GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Bachelor of Science

Level: Under Graduate

Branch Name: Honors/ Honors With Research (Biotechnology)

Course / Subject Code: BS04001011

Course / Subject Name: Plant and Animal Biotechnology

W.e.f. Academic Year:	2025-26
Semester:	4
Category of the Course:	Core Courses

Prerequisite: Student should have basic knowledge of eukaryotic cells special plant and animal cells and its structural features. Students should have brief idea about plant and animal physiology. Student must be aware of good laboratory practice

Rationale:

The Plant and Animal Biotechnology syllabus equips graduate students with fundamental and applied knowledge in genetic engineering, molecular biology, and bioinformatics to address challenges in agriculture, healthcare, and sustainability. It emphasizes food security, biomedical applications, ethical considerations, and hands-on training, preparing graduates for research, industry, and policy roles.

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
				Theory		Practical		
L	T	PR	C	ESE (E)	PA(M)	ESE (V)	PA (I)	
3	0	2	4	70	70	30	30	200

Course Content:

Sr. No.	Course Content	No. of Hours	% of Weightage
1	**Animal cell culture and applications** Primary cells and cell lines. Maintenance of cultures; Simulating natural conditions for growth of animal cells; Significance of media components. Anchorage dependence and contact inhibition. Types of Animal cell culture; Organ culture; Primary explant cultures; Secondary cultures and Established cell lines; commonly used cell lines: origin and characteristics; Growth kinetics and cells in culture; 3 – D culture. Methods to transform primary cells. Choice of animal cells for protein production, Viral vaccine production. Scale-up of animal cell culture. Applications of animal cell culture with examples.	**10**	**22**
2	**Gene transfer and manipulation methods in animals** Transformation, Transfection, and Electroporation. Selection of cells for stable transfection and continuous production of protein from the transgene. Methods to knockdown the expression of endogenous genes. Embryonic stem cells, gene manipulations in embryonic stem	**10**	**21**

	cells, transgenic, knockout, and Cre/LOXP mice. Cloning of animals.		
3	**Introduction and Techniques used in plant tissue culture** Principles of plant tissue culture, cell totipotency and cyto-differentiation, Laboratory setup of plant tissue culture, sterilization techniques and instruments used, culture condition and explants selection, Media preparation and components of media, Role of growth hormone in plants and its application in tissue culture. Callus culture, Single cell culture, Protoplast isolation, culture and fusion, haploid culture: Anther culture, pollen culture, ovule culture, Triploid plant production: endosperm culture, Somatic embryogenesis, Somaclonal variation, Synthetic seeds, Generating Virus free plants, Plant breeding techniques, Conservation of plants (need of conservation of plant, liquid nitrogen, seed bank, gene bank etc)	**10**	**21**
4	**Genetic engineering of plants** Transformation of gene, vector mediated and non-vector mediated methods of transformation, Hairy root culture, Varieties included for crop improvement, selection of desired variety, Recombinant products by plant tissue culture, Introduction to Genome Editing and Genome Selection.	**10**	**22**
5	**Applications of plant and animal Biotechnology** Genetically modified animal models used in biomedical research such as Cancer, Diabetes, Immunology, and Toxicology Case studies on the production of genetically modified plants for herbicide tolerance, biotic and abiotic stress tolerance and improvement of quality traits Molecular pharming; importance and risks of transgenes in the ecosystems;	**5**	**14**

Textbook:

1. Plant Biotechnology by B. D. Singh
2. Animal Biotechnology by B. D. Singh

Reference Books:

1. Primrose S.B. and R.M. Twyman. Principles of Gene manipulation and Genomics. 7th Ed. Blackwell Publishing 667p.2006.
2. Sandy B. Primrose, Richard Twyman, Bob Old. Principles of Gene Manipulation: An Introduction to Genetic Engineering. 6th Ed.2001.

Course Outcome:

After Completion of the Course, Student will able to:

Sr. No	Course Outcomes	RBT Level
1.	Describe fundamental concepts of animal and plant biotechnology, including cell culture techniques and genetic engineering approaches.	RM
2.	Explain the principles and techniques used in gene transfer, tissue culture, and genome editing in plants and animals.	UN
3.	Apply various biotechnological techniques for the development of genetically modified organisms and biopharmaceuticals.	AP
4.	Analyze the applications and ethical implications of genetically modified plants and animals in agriculture and healthcare.	AN

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

List of Experiments:

1. Study of laboratory equipments
2. Stocks and Media preparation
3. Sterilization techniques in plant tissue culture
4. Explant selection, treatment and inoculation
5. Extraction of proteins from plants and its estimation
6. Laboratory set up of animal cell culture
7. Demonstration of use of Biosafety Cabinet
8. Media preparation and sterilization by membrane filtration

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