

DISCIPLINE SPECIFIC ELECTIVE COURSE - 10: Plant Tissue Culture

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course
		Lecture	Tutorial	Practical/Practice		
Plant Tissue Culture DSE-10	4	2	0	2	Class XII pass	Nil

Learning Objectives:

- To impart foundational knowledge of plant tissue culture techniques and their theoretical principles.
- To familiarize students with the historical development and key contributors in plant tissue culture.
- To provide hands-on understanding of media preparation, explant selection, and aseptic techniques.
- To expose learners to advanced applications such as micropropagation, protoplast fusion, and somatic embryogenesis.
- To develop entrepreneurial and research skills for applying tissue culture in agriculture, biotechnology, and industry.

Learning Outcomes:

After successful completion of the course, students will be able to:

- Explain the historical background and basic principles of plant tissue culture, and define key terminology.
- Identify various types of tissue culture media, their components, and their physiological relevance.
- Demonstrate knowledge of sterile techniques, explant preparation, and culture initiation.
- Apply tissue culture methods such as micropropagation, protoplast culture, anther culture, and embryo rescue in crop improvement.

- Evaluate advanced applications like artificial seeds, secondary metabolite production, cryopreservation, and germplasm conservation for commercial and biodiversity goals.

Theory: **30 hours**

Unit 1: Introduction **2 hours**

Historical perspective, Important contributions of Haberlandt, White, Reinert & Steward, Murashige, Skoog, Cocking, Guha & Maheshwari, Morrel & Martin.

Terminologies: Cell culture, organ culture, explant, callus, totipotency, plasticity, regeneration, soma clonal variation.

Unit 2: Techniques of Plant Tissue Culture **6 hours**

Types and composition of Media: Role of nutrients, vitamins, hormones, and supplements in nutrient medium. Composition of Murashige and Skoog's and White's medium. Impact of gelling agents and pH on the nutrient medium.

Collection of plant material, aseptic culture techniques: surface sterilization of tissues (maintenance of aseptic conditions by use of autoclave and laminar flow chamber), filter sterilization, inoculation.

Unit 3: Protoplast culture and Micropropagation **10 hours**

Protoplast isolation (mechanical and enzymatic), culture, purification (viability test) and fusion (spontaneous, induced), selection of fused protoplasts, applications of protoplast culture; Micropropagation: Selection of plant material and suitable explant, methodology, plant regeneration pathways-somatic embryogenesis, organogenesis, difference between somatic and zygotic embryos.

Unit 4: Applications of Plant Tissue Culture **12 hours**

Anther culture, Production of haploids, triploids and cybrids, artificial seeds (production & advantages), embryo rescue, virus elimination, bioreactors for secondary metabolite production; Cryopreservation; Germplasm conservation, Novel sources of variation.

Practicals: **60 hours**

1. To study the equipment used in tissue culture: autoclave and laminar air flow chamber.
2. Preparation of Murashige & Skoog's (MS) medium.
3. Demonstration of sterilization and inoculation methods using leaf and nodal explants of tobacco, carrot, *Datura*, *Brassica*, etc. (any two).
4. Study of anther, embryo and endosperm culture (demonstration/photographs).
5. Study of micropropagation, somatic embryogenesis & artificial seeds (demonstration/photographs).
6. Isolation of protoplasts (demonstration/photographs)

7. Visit to a plant tissue culture facility/ Industry and submission of report.

Suggested Readings:

- Bhojwani, S.S. (1990). Plant Tissue Culture: Applications and Limitations {Elsevier}
- Bhojwani, S.S, Bhatnagar, S.P. (2015). The Embryology of Angiosperms, 6th edition. New Delhi, Delhi: Vikas Publication House Pvt. Ltd.
- Bhojwani, S. S. and Dantu, P. K. (2013). Plant Tissue Culture: An Introductory Text Springer
- Bhojwani, S. S. and Razdan, M. K. (1996). Plant Tissue Culture: Theory and Practice, Revised Edition, Elsevier
- Newmann, Karl-Hermann (2020). Plant Cell and Tissue Culture: A Tool in Biotechnology, 2nd Edition Springer

Additional Resources:

- Park, Sunghun (2021). Plant Tissue Culture: Techniques and Experiments, 4th Edition Elsevier
- Razdan, M. K. (2019). Introduction to Plant Tissue Culture, 3rd Edition CBS / Oxford & IBH
- Smith, R. H. (2013). Plant Tissue Culture: Techniques and Experiments, 3rd Edition {Elsevier}
- Stewart, C. Neal (2016). Plant Biotechnology and Genetics, 2nd Edition Wiley-Blackwell
- Trigiano, R. N. (2011). Plant Tissue Culture, Development, and Biotechnology CRC Press

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.