



Syllabus and Structure
of
Certificate Course in Tissue Culture
Run
by
Department of Zoology,
Walchand College of Arts and Science,
Solapur



Certificate Course in Tissue Culture
Run by Department of Zoology,
Walchand College of Arts and Science, Solapur

Eligibility: 10 + 2

No. of Participants: 30

Duration: 180 days

Total No. of Credits: 30 (1 credit = 15 hours)

Total Hours: 450 hours

Theory, Training and Project Work: 20 credits (300 hours)

Practical: 10 credits (150 hours)

A. Syllabus for Theory / Classroom Teaching and Training and Project work :

- No. of credits for theory / Class room Teaching
and Training and Project work : 20 credits (1 credit = 15 hours)

No. of credits for theory : 10 credits

No. of credits for Training and Project work : 10 credits

Total No. of hours for theory / Class room Teaching
and Training and Project work : $20 \times 15 = 300$ hours

1. Introduction to Animal tissue culture & media (1.5 credits)

- Introduction to animal tissue culture
- Physicochemical properties of media
 - a) pH
 - b) CO₂ & biocarbonate
 - c) Buffering



- d) Oxygen
- e) Osmolality
- f) Temperature
- g) Viscosity
- h) Surface tension & foaming

- **Balanced salt solutions**
- **Composition of complete media**
 - a) Amino acids
 - b) Vitamins
 - c) Salts
 - d) Glucose
 - e) Organic supplements
 - f) Hormones
 - g) Growth factors
 - h) Antibiotics
 - i) Serum

2. Primary cell culture

(1 credit)

- **Disaggregation of tissue- Enzymatic and Mechanical disaggregation**
- **Enzymatic disaggregation**
 - a) Warm trypsinization
 - b) Cold trypsinization
 - c) Collagenase
- **Mechanical disaggregation**
 - a) Scraping
 - b) Sieving
 - c) Syringing
 - d) Trituration by pipette
- **Establishment of primary culture**
- **Subculture and propagation**



3. Introduction to plant tissue culture & laboratory

(1 credit)

- Introduction to plant tissue culture
- Introduction to plant tissue culture laboratory --
 - a) Washing area/room
 - b) General laboratory
 - c) Media preparation room
 - d) Transfer area
 - e) Culturing facilities
 - f) Green house
 - g) Laboratory and personal safety.

4. Tissue culture medium

(1 credit)

- Units for solution preparation
- Media composition- Inorganic nutrients and organic nutrients
- Inorganic nutrients-
 - a) Microelements
 - b) Macroelements
- Organic nutrients-
 - a) Vitamins
 - b) Amino acids
 - c) Undefined supplements
 - d) Carbon source
- Growth hormones
 - a) Auxines
 - b) Cytokinins
 - c) Gibbberllins
 - d) Ethylene
 - e) Others



5. Techniques of sterilization

(1 credit)

- Sterilization of-
 - a) Media
 - b) Containers
 - c) Small instruments
 - d) Glass wares
- Types of sterilization-
 - a) Steam sterilization
 - b) Dry sterilization
 - c) Filter sterilization
 - d) UV sterilization
- Maintenance of aseptic condition- alcohol sterilization, flame sterilization
- Sterilization of explants- chemical sterilization

6. Types of cultures

(1 credit)

- Cytodifferentiation
- Organogenic differentiation
- Seed culture
- Embryo culture
- Root culture
- Callus culture
- Protoplast culture
- Cell suspension culture
- Anther culture
- Pollen culture
- Endosperm culture



7. Production of secondary metabolites

(1 credit)

- Morphological and chemical differentiation
- Growth production patterns
- Environmental factors
- Selection of high yielding cell lines
- Elicitation
- Product release and analysis
- Applications and problems associated with secondary metabolite production

8. Micropropagation

(1.5 credits)

- Stages in micropropagation-
 - a) Stage 0 – preparative stage
 - b) Stage 1- initiation of cultures
 - c) Stage 2- multiplication
 - d) Stage 3- rooting of shoots
 - e) Stage 4- transplantation
- Auxillary bud proliferation approach
- Organogenesis
- Embryogenesis
- Factors affecting invitro stages of micropropagation
- Applications of micropropagation
- Limitations of micropropagation

9. Applications of animal and plant tissue culture

(1 credit)

- Production of monoclonal antibodies
- Hybridoma technology
- Transgenic animals
- Production of haploid, triploid and polyploidy
- Synthetic seeds



- Virus free plants
- Transgenic plants
- *In vitro* pollination

10. Training & Project Work

No. of Credits for Training & Project Work : 10 credits (1 credit = 15 hours)

Visits to commercial plant tissue culture laboratory and their report

(Study of micropropagation.)

