Plant Biotechnology - Web course

COURSE OUTLINE

Applications of Plant Biotechnology in Crop Improvement, Microtechniques, Plant Genetic Engineering and Production of Transgenic Plants, Applications of Cell Culture Systems in Metabolic Engineering, Molecular farming and Applications.

COURSE DETAIL

Module	Topics and Contents	No. of Lectures
1.	**Broad Title: Applications of Plant Biotechnology in Crop Improvement** Introduction to plant tissue culture, lab facilities and operations, tissue culture media: preparation and handling, establishing aseptic cultures; Micropropagation via axillary and adventitious shoot proliferation; Somatic embryogenesis; production of artificial seeds; Double haploid production by androgenesis and gynogenesis; triploid production by endosperm culture; production of virus free plants by meristem, shoot-tip culture; Cell Suspension cultures; protoplast isolation and regeneration, somatic hybridization and cybridization; protoclonal, somaclonal and gametoclonal variation for crop improvement; Cryopreservation.	15
2.	**Broad Title: Microtechniques** Cytology and various staining procedures for ploidy analysis; microscopy with special emphasis on confocal, scanning and transmission electron microscopy; Principles and applications of flow cytometry and cell sorting; histological techniques.	5
3.	**Broad Title: Plant Genetic Engineering and Production of Transgenic Plants** Genetic material of plant cells with an introduction to chloroplast and mitochondrial DNA; Restriction enzymes; Transformation of plant cells; different type of vectors including viral vectors and their benefits; Modes of gene delivery in plants: Particle bombardment, electroporation, microinjection; *Agrobacterium* mediated gene transfer, Ti and Ri plasmids; Screening and selection of transformants, PCR and hybridization methods; Transgene selection and silencing; Generation and maintenance of transgenic plants, Bt cotton, golden rice and some others as examples.	10
4.	**Broad Title: Application of Cell Culture Systems in**	8

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	Metabolic Engineering Advantages of cell, tissue and organ culture as source of secondary metabolites; hairy root cultures; screening of high yielding cell lines; procedures for extraction of high value industrial products, fractionation, bioassays; growth and production kinetics of cell cultures in shake flasks; scale-up procedures in bioreactors, types of bireactors for plant cell cultures; Manipulation in production profile by biotic and abiotic elicitation; biotransformation.	
5.	**Broad Title: Molecular Farming and Applications** Aims and scope, bottlenecks; production of industrial enzymes, biodegradable plastics, polyhydroxybutyrate, antibodies, edible vaccines; manipulation of metabolic pathways for production of fatty acids, industrial oils, terpenoids, flavanoids etc.	4
	Total	42

References:

Text Books:

1. Bhojwani S.S. and Razdan M.K. Plant Tissue Culture: Theory and Practice, a Revised Edition, Elsevier Science, 1996.
2. Singh B.D. Text Book of Plant Biotechnology, Kalyani Publishers, 1998.

Reference Books:

1. Dodds J.H. and Roberts L.W. Experiments in Plant tissue Culture, 3rd edition, Cambridge University Press, 1995.
2. Cseke L.J., Kirakosyan A., Kaufman P.B., Warber S.L., Duke J.A. and Brielmann H.L. Natural Products from Plants, 2nd edition, Taylor & Francis group, 2006.