

GUJARAT TECHNOLOGICAL UNIVERSITY

School of Applied Sciences and Technology

Integrated M.Sc. Biotechnology

PLANT & ANIMAL BIOTECHNOLOGY

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 objective of this course is to educate students about fundamental concepts of animal and plant cell system, bioprocess technology using eukaryotic system and their related applications, thus, preparing them to meet challenges of new and emerging areas of biotechnology industry

Course Scheme:

| Teaching Scheme | | | Total Credits | Assessment Pattern and Marks | | | | Total Marks |
|-----------------|---|---|---------------|------------------------------|-----------------------------|------------------------------------|--|-------------|
| L | T | P | C | Theory | | Tutorial/ Practical | | |
| | | | | University exams (ESE) | Progressive Assessment (PA) | External Practical /viva Exam(ESE) | Internal evaluation Practical /viva Exam(PA) | |
| 4 | 0 | 8 | 8 | 70 | 30 | 30 | 20 | 150 |

Course Content:

| Unit No. | Content | No. of Hours | 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- | 12 | 20 |

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|----------|---|----|----|
| | up of animal cell culture. Applications of animal cell culture with examples. | | |
| 2 | <p>Gene transfer and manipulation methods in animals</p> <p>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 cells, transgenic, knockout, and Cre/LOXP mice. Cloning of animals.</p> | 12 | 20 |
| 3 | <p>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)</p> | 12 | 20 |
| 4 | <p>Genetic engineering of plants</p> <p>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.</p> | 12 | 20 |
| 5 | <p>Applications of plant and animal Biotechnology</p> <p>Genetically modified animal models used in</p> | 12 | 20 |

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| 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; | | |
| Total Hours: | 60 | |

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 Outcomes:

| No. | Course Outcomes | RBT Level* |
|-----|--|----------------|
| 1 | Contributing towards developing high yielding and good quality crops to meet demands of the farmers and population | UN,RM,AP,AN,EV |
| 2 | Contributing towards developing plants for bioremediation and sustaining in stressed climatic conditions | UN,RM,AP,AN,EV |
| 3 | Work in institutions and industries contributing to agribiotech sector | UN,RM,AP,AN,EV |
| 4 | Become a skilled personnel in animal cell culture | UN,RM,AP,AN,EV |
| 5 | Become a skilled personnel in Plant tissue culture | UN,RM,AP,AN,EV |

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

Suggested Course Practical List:

1. Study of laboratory equipments
2. Stocks and Media preparation

3. Sterilization techniques in plant tissue culture
4. Explant selection, treatment and inoculation
5. Subculture of initiated cultures
6. Acclimatization of cultures
7. Extraction of proteins from plants and its estimation
8. Laboratory set up of animal cell culture
9. Demonstration of use of Biosafety Cabinet
10. Media preparation and sterilization by membrane filtration
11. Peripheral Blood Lymphocyte Culture
12. Cell suspension studies using cell lines

List of Laboratory/Learning Resources Required

1. https://onlinecourses.swyam2.ac.in/cec22_bt07/preview
2. <https://nptel.ac.in/courses/102103016>