P Syllabus for Practical:

No. of credits for Practicals: 10 credits (1 credit = 15 hours)

1. Preparation of animal tissue culture media
2. Preparation of pH standards
3. Introduction to plant tissue culture laboratory
4. Handling of plant tissue culture instruments
5. Preparation of media
6. Sterilization techniques of plant tissue, glass wares and media
7. Aseptic seed germination
8. Isolation of explants, establishment and maintenance of callus
9. Initiation and establishment of cell suspension culture.
10. Establishment of anther culture
11. Establishment of endosperm culture
12. Establishment of ovule culture
13. Establishment of embryo culture
14. Isolation of protoplast
15. Establishment of organogenesis in any suitable plant
16. Induction of somatic embryogenesis in culture



C. List of Reference Books :

1. Introduction to plant tissue culture M. K. Razdan
2. Introduction to plant Biotechnology H. S. Chawla
3. Plants from test tubes- An introduction to micropropagation. Lydiane Kyte, John G. Kley
4. Plant tissue culture- Techniques & Experiments Roberta H. Smith
5. Plant tissue culture- Basic & applied Timir Baran, Jha, Bisvajit Ghosha
Plant cell & tissue culture S. Narayanswamy
7. *In vitro* culture of higher plants R.L.M. Pierik
8. Applied & fundamental aspects of Plant cell, tissue & organ culture J. Reinert, Y.P.S. Bajaj
9. Plant tissue culture- Applications & Limitations Sant Saran Bhojwani
10. Plant tissue culture- Practices & new experimental protocols B. N. Satyanarayan
11. Plant cell culture protocols Robert D. Hall
12. Plant tissue culture Dennis Neal Butcher, David S. Ingram
13. Plant tissue culture S.P. Misra
4. Plant tissue culture-100 years since gottlieb Haberlandt Margit Laimer, Waltraud Rucker
15. Plant tissue culture Kalyan Kumar De
16. Plant cell & tissue culture- Principles & Applications William R. Sharp
17. Plant tissue culture Mahesh Prasad Singh, Sunil Kumar
18. Plant Biotechnology- Laboratory manual for plant biotechnology H.S. Chawla
19. Plant cell culture Hamish A. Collin, Sue Edwards
20. Plant cell & tissue culture Jerrey W. Pollard



21. Plant Biotechnology- The Genetic

Manipulation of plants

Adrian Slater, Nigel W. Scott, Mark R. Fowler

22. Plant cell culture protocols

Victor M. Loyola Vargas, Felipe Vazquez

Flota

23. Transgenic plants- Methods & Protocols Leandro Pena

24. Biotechnology of plant tissues

Rajiv Tyagi, P.R. Yadav

25. Plant tissue culture- theory & practice

S.S.Bhojwani, M.K.Razdan

9



1. Rules and Regulations of Examination:

1. **Attendance:** Students will be required to complete minimum 80 % attendance in theory & practical to become eligible for appearing in examinations.
2. **Annual Examination:** It is the major component of the evaluation system. It carries 50 % weight age for annual written theory examination and 20 % weight age will be given to training and project work report 30% weightage will be given to annual practical examination. Each student has to take the examination after completion of the course. If in any case student does not score a pass grade, the candidate will reappear at the next year end examination.

3. Conversion of Percentage into Grades :

Percentages %	Grade
1) Below 40 %	D (Fail)
2) 40 – 50	C (Pass)
3) 51 – 60	B (Second Class)
4) 61 – 74	A (First)
5) 75 % & Above	O (First with Distinction)

4. Examination Pattern :

Following Annual Examination pattern for Theory & Practical will be followed for the evaluation of the student :

Written Examination :

(a) Theory	Marks
(1) Written Test	50
(2) Training & Project work Report (Participation / Attendance / Report Writing / Overall Behaviour)	20

	70
(b) Practical	
(1) Two Practicals - Experiments	25
(2) Record keeping	05

	30

70 (Theory) + 30 (Practical) = 100 (Total Marks)