

**Suggested Reading:**

1. Jain, S. K. (1981). Glimpses of Indian Ethnobotany. Oxford & IBH publishing Co. Pvt. Ltd., New
2. Jain, S. K. (1989). Methods and approaches in Ethnobotany. Society of Ethnobotanists, Lucknow13.
3. Jain, S. K. (1995). A manual of Ethnobotany. Scientific Publishers, Jodhpur.

**FOURTH ELECTIVE****PRACTICAL : Lab work based on Core/Elective      OR****PRACTICAL/INDUSTRIAL TRAINING/PROJECT PRESENTATION****(The candidate are required to choose only one elective)****SEMESTER-III****CORE-I PLANT PHYSIOLOGY****UNIT-I**

Membrane transport and translocation of water and solutes: Plant-water relations, mechanism of water transport through xylem, phloem loading and unloading, passive and active solute transport, membrane transport of proteins. Transpiration: Types and mechanism of stomatal opening and closing. Mineral Nutrition: Essential and beneficial elements, Role and deficiency effects of essential nutrient elements.

**UNIT-II**

Nitrogen fixation and metabolism: Biological nitrogen fixation, mechanism of nitrate uptake and reduction, ammonium assimilation. Glycolysis, TCA Cycle, electron transport and ATP Synthesis, pentose phosphate pathway, glyoxylate cycle, Cyanide resistant respiration, Lipid metabolism.

**UNIT-III**

Photosynthesis: General concepts and historical background, steps of photosynthesis, Emerson's effect, two pigment systems, Calvin cycle, photorespiration and its significance, C4 cycle, CAM pathway.

**UNIT-IV**

Plant growth regulators: Physiological effects and mechanism of auxins, gibberellins, cytokinins, ethylene, abscisic acid, polyamines, jasmonic acid, hormone receptors and vitamins and hormones. Photoperiodism and vernalization: Photoperiodism and its significance, floral induction and development, significance of vernalization, devernialization.

Plant growth: Growth stages, Apical dominance, germination, dormancy (bud and seed).  
Phytochrome: Its structure and functions. Biological clock and circadian rhythms. Stress physiology: Plant responses to biotic and abiotic stress, mechanism of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, freezing and heat stress, oxidative stress.

### **Suggested Readings:**

1. Hopkins, W. G. 1995. Introduction to plant physiology.
2. Salisbury & Ross 2003. Plant Physiology.
3. Frank Boyer Salisbury and Cleon Ross, 1991, Plant Physiology, CA
4. Peter Scott, Physiology and Behaviour of Plants. Wiley-Blackwell.

## **CORE-II PLANT BIOCHEMISTRY**

### **UNIT-I**

Bioenergetics: Laws of thermodynamics, concept of enthalpy and entropy and their significance in biological systems, Water biochemistry, high energy molecules, redox potential; Amino acids and proteins: Structure and physiochemical properties of amino acids; Proteins: Primary, Secondary, tertiary and quaternary structure of proteins, physical and chemical properties of proteins and biological significance. Enzymes: Classification, physical-chemical nature, enzyme kinetics, mechanism of action and regulation.

### **UNIT-II**

Carbohydrates: Structure and physical-chemical properties of carbohydrates, biological significance, Glycoprotein, Lipids: Classification, structure and properties of important lipids, biological significance of glycolipids, fatty acid biosynthesis and storage lipids and their catabolism. Vitamins and Coenzymes: Structure and general biochemistry.

### **UNIT-III**

Nucleic Acid: Structure and conformation of nucleic acids; replication and transcription of DNA, regulation of transcription, DNA damage and repair, Structure of mRNA, rRNA and tRNA, Splicing, transport of RNAs, RNA editing.

### **UNIT-IV**

Biological Nitrogen Fixation: Nitrogenase enzyme, substrate for nitrogenase, Reaction mechanism, strategies to exclude oxygen and need to control hydrogen evolution.

### **Suggested readings:**

1. Devi, P. 2000. Principles and methods of Plant Molecular Biology, Biochemistry and Genetics.
2. Cooper, T. G. 1977. Tools in Biochemistry.
3. Lehninger. Principles of Biochemistry
4. Srivastava, H. S. 1983. Elements of Biochemistry. Rastogi Publications, Meerut.

## **CORE-III CYTOGENETICS AND BIOSTATISTICS**

### **UNIT-I**

Basic concept and organization: Chromosome structure, nucleosome, solenoid model, euchromatin and heterochromatin, special type of chromosomes- Polytene chromosomes, lampbrush chromosomes, B chromosomes. Gene concept; allele concept, multiple alleles, isoalleles, Pseudoalleles, cell division.

### **UNIT-II**

Inheritance Genetics: Principles of Mendelian Inheritance and interaction of genes. Cytoplasmic inheritance involving chloroplast and mitochondria, mitochondrial and chloroplast genomes, interaction between nuclear and cytoplasmic genes, Sex determination in plants.

### **UNIT-III**

Cytogenetics and Induced Variations: Linkage and recombination: Concept of Linkage, evolution of linkage concept, cis and trans arrangement of linked gene, kinds of linkage, germinal and somatic crossing over, detection of crossing over, kinds of crossing over.

Mutation: Spontaneous and induced mutations, point mutation, transitions, transversions, physical and chemical mutagens, molecular basis of mutations.

Numerical alterations in chromosomes: Euploidy, polyploidy and its significance, aneuploidy, autopolyploidy, Induction of trisomics and monosomics.

