|  |  |  |
| --- | --- | --- |
| **B. Sc** | **Semester-V** (Skill Enhancement Course - Elective) | **Credits: 4** |
| **Course: 6C** | **Plant Tissue Culture** | **Hrs/Wk: 4** |

## 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.

**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 I: Basic concepts of plant tissue culture (10h)

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

## UNIT II: Sterilization techniques and culture media (10h)

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

## UNIT III: Callus culture technique (10h)

1. Explant: Definition, different explants for tissue culture: shoot tip, axillary 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; soma clonal variations.

## UNIT IV: Micropropagation (10h)

1. Direct and indirect morphogenesis, organogenesis, role of PGRs; somaticembryogenesis and synthetic seeds.
2. Greenhouse hardening unit operation and management; acclimatization and hardeningof plantlets - need, process, packaging, exports.
3. Pathogen (Virus) indexing- significance, methods, advantages, applications.

## UNIT V: 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.

## 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.

|  |  |  |
| --- | --- | --- |
| **B. Sc** | **Semester-V** (Skill Enhancement Course - Elective) | **Credits: 1** |
| **Course: 6C** | **Plant Tissue Culture Lab** | **Hrs/Wk: 2** |

## Plant Tissue Culture – Practical syllabus

**Learning Outcomes:** On successful completion of this practical course, student willbe 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 andMicro propagation.
4. Acquire skills in observing and measuring callus growth.
5. Perform some techniques related to plant transformation for secondary Metabolite production.

**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.

## 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](https://www.routledge.com/search?author=Robert%20N.%20Trigiano) and [Dennis J. Gray,](https://www.routledge.com/search?author=Dennis%20J.%20Gray) 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.

## Co-Curricular Activities:

1. **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.

* 1. Unit tests (IE).

## 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, researchorganizations, private firms, etc.
  7. Invited lectures and presentations on related topics by field/industrial experts

## MODEL QUESTION COURSE (Sem-End)

**B. Sc DEGREE EXAMINATION Semester-V** (Skill Enhancement Course - Elective)

**Course 6C: Plant Tissue Culture**

**Time: 3Hrs. Max. Marks: 75**

## SECTION - A

**Answer any FIVE questions. Each question carries 5 marks 5 x 5 =25M**

1. Totipotency
2. Types of Cultures
3. Nutrient Media
4. Sub Culture
5. Somaclonal Variations
6. Acclimatization
7. Bioreactors
8. Secondary Metabolites

## SECTION - B

**Answer ALL the questions. Each question carries 10 marks 5X10 =50M**

1. (a) Define Tissue Culture? Write the Scope and Significance

(OR)

(b) Write the Infrastructure and Equipment required to establish a Tissue Culture Lab

1. (a) Write the composition and preparation of Murashige and Skoog Culture Medium.

(OR)

(b) What are the methods followed to maintain Aseptic Conditions in Tissue Culture Lab

1. (a) What is an Explant? Write the different explants used for Tissue Culture

(OR)

(b) What is Callus Culture? Explain various steps in Callus Culture

1. (a)What is Somatic Embryogenesis. Explain the production of Synthetic Seeds.

(OR)

(b)What is Pathogen Indexing. Write its methods and applications.

1. (a) Explain in detail Germplasm Conservation

(OR)

(b) What are Transgenic Plants. Explain the Gene Transfer method in BT Cotton

# Model Question Paper Pattern for Practical Examination

Semester – V/ Botany Skill Enhancement Course

# Plant Tissue Culture

**Max. Time: 3 Hrs. Max. Marks: 50**

1. Demonstration of a sterilization technique ‘A’ 8
2. Preparation of MS medium ‘B’ 10
3. Demonstration of callus culture technique/growth measurements ‘C’ 12
4. Scientific observation and data analysis 4 x 3 = 12
5. Tissue culture equipment /photograph
6. Morphogenesis or organogenesis - photograph
7. Bioreactor/Secondary metabolite
8. Transgenic plant/photograph
9. Record + Viva-voce 5+3 = 8