Programme	BS Biotechnology	Course Code	BT. 201	Credit Hours	3-0
Course Title	Agriculture Biotechnology				

Course Introduction

This course provides an introduction to agricultural biotechnology, designed for undergraduate students majoring in Biochemistry and Biotechnology. The curriculum covers techniques for developing transgenic crops, plant molecular markers, tissue culture, somatic embryogenesis, and various methods of plant transformation. Students will also learn about the commercial applications of tissue culture, field evaluation, and biosafety concerns related to genetically modified (GM) crops

Learning Outcomes

By the end of this course, students will be able to:

- Explain the principles and applications of genetic modification in crop and livestock improvement.
- Analyze the impact of biotechnology on food security and sustainable agricultural practices.
- Discuss the ethical and regulatory issues in agricultural biotechnology.

Course Content

Theory Unit

- Introduction to Agriculture Biotechnology
- History and its applications in crop improvements
- History and Requirements for In-Vitro Cultures
- Application in Crop Improvement
- Concepts of Molecular Markers and Marker Assisted Selection
- Types and Applications in Crop Improvement
- Methods of Gene Transfer (direct and indirect gene transfer)
- Gene Gun Method of Transformation
- Agrobacterium Mediated Transformation
- Chloroplast Transformation
- Polyethylene glycol (PEG) Mediated Transformation
- Transgenic Plants: Case Studies (Bt Cotton, Golden Rice)
- Gene Editing Techniques (CRISPR-Cas9)
- Transgenic Animals: Case Studies
- Plant Hormones
- Signaling Pathways
- Applications in Biotechnology
- Transgenic Crops with Herbicide Resistance
- Biotic Stress resistant transgenic Crops
- Transgenic Crops with Pest Resistance
- Biotic Stress resistant transgenic Crops
- Transgenic Crops with Disease Resistance
- Abiotic Stress resistant transgenic Crops
- Drought stress Tolerance

- Salt Stress Tolerance
- Abiotic Stress resistant transgenic Crops
- Heat Stress Tolerance
- Introduction to Biofertilizers and Biopesticides
- Types and Applications of Biofertilizers in Sustainable Crop Production.
- Types and Applications of Biopesticides in Sustainable Crop Production
- Genetic Improvement of Livestock
- Applications in Animal Health
- Future Prospects and Emerging Technologies
- Next-Generation Sequencing
- Synthetic Biology
- Future Trends in Agricultural Biotechnology
- Field Evaluation and Commercialization of Transgenic Crops
- Ethical Considerations in Genetic Engineering
- Environmental Impact of GMOs

Textbooks and Reading Material

Textbooks.

- Neal Stewart (2016). *Plant Biotechnology and Genetics: Principles, Techniques, and Applications 2nd Edition.* Academic Press.
- Adrian Slater, Nigel W. Scott, Mark R. Fowler, 2008. *Plant Biotechnology: The Genetic Manipulation of Plants 3rd Edition*, Oxford University Press.
- Firdos Alam Khan (2020). *Biotechnology Fundamentals 3rd Edition*. CRC Press.
- Matthew P. Reynolds and Hans-Joachim Braun. (2022). *Wheat improvement: food security in a changing climate*. Springer Nature.
- Hans-Walter Heldt and Birgit Piechulla. (2021). *Plant biochemistry 5th Edition*. Academic Press.
- Bernard R. Glick and Cheryl L. Patten. (2022). *Molecular biotechnology: principles and applications of recombinant DNA 6th Edition*. John Wiley & Sons.

Teaching Learning Strategies

- Class lecture
- Class Discussions
- Class Tutorials

Assignments: Types and Number with Calendar

- 1st Quiz in 4th Week of 5 marks
- 2nd Quiz in 10th Week of 5 marks
- 3rd Quiz in 14th Week of 5 marks
- 1st Assignment in 8th Week of 10 marks

Assessment

Sr. No.	Elements	Weightage	Details
1	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.

2	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.