

Shree Manibhai Virani and Smt. Navalben Virani Science College, Rajkot
(Autonomous)
Affiliated to Saurashtra University, Rajkot
Department of Biotechnology

Offering Part III Skill Enhancement Course (SEC) – II

CO CURRICULAR COURSE

PLANT TISSUE CULTURE

(Career Oriented Programme)

SCHEME OF INSTRUCTION AND EXAMINATIONS

(For Students Admitted from A.Y. 2016-2017 & Onwards)

The career oriented programme in Plant Tissue Culture aims at training students in the area of Plant Biotechnology. This programme offers specialized curriculum in plant tissue culture. The student undergoing this programme would also be trained to assist plant tissue culture based industries in explaining and/or solving problems. In addition, the programme also aims at generating manpower capable of establishing their own industry or to serve in an industry or academic institution.

The above objectives assume significance in the light of the fact that vast Saurashtra region of Gujarat, has no such programme at under graduate level to train and develop manpower in the ever-expanding demand of plant tissue culture in India.

Keeping these things in mind, we at Department of Biotechnology, Shree M and N Virani Science College are going to offers certificate course in Plant Tissue Culture under skill enhancement courses category with following structure and design:

ELIGIBILITY AND DURATION OF THE PROGRAMME

Students enrolled in any undergraduate programme of this college, shall be eligible for admission. The Programme shall extend over a period of one academic year comprising of two semesters. The students of odd semester will be enrolled in the programme.

ADMISSION

Admission will be given to student on first come basis after the wide circulation of announcement and one day workshop on career prospective of this course. Personal interviews will also be conducted if the number of enrollees increases.

OBJECTIVES OF THE PROGRAMME

It is envisaged that professionally qualified graduates with a sound knowledge of their core disciplines and expertise in a concerned skill will have more openings in service, industry and self-employment sectors. Demand and scope for such professionally trained graduates are visible in the applied fields of almost all basic/core disciplines and faculties in the current changing global scenario and is likely to increase in the future.

Plant tissue culture is a method or technique to isolate parts of plants (protoplasts, cells, tissues, and organs) and grow them on artificial media in aseptic conditions in a controlled space so that parts of these plants can grow and develop into complete plants. Plant tissue culture now has direct commercial applications as well as value in basic research. This course provides basic knowledge of plant tissue culture, about the organization, scope and profits of a tissue culture based industries and how to start with own industry *i.e.* entrepreneurship.

Keeping these things in mind, curriculum is designed to attain the following learning goals which students shall accomplish by the time of end of this programme:

- This programme will facilitate students to attain knowledge on the brass tacks of plant tissue culture and will enable them to appreciate emerging and advanced concept in this area as well as it will help them to take their career in this field.
- The objective of the programme is to introduce career and market-oriented, skill enhancing add-on courses that have utility for job, self-employment and empowerment of the students.
- The Programme is planned to help the students to be the ground-breaking and multitalented personalities in the field of plant biotechnology and to provide the trained manpower required by Industry, Research and Development and Institutions of Higher Learning.
- Assist and identify potential enrollees, assist in identifying potential employers, assist with resumes and other job search skills.

STRUCTURE OF THE PROGRAMME

The COP programme shall have a curriculum comprising theory and practical courses with a specified syllabus. The curriculum of the programme is a blend of theory courses and practical courses. The programme will be offered to all the under graduate students as co-curricular course

(along with the pool of other course offered by other departments of the college) under the category of SEC (skill enhancement course) of under graduate as directed in UGC guideline for choice based credit system. The course will be of total one credit and comprising more than eighty hours.

The medium of instruction and examinations shall be English.

EVALUATION

The evaluation shall generally comprise of Continuous Internal Evaluation (CIE) and Course End Examination (CEE) with percentage weightage as specified below, unless specified otherwise in the Scheme of Instruction and Examinations.

<i>Theory Courses</i>		<i>Practical Courses</i>	
Continuous Internal Evaluation (CIE)	40%	Continuous Internal Evaluation (CIE)	40%
Course End Examination (CEE)	60%	Course End Examination (CEE)	60%

ISSUE OF MARKSHEET AND CERTIFICATE

The college shall publish the result after evaluation and with the recommendations of Result Passing Board at the end of programme.

1. After successful completion of the course, no marks will be given to students only remarks be given as per follows for earning one credit as a co-curricular course to earn the degree. However, this remark and credit will be indicated only in the consolidated mark sheet of the students.

Range of Marks (Theory + Practical)	Remarks
180 – 200	Excellent
150 – 179	Very Good
120 – 149	Good
080 – 119	Fair
79 and below	Not completed

2. The students in addition will receive the following as a completion of the course:
 - a) Individual marksheet per semester
 - b) Certificate on completion

SCHEME OF INSTRUCTION AND EXAMINATIONS

Course Code	Course	Hrs of Instruction / week	Exam Duration (Hrs)	Max Marks			Credit
				CIE	CEE	Total	
Odd - Semester							1
16UBTCOC1	Core 1 Theory: Basics of Plant Tissue culture	2	3	20	30	50	
	Core 1 Practical : Plant Tissue Culture Practical-1	4	3	20	30	50	
Total		6					
Even - Semester							
	Core 2 Theory: Applied Plant Tissue Culture	2	3	20	30	50	
	Core Practical : Plant Tissue Culture Practical-2	4	3	20	30	50	
Total		6				200	1

	Co-curricular Course Plant Tissue Culture	Duration of Course & Semester 1 Year (140 hrs) Odd to Even	Student opting in Semester I & III	1 Credits
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Odd - Semester

Core 1 Theory - Basics of Plant Tissue Culture (25 hrs)

Objectives:

