

A.P. State Council of Higher Education  
Semester-wise Revised Syllabus under CBCS, 2020-21

**Course 6C: Plant Tissue Culture**  
(Skill Enhancement Course (Elective), Credits: 05)

**I. Learning Outcomes:**

Students at the successful completion of the course will be able to:

1. Comprehend the basic knowledge and applications of plant tissue culture.
2. Identify various facilities required to set up a plant tissue culture laboratory.
3. Acquire a critical knowledge on sterilization techniques related to plant tissue culture.
4. Demonstrate skills of callus culture through hands on experience.
5. Understand the biotransformation technique for production of secondary metabolites.

**II. Syllabus:** (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05) (*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

**Unit - 1: Basic concepts of plant tissue culture** (10h)

1. Plant tissue culture: Definition, history, scope and significance.
2. Totipotency, differentiation, dedifferentiation, and re-differentiation; types of cultures.
3. Infrastructure and equipment required to establish a tissue culture laboratory.

**Unit - 2: Sterilization techniques and culture media** (10h)

1. Aseptic conditions – Fumigation, wet and dry sterilization, UV sterilization, ultra filtration.
2. Nutrient media: Composition of commonly used nutrient culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acid etc.
3. Composition and preparation of Murashige and Skoog culture medium.

**Unit - 3: Callus culture technique** (10h)

1. Explant: Definition, different explants for tissue culture: shoot tip, auxiliary buds, leaf discs, cotyledons, inflorescence and floral organs, their isolation and surface sterilization; inoculation methods.
2. Callus culture: Definition, various steps in callus culture.
3. Initiation and maintenance of callus - Growth measurements and subculture; somaclonal variations.

**Unit – 4: Micro propagation** (10h)

1. Direct and indirect morphogenesis, organogenesis, role of

- PGRs; somatic embryogenesis and synthetic seeds.
2. Greenhouse hardening unit operation and management; acclimatization and hardening of plantlets - need, process, packaging, exports.
  3. Pathogen (Virus) indexing- significance, methods, advantages, applications.

**Unit – 5: Applications of plant tissue culture (10h)**

1. Germplasm conservation: cryopreservation methods, slow growth, applications and limitations; cryoprotectants.
2. Plant transformation techniques and bioreactors; production of secondary metabolites-optimization of yield, commercial aspects, applications, limitations.
3. Transgenic plants- gene transfer methods; BT cotton.

**III. References:**

1. Kalyan Kumar De (2001) An Introduction to Plant Tissue Culture, New Central Book Agency (P) Ltd., Calcutta
2. Razdan, M.K. (2005) Introduction to Plant Tissue Culture, Oxford & IBH Publishers, Delhi
3. Bhojwani, S.S. (1990) Plant Tissue Culture: Theory and Practical (a revised edition). Elsevier Science Publishers, New York, USA.
4. Vasil, I.K. and Thorpe, T.A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, the Netherlands.
5. Web resources suggested by the teacher concerned and the college librarian including reading material.

**Course 6C: Plant Tissue Culture – Practical syllabus**

**IV. Learning Outcomes:** On successful completion of this practical course, student will be able to:

1. List out, identify and handle various equipment in plant tissue culture lab.
2. Learn the procedures of preparation of media.
3. Demonstrate skills on inoculation, establishing callus culture and Micro propagation.
4. Acquire skills in observing and measuring callus growth.
5. Perform some techniques related to plant transformation for secondary Metabolite production.

**V. Practical (Laboratory) Syllabus: (30 hrs)**

1. Principles and applications of- Autoclave, Laminar Airflow, Hot Air Oven.
2. Sterilization techniques for glass ware, tools etc.,
3. MS medium - Preparation of different stock solutions; media preparation

4. Explant preparation, inoculation and initiation of callus from carrot.
5. Callus formation, growth measurements.
6. Induction of somatic embryos, preparation of synthetic seeds.
7. Multiplication of callus and organogenesis.
8. Hardening and acclimatization in green house.

**VI. Lab References:**

1. Reinert, J. and M.M. Yeoman, 1982. Plant Cell and Tissue Culture - A Laboratory
2. Manual, Springer-Verlag Berlin Heidelberg
3. Robert N. Trigiano and Dennis J. Gray, 1999. Plant Tissue Culture Concepts and Laboratory Exercises. CRC Press, Florida

4. Ashok Kumar, 2018. Practical Manual for Biotechnology, College of Horticulture & Forestry, Jhalawar, AU, Kota
5. Chawla, H.S., 2003. Plant Biotechnology: A Practical Approach, Nova Science Publishers, New York
6. Web sources suggested by the teacher concerned.

## **VII. Co-Curricular Activities:**

### **a) Mandatory:** (*Lab/field training of students by teacher: Lab: 10 + field: 05 hours*)

1. **For Teacher:** Training of students by teacher in the laboratory/field for a total of not less than 15 hours on the field techniques/skills of sterilization procedures, preparation of media, establishment of callus culture, growth measurements; morphogenesis and organogenesis; acclimatization and hardening of plantlets.
2. **For Student:** Students shall (individually) visit anyone of plant tissue culture laboratories in universities/research organizations/private facilities, write their observations on tools, techniques, methods and products of plant tissue culture; and submit a hand-written Fieldwork/Project work Report not exceeding 10 pages to the teacher in the given format.
3. Max marks for Fieldwork/Project work Report: 05
4. Suggested Format for Fieldwork/Project work Report: Title page, student details, index page, details of place visited, observations, findings and acknowledgements.
5. Unit tests (IE).

### **b) Suggested Co-Curricular Activities:**

1. Training of students by related industrial experts.
2. Assignments (including technical assignments like identifying tools in plant tissue culture and their handling, operational techniques with safety and security, IPR)
3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
4. Preparation of videos on tools and techniques in plant tissue culture.
5. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.
6. Visits to plant tissue culture/biotechnology laboratories in universities, research organizations, private firms, etc.
7. Invited lectures and presentations on related topics by field/industrial experts