

As Per NEP 2020

University of Mumbai



Syllabus for Minor (Scheme III) Vertical 2

Faculty of Science & Technology	
Board of Studies in Botany	
Third Year Programme in Minor B.Sc. (Botany)	
Semester	V
Title of Paper	Plant Biotechnology
Credits	2
From the Academic Year	2026-27

Sem. - V

Syllabus B.SC. (Botany) (Sem.- V)

Title of Paper: Plant Biotechnology

Sr. No.	Heading	Particulars
1	Description of the course : Including but Not limited to :	Plant Biotechnology is a minor course offered to TYBSc students which includes in vitro propagation techniques of the plants. Students will be able to produce the plants on a large scale using plant tissue culture technology. This course gives insight on various techniques to produce the plant using different types of explants. Minor course on plant biotechnology also include the concept of transgenic plants. Several techniques of gene transfer are elaborated in the module. Industrial plant biotechnology explores the commercial production of bioactives using plants. Students are made aware about industrial operations for the large scale production of plant based products. This course opens diverse career pathways in the rapidly expanding fields of plant biotechnology, agriculture, pharmaceuticals, and bio-based industries. Students trained in plant tissue culture, transgenic technology, and industrial plant biotechnology can pursue roles in research laboratories, biotechnology companies, plant nurseries, and agricultural biotechnology firms. Opportunities exist as plant tissue culture technicians, research assistants, quality control analysts, and laboratory technologists in biotechnology and horticulture industries involved in large-scale plant propagation and production of plant-derived bioactive compounds. The knowledge of in vitro propagation and gene transfer techniques also prepares students for higher studies and research in plant biotechnology, molecular biology, and crop improvement. Graduates may work in research institutions, seed technology companies, herbal product industries, and biopharmaceutical sectors focusing on plant-based therapeutics. The course also encourages entrepreneurial ventures, such as establishing commercial plant

		tissue culture laboratories, micropropagation nurseries for ornamental, horticultural, and medicinal plants, and production units for plant-based bioactive compounds and herbal products. With growing demand for disease-free planting material, medicinal plants, and value-added botanical products, students can develop startups in plant propagation services, specialty plant nurseries, and bioactive extraction units, contributing to sustainable agriculture and the green biotechnology sector.
2	Vertical :	Minor
3	Type :	Theory
4	Credit:	2 credits (1 credit = 15 Hours for Theory or 30 Hours of Practical work in a semester)
5	Hours Allotted :	30 Hours
6	Marks Allotted:	50 Marks
7	Course Objectives: To enable the learner to: 1. Understand the nutritional requirements for in vitro plant growth and the significance of callus in plant tissue culture. 2. Explain the principles of micropropagation and somatic embryogenesis with reference to their industrial applications. 3. Acquire knowledge of various gene transfer techniques used in plant biotechnology. 4. Comprehend the diverse applications of plant biotechnology across different industries.	
8	Course Outcomes: The learner will be able to: 1. Explain MS medium composition and demonstrate callus induction in plant tissue culture. 2. Describe the steps involved in micropropagation and somatic embryogenesis and relate them to their applications. 3. Illustrate and compare different techniques of gene transfer in plants. 4. Elaborate on the applications of plant biotechnology in agriculture, industry, and allied sectors.	

9	Modules:-	
	Module 1- Plant Tissue Culture	1 Credit
	• Nutrient medium for in vitro growth of plant tissue – concept, types: Basal and defined medium. • Murashige and Skoog Culture Media Preparation: Macronutrients, micronutrients, vitamins, PGRs, gelling agents, sterilization. • Callus Induction and Suspension Cultures: Techniques, optimization factors.	

	● Somatic Embryogenesis & Synthetic Seeds: Direct/indirect pathways, encapsulation techniques. ● Micropropagation: Stages I–IV, commercial applications. Activities: ● Designing and layout of plant tissue culture laboratory. ● Problems on preparation of different strength Basal and defined medium.	
	Module 2: Gene Transfer and Industrial Plant Biotechnology 1 Credit	
	● Gene Transfer Methods: Protoplast fusion, electroporation, particle gun method, microinjection, Agrobacterium-mediated transformation. ● Protoplast Culture and Transformation: Isolation, PEG treatment, regeneration, selection. ● Cell Immobilization: Techniques, matrices, applications. ● Bioreactor: Stirred tank- monitoring parameters. ● Industrial Applications: Secondary metabolites (cellulase and shikonin), molecular farming, algal biotechnology. Activities: ● Model preparation – stirred tank bioreactor. ● Encapsulation and preservation of axillary buds as germplasm.	
10	Text Books: ● Plant Tissue Culture. Kalyan Kumar Day. ● Plant Tissue Culture. M K Razdan.	
11	Reference Books: ● Plant Biotechnology. B D Singh ● Fermentation Technology. Stanbury Whittaker ● https://share.google/MncyBGnuKvZegMwbA ● Kunka Kamenarova, Nabil Abumhadi, Kostadin Gecheff and Atanas Atanasso. (2005). Molecular farming in plants: An approach to agricultural biotechnology. Journal of Cell and Molecular Biology 4: 77-86.	
12	Internal Continuous Assessment: 40%	External, Semester End Examination 60% Individual Passing in Internal and External Examination
13	Continuous Evaluation through: Quizzes, Class Tests, presentation, project, role play, creative writing, assignment, module based activity, etc.(at least 3)	Term end examination 30 Marks Three questions with options, each question with 10 marks.

QUESTION PAPER PATTERN
(External and Internal)
TYBSc Botany NEP Question Paper Pattern
External Theory (Minor) Credits: 2

Time: 1 Hour

Marks: 30

NB: 1. All Questions are Compulsory. 2. Draw neat and labelled diagrams wherever necessary.			
Q. No	Type	Marks	Module
Q1	Multiple Choice Question /Fill in the Blanks (Any 5 out of 10) (5 from each Module)	5	1 & 2
Q2	Answer in 1-2 Sentences: (Any 5 out of 10) (5 from each Module)	5	1 & 2
Q3	Answer any 1 of the following. (Any 1 out of 2)	10	1
Q4	Answer any 1 of the following. (Any 1 out of 2)	10	2

Internal Theory 20 M

Continuous Evaluation through:	Quizzes, Class Tests, presentation, Project, role play, creative writing, Assignment and any 1 activity based on theory etc. (at least 3)
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Note:

Individual Passing in Internal and External Examination.

Sd/-
BOS Chairman
Principal Dr. Vasant
P. Mali
BOS in Botany

Sd/-
Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science &
Technology

Sd/-
Offg. Dean
Prof. Shivram S. Garje
Faculty of Science &
Technology