After completion of this course, student will be able to:

1. Understand the principle and applications of plant tissue culture
2. Define and describe components of plant tissue culture medium and methodology of preparation of medium
3. Independently establish in vitro culture of plant

Unit 1: Basic of Plant Tissue Culture - I (5 hrs)

- History, contribution of Indian Scientists.
- Concept of cellular totipotency and differentiation
- Scope and Applications of Plant Tissue Culture

Unit 2: Basic of Plant Tissue Culture - II (5 hrs)

- Laboratory Planning and Designing
- Plant tissue culture media: component and preparation
- role of nutrient in growth

Unit 3: Establishment of Cultures - I (05 hrs)

- Different stages of plant tissue culture
- Explant: types, collection and preparation
- Sterilization and aseptic inoculation of explants on suitable medium

Unit 4: Establishment of Cultures - II (05 hrs)

- Micropropagation pathways and criteria for selection of pathways

- Somatic embryogenesis
- Embryo culture and embryo rescue

Unit 5: Protoplast Culture

(04 hrs)

- Isolation of protoplast: physical and enzymatic methods
- Culture of protoplast
- Special culture methods of protoplast

Core 1 Practical: Plant Tissue Culture Practical-1

Objectives:

After completion of this course, student will be able to:

- Understand the laboratory organization and requirement of plant tissue culture laboratory
- Learn to methodology of preparation and sterilization of stock solution and different tissue culture medium
- independently establish the micropropagation protocol of important protocol

Laboratory Exercise

(45 hrs)

1. Plant tissue culture: laboratory organization and facilities requirements
2. To study principles, methodology and handling of equipments used in plant tissue culture
3. Preparations of stock solutions for tissue culture medium preparation
4. Preparation of Plant tissue culture media (M S medium)
5. Preparation of other enriched medium for tissue culture (Nitsch and whites medium).
6. To study explant characteristics, preparation of explant and aseptic inoculation of explant
7. In vitro culture of suitable explant for induction of callus
8. Study of growth characteristics of callus
9. Establishment of cell suspension culture from callus
10. Study of growth in suspension culture using spectrophotometric/cell count method

11. In vitro establishment of shoot culture using mature node explant
12. Extraction and estimation of secondary metabolites from in vitro grown callus

Even - Semester

Core 2 Theory - Applied Plant Tissue Culture (25 hrs)

Objectives:

After completion of this course, student will be able to:

1. Understand the principle and application of hybridization and develop skill to isolate, culture and fuse the plant protoplast
2. Define the causes, molecular mechanism and detection methods of variations arise during culture conditions
3. Understand the current scenario and scope of tissue culture based industries in India

Unit 1: Protoplast fusion and hybrids (05 hrs)

- Protoplast fusion: chemical and physical methods
- Selection method of true hybrid after fusion experiments
- Symmetric and Asymmetric hybrids and cybrids

Unit 2: Variability in Tissue Culture - I (05 hrs)

- Somaclonal variations
- Origin and causes of variation
- Molecular mechanism of variation

Unit 3: Variability in Tissue Culture - II (05 hrs)

- Scope of somaclonal variation in interspecific crosses
- Comparison of somaclonal variations and gametoclonal variations
- Methods to detect the variations

Unit 4: Hardening of tissue culture derived plantlets (05 hrs)

- Factors affecting hardening and acclimatization of tissue culture grown plants
- Primary and secondary hardening units; operation and managements
- Hardening and acclimatization – success and bottlenecks

Unit 5: Hardening of tissue culture derived plantlets (05 hrs)

- Scaling-up production and automation in plant propagation
- Global market of plant tissue culture
- Commercial opportunities in plant tissue culture with special reference to plant tissue culture industries in India

Core 2 Practical: Plant Tissue Culture Practical - 2

Objectives:

After completion of this course, student will be able to:

- Learn the technique to establish the cultures of plant using mature internode and leaf explant
- Understand *in vitro* rooting techniques and methodology of hardening and acclimatization process of tissue culture grown plant
- Learn the techniques of isolation and culture of plant protoplast and methodology of artificial seed preparation

Laboratory Exercise (45 hrs)

1. *In vitro* establishment of shoot culture using mature internodes explant
2. *In vitro* establishment of shoot culture leaf explant
3. Root induction in *in vitro* raised shoots
4. To study the hardening and acclimatization of tissue culture raised plantlets
5. Culture of anther for production of androgenic haploids
6. Protoplast culture, isolation and regeneration
7. Meristem tip culture for production of virus free plants

8. Encapsulation of somatic embryos/shoot buds for production of synthetic seeds
9. Genomic DNA isolation of tissue culture raised micropropagules for molecular studies
10. To test the fidelity of tissue culture derived micropropagules using RAPD markers
11. To study the application of software (e.g. NTsys) for interpretation of data received from PCR amplification of tissue culture derived plants DNA for fidelity/diversity analysis

Reference Books:

1. Chawla, H.S. (2002). Introduction to Plant Biotechnology. Oxford & IBH Publishers.
2. Narayanaswamy, S. (1994). Plant cell and tissue culture. Tata McGraw-Hill Education.
3. Bhojwani, S. S., & Razdan, M. K. (1986). Plant tissue culture: Theory and practice (Vol. 5). Elsevier.
4. Gamborg, O. L., & Phillips, G. (Eds.). (2013). Plant cell, tissue and organ culture: fundamental methods. Springer Science & Business Media.
5. George, E. F., Hall, M. A., & De Klerk, G. J. (Eds.). (2007). Plant propagation by tissue culture: volume 1. The background (Vol. 1). Springer Science & Business Media.
6. Smith, R. (2012). Plant tissue culture: Techniques and Experiments. Elsevier Science.