GUJARAT TECHNOLOGICAL UNIVERSITY
BIOTECHNOLOGY (04)
ANIMAL AND PLANT BIOTECHNOLOGY
SUBJECT CODE: 2180402
B.E. 8th Semester

Type of course: B.E. (Biotechnology)

Prerequisite: Basic Concepts of animal and plant anatomy and physiology.

Rationale: It is one of the advanced subjects of Biotechnology. It involves the establishment of animal and plant tissue culture in the laboratory conditions using artificial media.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		PA (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	3	6	70	20	10	20	10	20	150

Course Contents:

Sr. No.	Topics	Teaching Hours	Module Weightage
1	**UNIT I: Animal Cell and Tissue Culture** History and scope of animal cell and tissue culture; advantages and disadvantages of tissue culture; laboratory facilities for tissue culture; the substrate on which cells grow; treatment of substrate surfaces; feeder layers on substrate; the gas phase for tissue culture; culture media for cells and tissues; culture procedures, Disaggregation (enzymatic and mechanical) of tissue and primary culture; cultured cells and evolution of cell lines; maintenance of culture-cell lines, Tissue culture (slide, flask and test tube cultures); organ culture; whole embryo culture; tissue engineering (artificial skin and artificial cartilage).	**11**	**22.91**
2	**Unit II: In Vitro Fertilization & Transgenic Animals** In vitro fertilization (IVF) in humans; embryo transfer (ET) in humans; superovulation, IVF and embryo culture in farm animals (e.g. cow); embryo transfer in cattle, Gene transfer or transfection (using eggs and cultured stem cells); targeted gene transfer; transgenic animals. (mice, sheep, pigs, rabbits, goats, cows, fish).	**5**	**10.41**
3.	**UNIT III: Plant tissue culture** Introduction, History, Laboratory organization, Nutrition medium, media composition, different kinds of sterilization techniques for the preparation of sterile media, containers & instruments, maintenance of aseptic conditions.	**5**	**10.41**

4.	**Unit IV: Types of culture** Cytodifferentiation, Organogenic differentiation, Types of culture - Seed culture, Embryo culture, Mature embryo culture, Immature embryo culture/embryo rescue, Application of embryo culture, Callus culture, Organ culture, Nucellus culture, Application Endosperm culture, Application cell culture, Micropropagation, secondary metabolite production, haploid production, protoplast isolation & fusion, somaclonal variation.	**12**	**25.00**
5.	**Unit V: Transgenics in crop improvement and Bioethics** Resistance of biotic stresses, Insect resistance, Resistance genes from microorganisms, Resistance genes from higher plants**,** Resistance genes from animals**,** Virus resistance**,** Coat protein mediated cross protection**,** Non structural protein mediated resistance**,** Antisense and sense mediated resistance**,** Satellite RNA protection**,** Pathogen targeted resistance**,** Disease resistance**,** Pathogenesis related proteins, Phytoalexins**,** Manipulation of disease resistance genes**,** Resistance of abiotic stresses**,** Herbicide resistance**,** Transgenic for quality**,** Transgenic for improved storage**,** Longer life transgenic flowers**,** Transgenic for male sterility**,** Terminator technology for use in hybrid seed production**,** Commercial transgenic crops. **Bioethics:** Concepts of bioethics, socioeconomic impacts of ethical and non-ethical practices; ethical aspects of genetically modified organisms and their release in environment.	**15**	**31.25**

Suggested Specification table with marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
12	12	22	16	08	-

Legends: R= Remembrance**; U=** Understanding**; A=** Application**; N =** Analyze**;**
E = Evaluate and above Levels **(Revised Bloom's Taxonomy)**

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Introduction to Biotechnology, P.K.Gupta, Kalyani Publishers,second edition.
2. Introduction to plant Biotechnology, H.S.Chawala, second ed., PHI
3. Plant Biotechnology – P. C. Trivedi
4. Applied Plant Biotechnology – Ignacimuthu
5. Animal Biotechnology – Babinnk and Philips.
6. Biotechnology – B. D. Singh.
7. Plant Tissue Culture – S.S. Bhojwani, M.K. Razdan.
8. Biotechnology Fundamentals and Applications – Purohis S S

9. Biotechnology in the Welfare of Mankind – Ali Khan

Course Outcome:

After learning the course, the students should be able to:

- Develop a fundamental understanding of basic concepts of animal and plant tissue culture methods and their applications in the field of Biotechnology.
- Evaluate applications of various concepts & techniques of animal and plant tissue culture to facilitate biotechnological advancement and innovations.

LIST OF PRACTICALS:

1. To study the various aspects of laboratory organization for plant tissue culture.
2. To collect various explants for their manipulation and surface sterilization.
3. To study the asceptic handling of explants and performing assay to identify common contaminants.
4. Preparation of Murashige-Skoog (MS) media
5. To perform induction of callus in *Solenum tuberosum*.
6. To perform callus induction in *Daucus carrota*.
7. To perform callus induction in *Zea mays*.
8. Initiation of anther culture and haploid production.
9. Establishment of primary culture of chicken liver hepatocytes.
10. Establishment of primary culture of chicken cardiac myocytes.

Open Ended Problem:

Students are free to select any area of science and technology based on Animal & Plant Biotechnology applications to define Projects.

Some suggested projects are listed below:

- To establish a desired animal cell-line
- To analyze the difficulties faced in establishing new culture of animal cells & tissues.
- To establish different types of cultures of plant cells and tissues.
- To perform optimization experiments for micropropagation of explants.

List of Open Source Software/learning website:

Students can refer to video lectures available on the websites including NPTEL. Students can refer to the CDs which are available with some reference books.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.