

GENETIC ENGINEERING & APPLICATIONS

PART A

UNIT 1. INTRODUCTION

Role of genes within cells, genetic code, genetic elements that control gene expression, method of creating recombinant DNA molecules, vectors in recombinant DNA technology, biology and salient features of vectors, types of vectors – plasmids, cosmids, phages and viruses.

06 Hours

UNIT 2. ENZYMES IN GENETIC ENGINEERING

Introduction. Restriction Endonucleases - Exo & exdo nucleases, classification, mode of action. Enzymes in modification - Polynucleotide phosphorylase, DNase, Methylases, phosphatases, polynucleotide Kinase, Ligases, RNase and their mechansim of action.

06 Hours

UNIT 3. NUCLEIC ACID HYBRIDIZATION AND AMPLIFICATION

Methods of nucleic acid detection, polymerase chain reaction (PCR) and its applications, variations in PCR and applications, methods of nucleic acid hybridization, probe and target sequences, Southern and Northern hybridization techniques, nucleic acid mutagenesis *in vivo* and *in vitro*.

08 Hours

UNIT 4. CONSTRUCTION OF DNA LIBRARIES

Isolation and purification of nucleic acids, quantification, storage, Isolation of plasmids, Construction of genomic and cDNA libraries, screening and preservation.

06 Hours

PART B

UNIT 5. GENE TRANSFER TECHNIQUES

Gene transfer techniques in plants, animals and microbes – Transformation, electroporation, microprojectile system, liposome mediated transfer, gene gun etc. Agrobacterium-mediated gene transfer in plants – Ti plasmid: structure and functions, Ti plasmid based vectors - advantages. Chloroplast transformation.

08 Hours

UNIT 6. TRANSGENIC SCIENCE AND GENETIC IMPROVEMENT

Transgenic science in plant improvement, biopharming – plants as bioreactors, transgenic crops for increased yield, resistance to biotic and abiotic stresses.

Techniques of gene mapping in plants. Marker-assisted selection and breeding for improvement. Transgenic science for animal improvement, biopharming - animals as bioreactors for recombinant proteins, Gene mapping in farm animals. Marker-assisted selection and genetic improvement of livestock.

08 Hours

UNIT 7. OTHER APPLICATIONS

Microbial biotechnology - Genetic manipulation, engineering microbes for the production of antibiotics, enzymes, Insulin, growth hormones, monoclonal antibodies, clearing oil spills.

06 Hours

UNIT 8. GENE THERAPY

Introduction. Methods of Gene therapy. Gene targeting and silencing. Gene therapy in the treatment of cancer, SCID, muscular dystrophy, respiratory disease (emphysema), cystic fibrosis, etc., Challenges in gene therapy. Future of gene therapy.

04 Hours

TEXT BOOKS

Introduction to Genetic Engineering by Nicholl. Cambridge Low Price Edition, 2006.

Principles of gene manipulation - An introduction to genetic engineering, Old R.W., Primrose S.B., Blackwell Scientific Publications, 1993.

From Genetics to Gene Therapy – the molecular pathology of human disease by David S Latchman, BIOS scientific publishers, 1994.

Genes VIII by Benjamin Lewis. Oxford University & Cell Press, 2007.

DNA Science by David A Micklos, Greg A Freyer and David A Crotty, I K International, 2003.

REFERENCE BOOKS

Molecular Biotechnology: Principles and Practices by Channarayappa, 2006, University Press.

Genetic Engineering Vol. 1-4 (Williamson Edition).

Recombinant DNA by Watson et al., 1983.

Vectors by Rodriguer and Denhardt, 1987.

Current protocols in molecular biology, Greena Publishing Associates, NY, 1988.

Berger S.L. Kimmel A.R. Methods in enzymology, Vol.152, Academic Press, 1987.

Molecular cloning Volumes I, II and III. Sambrook J et al (2000). Cold Spring Harbor lab Press.