

(Semester VI)

**Paper 18: FUNCTIONAL PLANT BIOLOGY**

THEORY

**Unit 1: Response of plants to environmental stress**

Water stress; High light stress; Temperature stress; Hypersensitive reaction; Pathogenesis-related (PR) proteins; Systemic acquired resistance; Mediation of insect and disease resistance by jasmonates. **(10 lectures)**

**Unit 2: Developmental and physiological mechanisms that protect plants against environmental stress**

Adaptation in plants; Changes in root: shoot ratio; Aerenchyna development; Osmotic adjustment; Compatible solute production. **(3 lectures)**

**Unit 3: Reactive oxygen species–Production and scavenging mechanisms. (2 lectures)**

**Unit 4: Structural genomics**

An overview; Correlated Genetic; Cytological, and physical maps of chromosomes; Molecular map; Map-position based cloning of gene: Chromosomes walking; Chromosomes jumping whole genome sequencing; The Human genome Project. **(6 lectures)**

**Unit 5: Functional genomics**

Transcriptome; Proteome and Interactome RNA and Protein assays of genome function; Expressed sequences; Array hybridization and gene chips to study transcriptome; Reverse genetics through random and targeted mutagenesis. **(4 lectures)**

**Unit 6: Comparative genomics**

Phylogenetic interference comparative genomics of mice and humans, Chimpanzees and humans; Chloroplast and Mitochondrial genomics; genome evolution in cereal grasses **(3 lectures)**

**Unit 7: Model organisms and systems biology (2 lectures)**

**Unit 8: Introduction to bioinformatics**

Definition, Branches; Biological Database: Definition and classification; NCBI: Introduction, tools, databases, database retrieval tool, sequence submission tools, BLAST (types) ; Nucleotide database; Protein database. **(6 lectures)**

**Unit 9: Sequence alignment**

Introduction, concept of alignment; Multiple sequence alignment; CLUSTALW ([www.ebi.ac.uk/clustalw](http://www.ebi.ac.uk/clustalw)). (6 lectures)

**Unit 10: Molecular phylogeny**

Introduction; Representation of Phylogeny; Types of Trees; Methods of phylogeny. (6 lectures)

**PRACTICALS**

1. Quantitative estimation of peroxidase activity in the seedlings in the absence and presence of salt stress.
2. Superoxide activity in seedlings in the absence and presence of salt stress.
3. Zymographic analysis of peroxidase.
4. Zymographic analysis of superoxide dismutase activity.
5. Comparative maps of cereal grasses.
6. Nucleic acid and protein databases.
7. Sequence retrieval from databases.
8. Sequence alignment.
9. Sequence homology and Gene annotation.
10. Construction of Phylogenetic tree

**ESSENTIAL READINGS**

1. Buchanan, B.B., Gruissem, W. and Jones, R.L. (2000). Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists. Rockville, Maryland. U.S.A.
2. Taiz, L. and Zeiger, E. (2006). Plant Physiology. Sinauer Associates Inc. USA. 5<sup>th</sup> Edition.
3. Ghosh, Z. and Bibekanand, M. (2008). Bioinformatics: Principles and Applications. Oxford University Press. Delhi.
4. Pevsner, J. (2009). Bioinformatics and Functional Genomics. Wiley-Blackwell. U.S.A. 2<sup>nd</sup> edition.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5<sup>th</sup> edition.