

M.Sc - IIIrd sem

UNIT I

1. The recombinant DNA Technology : General concept and Principle of cloning
2. Enzymes : Nucleases and restriction endonucleases – properties and types; phosphomonoesterases; polynucleotide kinase; DNA ligase; DNA polymerase I; RNA Dependent DNA Polymerase; terminal deoxynucleotidyl transferase; poly A polymerase
3. Prokaryotic host-vector system : Characteristics of *E. coli* as host; vectors for cloning in *E. coli* (plasmid, bacteriophage and plasmid-phage)
4. Other Prokaryotic host vector systems : 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: Properties of yeast as host for cloning and different types of vectors designed for cloning in yeast.
3. Cloning in animal system: Animal system as model host, methods of introduction of foreign DNA in animal system; Vectors for cloning in animal system-SV-40, vaccinia virus, baculovirus and retrovirus vectors, pMal, GST, pET based vectors, Pichia based vectors.
4. Plant transformation technology: Features of Ti and Ri plasmids, mechanism of DNA transfer

UNIT III

1. Methods for constructing rDNA and cloning: Inserts; vector insert ligation; Infection, Transferring and cloning
2. Methods for screening and selection of recombinant clones
3. DNA Libraries: types, advantages and disadvantages of different types of libraries; Different methods for constructing genomic and full length cDNA libraries
4. Gross anatomy of cloned insert-size, restriction mapping and location

UNIT IV

1. Fine anatomy of DNA segment-General principle of chemical and enzymatic methods of nucleotide sequence analysis and advantages of automatic gene 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. Mutant construction: Introduction, deletion, insertion and point mutation

UNIT V

1. Principles and applications of Blotting techniques – Southern, Northern, Western and Eastern blotting; Polymerase Chain reaction and types (multiplex, nested, RT, real time, touchdown PCR, hot start PCR, colony PCR), Oligonucleotide synthesis,
2. Principle and applications of Gel Mobility Shift Assay, DNA Fingerprinting and DNA Foot printing, Restriction fragment length polymorphism, Chromosome mapping and chromosome painting
3. Applications of Recombinant DNA Technology in Medicine and Industry
4. Si RNA and Si RNA technology: Micro RNA construction of Si RNA vectors: Gene silencing and its applications in agro industry.

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302. PLANT BIOTECHNOLOGY

UNIT I

1. Objectives, roles and landmarks in plant breeding.
2. Special breeding techniques: Mutational breeding and distant hybridization.
3. Generation of genetically modified crops for resistance against biotic and abiotic stresses and 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 for plant improvement
2. Anther culture: haploid and diploid plant cell production and their applications
3. Protoplast isolation and fusion, selection of hybrid cell and cybrids, artificial seed production.
4. Cryopreservation techniques and application

UNIT IV

1. Plant cloning vectors: *Ti* Plasmid, RNA interference (RNAi) technology
2. Transgenic in crop improvement: Methods for gene transfer
3. Marker assisted selection: Morphological, Biochemical and Molecular markers, advantages and disadvantages, choice of mapping populations, Association mapping in plants
4. Plant DNA fingerprinting: Hybridization and PCR based markers (RFLP, SSR's, RAPD, QTLs, SCAR, AFLP etc.)

UNIT V

1. Plant Genome mapping: Physical and molecular maps, Gene tagging, classification and types of gene families in plants.
2. Insect resistance: Bt genes, Non-Bt like protease inhibitors, lectins, PR proteins etc.
3. Plant breeders' right: UPOV 369,370, 372. Germplasm maintenance
4. Intellectual property right (IPR) and Patenting of Biological material

R. S. Kajal Pranshu Deharma
 Bikharia Rohit Amal
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303. BIOPROCESS ENGINEERING AND MICROBIAL TECHNOLOGY

UNIT I

1. Introduction and basic principle of Biochemical engineering
2. Isolation, preservation and maintenance of industrially important microbes: Strain improvement of industrially important microorganisms
3. Kinetics of microbial growth and death
4. Media for industrial fermentation, media formulation; Sterilization; Aeration and agitation in bioprocess. Air sterilization

UNIT II

1. Scale of fermentation process: small scale, large scale and pilot scale fermentations
2. Bioreactors: Principle, types, design and applications
3. Types of fermentation processes; batch, fed-batch, and continuous bioreactions.
4. Measurement and control of fermentation: pH, temperature, pressure, media, air, Automation of the monitoring and control process

UNIT III

1. Upstream processing and down stream processing: Introduction and concept.
2. Down stream processing: removal of microbial cells and solid matter, foam separation, precipitation, centrifugation, cell disruption, chromatography, reverse osmosis
3. Extraction: Solvent, two phases, liquid extraction
4. Product recovery process. Crystallization, storage, packaging and quality control

UNIT IV

1. Industrial production of important bioproducts: Vitamins and amino acids (Vit B12 & Glutamic acid)
2. Industrial production of important bioproducts: antibiotics-Penicillin; and streptomycin
3. Enzyme- Amylase, Protease, Production, recovery and scaling up of enzymes and their role in food and other industries.
4. Immobilization of enzymes and their industrial applications.

UNIT V

1. Microbial production of alcoholic beverages: Distilled alcoholic beverages-Beer, microbial production of Vinegar.
2. Microbial production of organic acids: Citric acid and Acetic acid
3. Microbial production of solvents: Ethanol and acetone
4. Microbial production of food- SCP Mushroom cultivation, Biofertilizers and their applications

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Mishra

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Ramesh
Bhargava

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Dhanu

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304. BIostatISTICS AND COMPUTER APPLICATIONS

UNIT I

1. Introduction to Biostatistics, Common terms, notions and Applications
2. Statistical population and Sampling Methods
3. Classification and tabulation of data
4. Diagrammatic and graphical presentation
5. Frequency Distribution, Measures and central value
6. Measures of variability, Standard deviation, Standard error, Range, Mean Deviation Coefficient of variation, Analysis of variance

UNIT II

1. Basic tests, Test of Significance, t-test, chi-square test.
2. Regression; Basics of regression, regression analysis, Estimation, Testing, prediction, checking and residual analysis.
3. Multivariate Analysis
4. Design of Experiment, randomization, replication, local control, complimentary randomized, randomized block design

UNIT III

1. Factor Analysis
2. Path Analysis
3. Introduction to data mining
4. Virtuous cycle

UNIT IV

1. Classification and Discriminant Analysis Tools: CART, random forests
2. Fischer's discriminant functions
3. Neural networks
4. Multilayer perception, predictive ANN model building using back propagation Algorithm, exploratory data analysis

UNIT V

1. Introduction to computer basics, concept of hardware windows XP and LINUX
2. Concept of file, folders, directories and their management by windows XP and LINUX
3. Office applications: MS-office, MS-Word, MS-Excel, and MS-PowerPoint
4. Open Office on Linux: Word Processor, spread sheets, Impress
5. Statistical packages: Sigma plot etc.

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