment and STP, Ganga and Yamuna action plan, biogas production, biocontrol agents, biofertilizers.

### **Principles of Biotechnology**

Genetic engineering tools and technique, technique of separation and isolation of DNA, cloning vectors, electrophoresis, bio reactors, processing of its products. Tissue engineering ; Cryopreservation ; Fusion methods, detection and applications of monoclonal antibodies, DNA vaccines, Edible vaccines.; Application in agriculture : GMO for pest resistance, RNAi and dsRNA technology, Application in Medicine, genetically engineered products, gene therapy. Molecular diagnosis : serum and urine analysis, PCR, ELISA ; Transgenic animals : their physiology, biological products and their use for testing the safety of vaccine and chemicals ; Bioethics issues ; biopiracy.

### **Ecology**

Organism and its environment, distribution of biomes, major physical factors and the physiological responses shown by organisms ; Physical adaptation of plants and animals, rules governing adaptations ; Population attributes and growth, logistic curves, Darwinian fitness ; Population interactions and their theories ; Ecosystem structure and functions, ecosystem productivity and standing crop, decomposition in nature, energy flow in GFC / DFC, ecological pyramids, succession of community ; Nutrient cycle ; ecosystem services ; Biodiversity types and its patterns, importance of diversity, its loss and their causes, conservation strategies ; Environmental issues : Types of pollution, their indicators, causes, effects, prevention and treatment ; Deforestation, recommended forestation, reforestation, case studies of people's participation in conservation.