

Sardar Bhagwan Singh University, Balawala, Dehradun

Syllabus for Ph.D. entrance examination 2021 (BOTANY)

PLANT DEVELOPMENT AND REPRODUCTIVE BIOLOGY: Shoot development: Organization of the shoot apical meristem (SAM); cytological and molecular analysis of SAM; control of cell division and cell to cell communication. Reproduction: Vegetative options and sexual reproduction; flower- a modified shoot, structure, functions; structure of anther and pistil; Genetics of floral organ differentiation.

CYTOGENETICS AND MOLECULAR BIOLOGY: Plasma membrane: structure models and functions; sites for ATPases, ion carriers, channels and pumps, receptors. Mitochondria and chloroplast: Structure, genome organization, gene expression. Nucleus: structure, nuclear pores, nucleosome organization. Structural and numerical alterations in chromosomes: Origin, occurrence, production and meiosis of haploids, aneuploids and euploids, induction and characterization of trisomics and monosomics. Gene structure and expression: Genetic fine structure, cis-trans test; fine structure analysis of eukaryotes, introns and their significance, regulation of gene expression in prokaryotes and eukaryotes. DNA damage and repair mechanism, defects in DNA repair; Initiation of cancer at cellular level, proto-oncogenes and oncogenes.

PLANT BREEDING: Hybridization: Interspecific and inter generic; pure line; back cross hybridization; self-incompatibility system. Heterosis: Its genetic and physiological basis. Breeding for resistance to diseases, physiological races. Role of mutation in crop improving and evolution.

PLANT PHYSIOLOGY AND BIOCHEMISTRY: Photophysiology and photosynthesis: General concepts and historical background, evolution of photosynthetic apparatus, photosynthetic pigments and light harvesting complexes, photo oxidation of water, light reaction, Z scheme and photophosphorylation, mechanism of electron transport, carbon assimilation – the Calvin cycle, photorespiration and its significance, the C₄ cycle, the CAM pathway, factors of photosynthesis. Respiration and lipid metabolism: Overview of plant respiration, glycolysis, the TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidation system, photorespiration. Nitrogen fixation, nitrogen and sulphur metabolism: Overview, biological nitrogen fixation, nodule formation and nod factors, mechanism of nitrate uptake and assimilation, sulfur uptake, transport and assimilation.

RECOMBINANT DNA TECHNOLOGY: Scope of rDNA technology in various sectors, Vehicles: Plasmid and Bacteriophage; Purification of DNA: total DNA, plasmid DNA and bacteriophage DNA; enzymes used in manipulation of purified DNA. Cloning vectors based on *E. coli* plasmids, cloning vectors based on M13 bacteriophage and λ bacteriophage, vectors for genomic library construction, vectors for other bacteria. Vectors for yeasts and other fungi, higher plants, animal cells. Scope of rDNA technology in various sectors, Vehicles: Plasmid and Bacteriophage; Purification of DNA: total DNA, plasmid DNA and bacteriophage DNA; enzymes used in manipulation of purified DNA. Cloning vectors based on *E. coli* plasmids, cloning vectors based on M13 bacteriophage and λ bacteriophage, vectors for genomic library construction, vectors for other bacteria. Vectors for yeasts and other fungi, higher plants, animal cells. Transformation and identification of recombinants, transfection and identification of recombinants, transformation of non-bacterial cells.