Subject Code : P8BCE4

ELECTIVE COURSE IV – BIOTECHNOLOGY

Unit 1

Bioprocess– Basic principles of microbial growth. Types, design and operation of fermenters. Fermentation culture medium– carbon, nitrogen and vitamin sources. Antifoaming devices. Downstream processing– separation, concentration, purification, modification and drying. Production of vitamin B12, penicillin, streptomycin and methane.

Unit 2

Waste treatment– aerobic and anaerobic. Composting. Utilization of cellulose. Bioremediation. Microbial degradation of xenobiotics. Biodegradable plastics. Single cell protein. Immobilized enzymes, methods and applications. Industrial applications of enzymes in food, diary and leather industry.

Unit 3

Basic principles. Use of restriction enzymes for production of DNA fragments. Cloning vectors– plasmids (pBR 322, pUC 18), phages (_ and M13) and cosmids. YACs, BACs, PACs, HAECs and HACs. Splicing of DNA– cohesive end method, blunt end ligation, linkers and adaptors. Gene transfer methods– calcium phosphate coprecipitation, electroporation, lipofection, microinjection. Choice of host organisms for cloning. Recombinant selection and screening– marker inactivation, colony hybridization and in vitro translation. Cloning strategies– genomic and cDNA libraries. Chromosome walking. Cloning of insulin in E. coli.

Unit 4

Plant cell and tissue culture– culture media and cell culture. Tissue culture, micropropagation and somaclonal variation. Protoplast culture– isolation and purification of protoplasts, protoplast fusion, genetic modification of protoplasts. Methods of gene transfer in plants– Agrobacterium mediated transformation, viral vectors and particle gun method. Use of reporter genes in transformed plant cells. Transgenic plant technology– genetic engineering of plants for pest resistance, virus resistance, herbicide tolerance, stress tolerance and delay of fruit ripening. Use of plants to produce commercially important proteins, antibodies, viral antigens and peptide hormones.

Unit 5

In vitro fertilization and embryo transfer. Animal vaccines– production of vaccine for foot and mouth disease of cattle.Development of transgenic animals– retroviral, microinjection and embryonic stem cell methods. Applications of transgenic animals. Techniques in Human genome mapping– FISH, PCR, RFLP, DNA fingerprinting. Gene therapy–ex vivo and in vivo.

Antisense RNA technology and applications. Hazards and safety aspects of genetic engineering.

Books recommended

1. Fermentation Biotechnology O.P. Ward. 1989 Prentice Hall.
2. Biotechnology J.E. Smith Cambridge University Press 1996.
3. Introduction to Biotechnology Brown, Campbell and Priest Blackwell Science 1987.
4. A Textbook on Biotechnology H.D. Kumar 2nd edition East West Press 1998.
5. Molecular Biotechnology Glick and Pasternak, Panima Publ.
6. From Genes to clones Winnaecker VCH Publication.
7. Elements of Biotechnology P.K. Gupta, Rastogi Publication, 1998.
8. Molecular Biology and Biotechnology. Walker and Gingold. 3rd ed. Panima Publ. 1999.
9. Plant Biotechnology. Ignacimuthu, Oxford, IBH.
10. Recombinant DNA Technology, Watson, Scientific American Publ.
11. Principles of Genome analysis, Primrose, Oxford University Press, 1998.