

**Model Syllabus for 4-Year UG Honours in B.Sc. (Biotechnology) as Major
in consonance with Curriculum framework w.e.f. AY 2026-27**

COURSE STRUCTURE (for Semester IV)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
II	IV	8	Bioinformatics, Biostatistics & Bioethics	3	3
			Bioinformatics, Biostatistics & Bioethics- Practical	2	1
		9	Basics of Plant Biotechnology	3	3
			Basics of Plant Biotechnology-Practical	2	1
		10	Basics of Animal Biotechnology	3	3
			Basics of Animal Biotechnology-Practical	2	1

SEMESTER - IV

COURSE 9: BASICS OF PLANT BIOTECHNOLOGY

Theory

Credits: 3

3 hrs/week

Course Objectives:

1. To understand the principles of plant tissue culture and its applications.
2. To study specialized tissue culture techniques such as micropropagation, haploid culture, and protoplast fusion.
3. To learn different methods of genetic transformation in plants.
4. To explore the development and applications of transgenic plants.
5. To examine the use of plant biotechnology in production of valuable compounds, biofuels, and in sustainable agriculture, along with ethical and biosafety considerations.

Learning Outcomes:

After completing this course, students will be able to:

1. Explain the basic principles of plant tissue culture and its significance.
2. Apply micropropagation, haploid culture, and protoplast fusion techniques in plant improvement.
3. Differentiate between direct and indirect methods of plant genetic transformation.
4. Analyze the role of transgenic plants in agriculture, health, and environment.
5. Discuss applications of plant biotechnology in molecular farming, biofuels, biocontrol, and biofertilizers, and evaluate related ethical and biosafety issues.

Syllabus

Unit I

Plant Tissue Culture: Principles of plant tissue culture. Totipotency, differentiation, dedifferentiation, redifferentiation. Sterilization techniques, Types of culture media and composition of MS medium. Callus culture, organogenesis, somatic embryogenesis

Unit II

Specialized Plant Tissue Culture Techniques: Micropropagation and its applications. Haploid culture – anther and pollen culture, doubled haploids and their applications. Protoplast culture and fusion – somatic hybridization, cybrids. Cryopreservation and germplasm conservation

Unit III

Plant Genetic Transformation Methods: Direct gene transfer methods – particle bombardment, electroporation, microinjection. Indirect Gene Transfer Method - Agrobacterium tumefaciens and Ti plasmid, Ri plasmid. Agrobacterium-mediated gene transfer

Ch/any/assh

Unit IV

Transgenic Plants and Applications: Transgenic plants for insect resistance (Bt crops). Transgenic plants for herbicide tolerance. Transgenic plants for disease resistance and stress tolerance. GMO Foods, Ecological impact of transgenic plants

Unit V

Applications of Plant Biotechnology: Therapeutic proteins, Edible vaccines, biofortification, and molecular farming. Phytochemical products from plants- Secondary Metabolites (Alkaloids, Flavonoids, Terpenoids). Bioethanol and biodiesel production. Biocontrol and Biofertilizers. Ethical issues and biosafety regulations in Plant biotechnology

Reference books:

1. Bhojwani, S.S. & Razdan, M.K. (1996). *Plant Tissue Culture: Theory and Practice*. Elsevier.
2. Gamborg, O.L. & Phillips, G.C. (1995). *Plant Cell, Tissue and Organ Culture: Fundamental Methods*. Springer.
3. Chawla, H.S. (2009). *Introduction to Plant Biotechnology*. 3rd Edition, Oxford & IBH Publishing.
4. Slater, A., Scott, N. & Fowler, M. (2008). *Plant Biotechnology: The Genetic Manipulation of Plants*. 2nd Edition, Oxford University Press.
5. Singh, B.D. (2015). *Biotechnology: Expanding Horizons*. Kalyani Publishers.
6. Glick, B.R., Pasternak, J.J. & Patten, C.L. (2010). *Molecular Biotechnology: Principles and Applications of Recombinant DNA*. 4th Edition, ASM Press.
7. Razdan, M.K. (2003). *Introduction to Plant Tissue Culture*. Science Publishers.

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SEMESTER - IV

COURSE 9: BASICS OF PLANT BIOTECHNOLOGY

Practical

Credits: 1

2 hrs/week

Practical Component:

1. Plant culture media and composition of MS media
2. Raising of aseptic seedlings
3. Induction of callus from different explants
4. Plant propagation through Tissue culture (shoot tip and Nodal culture)
5. Establishing a plant cell culture (both in solid and liquid media)
6. Suspension cell culture

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4- Year UG Honours, Major
Syllabus
(2026-27)
Semester-IV

Model Question Paper

Time : 3hrs

Marks:75

Part-A

Answer any Five Questions. Each Question carries 3 Marks.

5x3=15

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.
- 8.
- 9.
- 10.

Answer the following questions. Each question carries 12 Marks

5x12=60

11. a) Unit-I
(Or)
b) Unit-I

12. a) Unit-II
(Or)
b) Unit-II

13. a) Unit-III
(Or)
b) Unit-III

14. a) Unit-IV
(Or)
b) Unit-IV

15. a) Unit-V
(Or)
b) Unit-V