

Syllabus for B.Sc. (Hons) Agriculture Year – III (Sem. VI)

Subject Code: 16AS0616

Subject Short Name: Biotech. 6.1

Subject Name: Fundamentals of Agricultural Biotechnology

Objective:

1. To provide complete knowledge of fundamental principles of biotechnology
2. To enable students with the intense knowledge of various developments in biotechnology and its potential applications

Credits Earned: 3 Credits (2+1)

Course Outcomes: After completion of this course, Students will be able to

- Gain the knowledge about various techniques utilized in plant tissue culture.
- Describe the various principles lying behind the concepts of plant molecular biology and plant biotechnology.
- Know various certification and quality parameters steps and procedures involved in plant tissue culture.
- Understand the new concepts of transgenic technology in plants.

| Teaching Scheme (Hours) | | | Credits | Theory Marks | | | Tutorial/ Practical Marks | | Total Marks |
|-------------------------|----------|-----------|---------|--------------|-------------|-----------------------------|---------------------------|----------------|-------------|
| Theory | Tutorial | Practical | | ESE (E) | Mid Sem (M) | Progressive Assessment (PA) | Viva (V) | Term work (TW) | |
| 2 | 0 | 2 | 3 | 40 | 20 | 20 | 10 | 10 | 100 |

Theory Content:

| Unit | Topics | Contact Hours |
|------|--|---------------|
| 1 | Introduction to Plant Tissue Culture and Genetic Engineering: History | 1 |
| 2 | Cellular totipotency and cytodifferentiation; Callus culture, Single cell/suspension culture and their applications; Organogenesis and somatic embryogenesis | 2 |

| | | |
|----|--|-----------|
| 3 | Somaclonal variation and its use in crop improvement; Embryo rescue technique and its significance in hybrid development | 2 |
| 4 | <i>In vitro</i> fertilization, ovule culture and its significance in hybrid development; Protoplast isolation, culture and regeneration | 2 |
| 5 | Somatic hybridization (somatic hybrids and cybrids) and its application in crop improvement | 1 |
| 6 | Anther and pollen culture for haploid production; Development of disease-free (virus free) plants through apical meristem culture | 2 |
| 7 | Micropropagation technique for the generation of quality planting material; Synthetic seeds and its applications | 2 |
| 8 | National certification and Quality management of TC plants-secondary metabolite production- <i>in vitro</i> germplasm conservation. | 1 |
| 9 | Introduction to Molecular Biology: DNA structure, structure and function; DNA replication, transcription and translation, RNA, types and function; Structure of prokaryotic and eukaryotic gene | 4 |
| 10 | Lac Operon concept - Nucleic acid hybridization; Polymerase chain reaction- DNA sequencing - Sanger method; PCR and its applications | 3 |
| 11 | Introduction to recombinant DNA technology: DNA modifying enzymes and vectors; plant genetic transformation - physical (Gene gun method), chemical (PEG mediated) and Agrobacterium-mediated gene transfer methods | 3 |
| 12 | Transgenic and its importance in crop improvement with successful stories; biosafety. Introduction to various molecular markers: RFLP, RAPD, SSR, SNP etc.; Marker-assisted breeding in crop improvement | 3 |
| | Total | 26 |

Practical Content:

| Unit | Topics | Contact Hours |
|------|--|---------------|
| 1 | Introduction to Plant Tissue Culture Laboratory; Good Laboratory Practices | 2 |
| 2 | Media Preparation and sterilization; Glassware sterilization | 2 |
| 3 | Micropropagation of important crops | 2 |
| 4 | Callus induction and culture | 2 |
| 5 | Anther culture; Apical meristem culture | 2 |
| 6 | Preparation of synthetic seeds | 2 |
| 7 | Isolation of genomic DNA | 2 |
| 8 | Quantification of DNA | 2 |
| 9 | PCR amplification of DNA; Gel electrophoresis of amplified DNA | 2 |
| 10 | Visit to tissue culture units/biotech labs | 2 |
| | Total | 20 |

Reference Books:

- Biotechnology: Expanding Horizon. Kalyani, Singh B.D., 2007
- Handbook of Plant Biotechnology. John Wiley & Sons, Christou P and Klee H. 2004
- Biotechnology and Genomics, Biotechnology and Genomics, Gupta, P.K, Rastogi Publications, 2006
- Plant Tissue Culture: Applications and Limitations, Plant Tissue Culture: Applications and Limitations, Bhojwani, S.S. (eds.), Elsevier, Amsterdam., 1990

Suggested Theory distribution:

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

| Distribution of Theory for course delivery and evaluation | | | | | |
|---|------------|-------|---------|----------|--------|
| Remember | Understand | Apply | Analyze | Evaluate | Create |
| 25% | 25% | 20% | 10% | 10% | 10% |

Instructional Method:

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by white board may also use any of tools such as demonstration, role play, quiz, brain storming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the class-rooms.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory/ field.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory.