

### 301. GENETIC ENGINEERING

#### UNIT I

1. Concept and principle of recombinant DNA Technology
2. Restriction endonucleases – properties and types
3. polynucleotide kinase; DNA ligase; DNA polymerase I; Reverse transcriptase, terminal deoxynucleotidyl transferase; polyA polymerase
4. Prokaryotic host-vector system : Characteristics of *E. coli* as host; vectors for cloning in *E. coli* (plasmid, bacteriophage and cosmid)
5. Characteristics of Gram positive and Gram negative organisms as host and suitable vectors for cloning; Shuttle Vectors

#### UNIT II

1. Design and characteristics of expression vectors for cloning in prokaryotes, factors that affect expression
2. Cloning in yeast, YACs
3. Methods of introduction of foreign DNA into animal systems; Vectors for cloning- SV-40, vaccinia virus and retrovirus, pMal, GST, pET & Pichia based vectors
4. Plant transformation: Features of Ti and Ri plasmids

#### UNIT III

1. Methods for constructing rDNA and cloning
2. Screening methods and selection of recombinant clones
3. DNA Libraries: types, advantages and disadvantages
4. Restriction mapping of the insert

#### UNIT IV

1. DNA sequencing: chemical and enzymatic methods, High throughput sequencers
2. Localization of cloned segments in genomes – molecular and chromosomal location
3. Methods for determination of copy number of a cloned gene in genome
4. Site directed mutagenesis

#### UNIT V

1. Blotting techniques – Southern, Northern, Western and Eastern blotting
2. Polymerase Chain reaction and types (multiplex, nested, real time, touchdown PCR, hot start PCR, colony PCR)
3. Gel Mobility Shift Assay, DNA Fingerprinting and DNA Foot printing, Restriction fragment length polymorphism
4. Applications of Recombinant DNA and antisense-technology

~~ATP 3/2/16~~

natani divarlan

Sr. 101.A  
2/15  
2/16  
②**Practical Exercises**

1. Bacterial Culture and antibiotic selection media. Preparation of competent cells
2. Isolation of plasmid DNA
3. Isolation of phage DNA
4. Quantitation of nucleic acids
5. Restriction mapping of plasmid DNA
6. Cloning in plasmid/phagemid vectors
7. Preparation of helper phage and its titration
8. Preparation of single stranded DNA template
9. Gene expression in *E. coli* and analysis of gene product
10. Polymerase Chain Reaction

**Reference Books**

1. Recombinant DNA - By Watson et al
2. Principles of Gene Manipulation, Old and Primrose
3. Gene Cloning: An introduction, Brown
4. Biotechnology: Theory and Techniques (Vol I & II, 1995), Chirikjian
5. Molecular Genetics of Bacteria, Dale
6. Molecular Cloning (Vol I, II & III, 2001), Sambrook & Russell
7. Applied Molecular Genetics (1999), Miesfeld
8. Genes and Genome (1991), Singer & Berg
9. Molecular Biotechnology, Glick & Pasternak
10. Plant Molecular Biology (Vol I & II, 2002), Gilmartin & Bowler

Note: All text books are of latest edition.

नेहरू विश्वविद्यालय  
अहमदाबाद

SS/05  
A15  
A16  
3

### 302. PLANT BIOTECHNOLOGY

#### UNIT I

1. Objectives, roles and landmarks in plant breeding
2. Mutation breeding and distant hybridization
3. Genetically modified crops for resistance against biotic and abiotic stresses and improved nutritional quality
4. Seed production techniques: release of new varieties

#### UNIT II

1. Introduction to plant tissue culture: Tissue culture media preparation
2. Initiation of callus culture and its maintenance
3. Cell synchronization
4. Organogenesis: Somatic embryo hybridization

#### UNIT III

1. Somaclonal variation and its application
2. Anther cultures and their applications
3. Protoplast isolation and fusion, selection of hybrid cell and cybrids, synthetic seeds
4. Cryopreservation techniques and its application

#### UNIT IV

1. Plant cloning vectors: *Ti* Plasmid and direct gene transfer
2. Transgenic crops: pest and herbicide resistance
3. Morphological, Biochemical and Molecular markers advantages and disadvantages  
Choice of mapping populations, Association mapping in plants
4. Plant DNA fingerprinting: Hybridization, PCR (RFLP, SSR's, RAPD, SCAR and AFLP) and sequence based (SNPs) markers

#### UNIT V

1. Plant Genome mapping: Physical and molecular maps, Gene tagging
2. Insect resistance: Bt genes, Non-Bt like protease inhibitors, lectins, PR proteins
3. Plant breeders' right: UPOV 369, 370, 372. Germplasm maintenance
4. Intellectual property right (IPR) and patenting of biological materials

*reludivar*  
~~ATP/11/11~~

SS 105  
2  
2/15  
2/16  
y

### Practical Exercises

1. Preparation of media .
2. Surface sterilization .
3. Organ Culture.
4. Callus propagation , organogenesis, transfer of plants to soil.
5. Protoplast isolation and culture.
6. Anther culture, production of Haploids.
7. Agrobacterium culture, selection of transformants , receptor gene (GUS) assays.
8. Genomic DNA isolation from seeds and plant tissues, electrophoretic analysis
9. Restriction digestion of plant genomic DNA
10. Setting up of PCR reactions.

### Reference Books

1. Plant Biotechnology. Springer Verlag, 2000. J. Hammond, P. McGarvey and V. Yusibov (Eds.) :
2. Introduction to plant tissue culture by Kalyan Kumar
3. Plant tissue culture by Bhojwani
4. Practical applications of plant molecular biology by Henry et al
5. Principles of Plant Biotechnology by Montell SH et al
6. Plant Genome analysis by PM Gresshoff
7. Essentials of plant breeding by Phundan Singh
8. Biotechnology: Theory and Techniques Vol I & II by Jack Chirikjian
9. Genetic engineering by Sandhya Mitra
10. Plant Molecular Biology Vol I & II by Phillip M Gimartin & Chris Bowler

revisi kuralain

~~2/15~~