Structural changes in chromosomes: Deficiency, duplication, inversion, translocation heterozygotes.

### **UNIT-IV**

Importance and scope of Biostatistics. Measures of Central tendency, Measures of dispersion: range, mean deviation, Standard deviation, Variance, Standard error of mean, Standard error of SD, Students 't' test, Chi-square test. Analysis of Variance (ANOVA). Correlation and regression- meaning, kinds of correlation, coefficient of correlation, method of studying correlation. Aims of regression analysis. Kinds of regression analysis.

#### **Suggested Reading:**

1. Lewin, B. 2000, Gene. Vol. VII. Oxford Univ. Press, New York, USA.
2. Watson, J. D. Molecular Biology of the Gene.
3. Gahalain, S. S. 2004. Fundamentals of Genetics.
4. Gupta, P.K., Cytogenetics, Rastogi Publication, Merrut.

## **FIFTH ELECTIVE - ECOLOGY AND PHYTOGEOGRAPHY**

### **Unit I**

Introduction to ecology, and environmental terminology, population dynamics, vegetation organization and development: population characteristics, population growth forms, density dependent and density independent controls, population structure (distribution, aggregation, isolation territoriality) energy partitioning, r - and k-selection, concept of carrying capacity. Wild life sanctuaries, botanical gardens.

### **Unit II**

Concepts of community and continuum, analysis of communities (analytical and synthetic characters), community coefficients, competition, ecological niche, succession, mechanism of ecological succession (relay floristic and initial floristic composition facilitation, tolerance and inhibition models), concept of climax.

### **Unit III**

Ecosystem organization, structure and function: primary production (methods of measurement), energy dynamics (tropic organization, energy flow pathway, energy quality, ecological efficiencies), biogeochemical cycles.

### **Unit IV**

Pollution and climate change: kinds, sources and effects of pollution, heavy metals (Pb, Cd,, Hg), green house gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CFCs), green house effect and global warming, ozone layer depletion and ozone hole, acid rain. Environmental impact assessment, threatened and endangered plant species, role of diversity in ecosystem stability, general account of remote sensing and its application, sustainable development. Major terrestrial biomes, biogeographical area of India, major vegetations.

### **Suggested reading:**

1. Odum, E. P. and Barret G.W. 2005. Fundamentals of Ecology. Cengage publication
2. Odum, E.P., 1983. Basic Ecology., Saunders College Publishing
3. Singh, LS., Singh S.P. and Gupta S.R. 2006. Ecology Environment and Resource Conservation. Anamaya Publishers

## **FIFTH ELECTIVE - PLANT BREEDING AND CROP IMPROVEMENT**

### **UNIT-I**

Importance, scope and major achievements of plant breeding. Germplasm; kinds of germplasm, collection, evaluation and organizations concerned with germplasm, in-situ and ex-situ conservation. Modes of reproduction in crop plants; sexual and asexual reproduction, apomixis, identification of apomictic plants. Incompatibility; genetic, physiological and biochemical basis of incompatibility, utility of self incompatibility. Male sterility; genetic and cytoplasmic male sterility and its applications.

### **UNIT-II**

Plant introduction; types of introduction, procedure, uses of plant introduction and organizations associated with introduction. Pure line selection, mass and progeny selection, procedure and achievements. Pedigree selection, recurrent selection and their applications.

Role of mutation in plant breeding, isolation of useful mutants and major achievements. Role of polyploidy in crop improvement.

### **UNIT-III**

Hybridization- kinds of hybridization, procedure of hybridization, types of hybridization and utility of hybridization. Hybrid breeding in self- and cross-pollinated crops. Back cross breeding. Heterosis; theories of heterosis, inbreeding depression.

### **UNIT-IV**

Protoplast fusion and somatic hybrids. Method of gene transfer and transgenics. Marker assisted selection. Breeding for disease resistance, salinity tolerance and quality traits.

### **Suggested Readings:**

1. Introduction to Plant Breeding, R.C. Chaudhary, Oxford & IBH Publishers, 1982.
2. Plant Breeding, V. Kumaresan, Saras Publication, 2015.
3. Plant Breeding Principles & Methods, B.D.Singh, Kalyani Publishers, 1983.
4. Fundamentals of Plant Breeding, Phundan Singh, Kalyani Publishers, 2017.
5. Principles of Plant Breeding, I.D.Tyagi, Jain brothers, 2015
6. Principles of Plant Breeding, Robert W. Allard, John Wiley & sons, 1960.

## **SIXTH ELECTIVE**

**PRACTICAL : Lab work based on Core/Elective      OR**

**PRACTICAL/PROJECT PRESENTATION**

**(The candidate are required to choose only one elective)**

## **SEMESTER- IV**

### **CORE-I MOLECULAR BIOLOGY AND MOLECULAR TECHNIQUE**

#### **UNIT-I**

Structure of nucleotides and DNA: A, B, and Z form of DNA and properties, coding and noncoding sequences, satellite DNA, DNA damage and repair, replication and transcription of DNA, structure of mRNA, rRNA and tRNA, replication of RNA, Splicing, transport of RNAs, RNA editing

#### **UNIT-II**

Protein synthesis: Mechanism of translation-Initiation, elongation and termination, post translational modification, protein targeting to organelles, regulation of protein synthesis at transcription and translation level in prokaryotes and eukaryotes.