

Course Name: Techniques in Plant Science**Course Code: RCW-4-15**

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COURSE OBJECTIVES

The course provides an advanced understanding of the core principals of various techniques used in biological experiments.

UNITS	CONTENTS	Contact Hrs.
I	Microscopy: Principles of Microscopy, Confocal microscopy, Fluorescence Microscopy, Electron Microscopy, Phase Contrast microscopy; Atomic Force Microscopy, Camera Lucida. Microtomy: Microtomy/Microtome & its types: dehydration, clearing and embedding of material, section cutting, dewaxing. Different types of stains, their preparation and uses: Safranin, fast green, hematoxylin, iodine, cotton blue, crystal violet, ruthenium red, Janus green, Gram's stains, Acetocarmine.	8
II	Spectroscopic Techniques: 12 hours General principles; Basic laws of light absorption; Types of spectra and their biological usefulness. Principle, application and instrumentation of UV-VIS spectrophotometry; FTIR, Atomic Absorption spectrophotometry; Raman Spectroscopy, MALDI-TOF; GCMS.	8
III	Separation Techniques & Electrophoresis 12 hours Chromatographic Technique: Paper chromatography, Thin Layer Chromatography (TLC), High Performance Liquid Chromatography (HPLC), HPTLC, Gas-Liquid chromatography (GLC), Isoelectric Focussing. Electrophoresis: PAGE, SDS PAGE, 1-D and 2-D gel electrophoresis, DIGE (Differential in Gel Electrophoresis). Separation of proteins through electrophoresis. Gel electrophoresis (AGE, 2D etc), ChIP, EMSA, Co-Immunoprecipitation.	6
IV	Techniques of Molecular Biology & Sequencing 12 hours Whole genome sequencing: Whole genome shotgun sequencing; clone-by-clone or 'hierarchical shotgun' sequencing; pan genomes and metagenome. Next generation Sequencing Technologies: 454 Pyrosequencing, Reversible Terminator Sequencing, Single-Molecule Real-Time (SMRT) Sequencing and Nanopore Sequencing; microbial genomes (including yeast); plant genomes (Arabidopsis, rice). Application of NGS. Genome editing tools ZFN, TALEN and CRISPR, Anti CRISPR; Genome annotation.	8
V	Bioinformatics 12 hours Computational biology Techniques and Tools: Techniques and tools for Sequences Alignment (Pairwise and multiple alignment), Phylogenetic analysis- Methods and Tools, gene prediction, ORF finding. Homology: Orthology & paralogy. Databases: NCBI, EMBL, DDBJ, Gene bank, Pubmed; Ensembl, Phytozome etc Online tools – BLAST, ORF finder, Primer3, protein motif and structure prediction tools. Generation and analysis of whole genome data, Whole genome annotation taking examples of major plant genomes.	8

REFERENCE BOOKS :

1.	Experimental Microbiology and Plant Pathology	K.R Aneja 5 th edition
2.	Laboratory Manual for Biotechnology	Ashish S./ Das Surajit & Singh Anchal Verma
3.	How to Use a Spectrophotometer	Richard A. Neuhaus
4	Bioinformatics: Experiments, Tools, Databases, and Algorithms	Orpita Bosu (Author), Simminder Kaur Thukral (Author)