

Biochemistry & Cell Biology (3 Cr.) Cell structure, biological molecules (Carbohydrates, Lipids, Proteins, Nucleic acids and Energetic molecules), structure and types of amino acids, role of structural & enzymatic proteins in living cells, molecular modification in post synthesis of proteins, ribosome, structure and chemical composition of cell wall and cell membrane, mitochondria & respiration cycle, analytical reactions for energy production (Glycolysis, Fermentation, Citrate cycle), chloroplast and photosynthesis, role of golgi apparatus in cells, lysosome and microbodies in cell biology, cellular genetic (Chromosome, mitosis and meiosis), specialties in plant cells.

Bioinformatic (2 Cr.) Definition and application of bioinformatics, definition and structure of database, varieties of database, database search for DNA and protein sequences, alignment of sequences, primer designing softwares, sotwares for calculation of DNA and protein characteristics (Physico-chemistry features, Signal peptide, post translation modification, motives and flanking regions, secondary structure), softwares for analysis and graphical observation of protein and DNA structure, analysis of molecular data (Calculation of similarity and genetic distance, Cluster analysis, Analysis of Molecular Variance (AMOVA) and parameters of population genetic).

Molecular Markers (2 Cr.) Definition and kinds of markers, morphological, biochemical and DNA related markers, hybridization based markers, PCR based markers (RAPD, AFLP, SSR, ...), marker assisted selection, construction of linkage maps, populations used in construction of molecular maps, bulk segregation analysis, gene tagging, QTL mapping.

Plant Cell & Tissue Culture (3 Cr.) Facilities and equipments in plant tissue culture laboratory, plant growth and maintenance, plant growth regulators in tissue culture, totipotency, organogenesis, kinds of In vitro culture, plant regeneration from cell, embryo, pollen, ovule and organs, protoplast isolation and fusion, somatic embryogenesis and production of synthetic seeds, somaclonal variation, double haploids.

Gene Transfer Technology in Plants (2 Cr.) Gene and promoters structure in plants, gene expression regulatory elements, mechanism of transgene integration, transient expression and stable transformation of transgene in plants, reconstructing a chimeric gene, reporter genes, selectable marker genes, gene transfer methods (Biological, Physical and Chemical), comparison of gene transfer methods, Agrobacterium mediated gene transfer, microprojectile bombardment, electroporation, microinjection and other methods of gene transfer, analysis of transgenic plants using molecular and histochemical techniques.

Recombinant DNA Technology (3 Cr.) History, importance and fundamentals, vectors (Plasmid, Cosmid, Bacteriophage, Yeast), DNA extraction and purification, enzymes in gene cloning, preparation of DNA enzymatic maps, methods in construct of recombinant DNA, genomic libraries, cDNA libraries, selection of specific clone, DNA sequencing, induction of mutation in genes, application of recombinant DNA technology in agriculture.

Genetic & Ecology of Microbes (3Cr.) Classification of microorganisms, structure of bacteria, role of cell components in activation of bacteria, microbial genome, plasmid in bacteria (Kinds, Replication, Compatibility,...), bacterial gene transformation (Mediated and non-mediated transformation, Conjugation), mutation in bacteria, transposones, growth and nutrition in microbes, microbial metabolites and antibiotics, classification of plant bacteria, microbial ecology in rhizospher, plant microbe interactions, signal exchange in Agrobacterium pathogenesis, Rhizobium-legume symbiosis, genes involved in pathogenesis and hypersensitivity reaction, bioremediation, fungal properties, fungal symbiont in plants, plant viruses, bacteriophage and gene transformation, food microbiology.

Application of Biotechnology in Agriculture (2 Cr.) History and importance of agricultural biotechnology, application of disease-free plants, preservation of genetic resources, application of haploid and double haploid plants, secondary metabolite production, genetic of pathogenesis and plant resistance genes, application of molecular markers (RFLP, RAPD, AFLP, SSR,...), application of molecular probes, application of transgenic plants (resistance to diseases and pests, pesticides and environmental stresses), estimation of genetic variation in plants.

Protein chemistry & proteomics (2 Cr.) Protein and amino acids structure, proteins analysis (Protein sequencing, Chemical synthesis, SDS-PAGE, IEF, 2D PAGE, Lipoprotein and glycoprotein identification, Measurement of protein concentration, MS, NMR, X-ray crystallography, Peptide map, Spectrophotometric), measurement and control of protein stability, protein interaction with DNA, carbohydrate and other proteins, immunochemistry, protein extraction and purification methods, physico-chemical properties of proteins, enzymatic proteins.

Special topics in Biotechnology (1 Cr.) This is a very dynamic course, usually involves discussion of newly published articles relevant to agricultural biotechnology