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 up to sub class) ; Botanical gardens ,herbaria, zoological parks and museums .Salient features of animal ( no chordates up to phylum level and chordates up to class level).

**Structural Organization in plants and animals**

 Morphology, Anatomy and histology of angiosperms: Root , stem , leaf, flower , inflorescence, fruits and seeds, Tissues : Meristematic 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 substrate 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, N2 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 ( C2 , C3, C4, 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 effects and mechanism of action of plant growth hormones, Flowering : Photoperiodism and its significance, endogenous clock and its regulation, floral induction and development, vernalization ; 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 angiosperm 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, galactopoietic, 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 recombination’s ; 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 behavior ; Misuse of genetics ; Genetic Counseling ; Gene therapy ; HGP ; Gene Activity in prokaryotes and eukaryotes ; Signals for gene control – Hormones and growth factors ; Totipotency & Pluripotency ; 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 Metazoan ; Evolution of chordate 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.