

REFERENCE BOOKS;

1. Molecular Biology of the Cell:- Alberts et al., 1983.
2. Molecular Biology of the Gene:- J.D. Watson.
3. Molecular Cell Biology:- Darnell et al.,
4. The Gene:- Benjamin Levine.
5. Bacterial Plasmids:- P. Breda.
6. Genetic Engineering Vol I-IV Willamson (Ed).
7. Gene Cloning:- Glover, 1984.
8. Recombinant DNA:- Watson et al., 1983.
9. Vectors:- Rodrignes and Denhardt, 1987.
10. Experiments with gene fusion:- Sil Havy et al.,
11. Tailoring genes for Crop improvement:- an Agricultural prospective Presenting G, Haads, J. Kosuge, T. Hollasender, A.
12. DNA technology:- Edward Alccuno. J. 1990.
13. Commercial Biotechnology:- OTA, 1984.
14. DNA Science:- Michols, D.A. 1990.
15. DNA Finger printing:- Krawizak, M and Schmidtke. J. Bios 1984.
16. Gene expression technology:- Hgoeddel, A. IP. 1991.
17. Genetically Engineered Organisms:- Fennchanm. J.R. S. 1991.

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50 Hrs.

HCT.3.2 PLANT BIOTECHNOLOGY

UNIT-1: Plant tissue culture: Introduction to cell and Tissue culture. Tissue culture as a technique to produce novel plants and hybrids.

02 Hrs,

UNIT-2: Tissue culture media (Composition and preparation)

01Hr

s.

02Hr

s.

UNIT-3: Initiation, maintenance of callus and suspension culture and single cell clones.

02Hrs.

UNIT-4: Organogenesis: Somatic embryogenesis, transfer and establishment of whole plants in soil.

02Hrs.

UNIT-5: Shoot tip culture: rapid clonal propagation and production of virus free plants.

01Hr

UNIT-6: Embryo culture and Embryo rescuer.

s.

02Hr

s.

UNIT-7: Protoplast isolation and fusion. Selection of hybrids cells and regeneration of hybrid plants. Symmetric and asymmetric hybrids, and hybrids.

UNIT-8: Anther, pollen and ovary culture for production of haploid plants and homozygous lines.

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9:

Bio-Technology

Employability

3rd SEMESTER

SYLLABUS FOR M.SC., IN BIOTECHNOLOGY

PAPER -HCT: 3.1 GENETIC ENGINEERING

50 Hrs.

5Hrs.

UNIT-1: Foundations of recombinant DNA technology:- Introduction, tools of genetic engineering, recombinant DNA experiment and the safety issues.

10Hrs.

UNIT-2: Plasmid Biology:- Plasmid vectors and their feature, common plasmids, plasmids of Gram-negative bacteria, PBR 322, PUC 18, Col EI, RI, PT 181, PSC 101. Plasmids of Gram-positive bacteria-PIJ 101, SLP and SCP. Plasmids from Bacteriophage lambda, Phage, M 13. Cosmids, Plasmids from animal viruses-SV40, Adenoviruses, retroviruses, Vaccinia viruses and Baculo viruses. Plasmids from Yeast and special vectors.

8Hrs.

UNIT-3: Gene Libraries:- Establishing a gene library, screening the gene library, The cDNA library. Applications of genetic engineering in Medical, Agricultural, Environmental and other fields.

8Hrs.

UNIT-4: DNA analysis and diagnosis:- Methods of DNA analysis-DNA, RNA and cDNA probes. PCR implication. DNA chips, RFLP analysis. Diagnosis of infectious diseases:- AIDS Tuberculosis and other diseases. Identifying genetic diseases, Hybridization techniques:- Southern, Northern and Western blotting Immunodiagnostic probes.

8Hrs.

UNIT-5: DNA finger printing:- DNA matching techniques-DNA finger printing, genetic identification and microbial identification.

9Hrs.

UNIT-6: DNA sequencing:- Maxam and Gilbert's methods, Sanger and Nicholason's methods, the primer, template, the dideoxynucleotide, terminates, and deoxynucleotides, and polymerases. Messing shot gun method. DNA sequencing homology-using computers. Application in plant. Animal and microbes.

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Cry preservation, slow growth and DNA banking for germ plasma conservation. 02Hrs.

01Hrs.

UNIT-10: Basic techniques in r-DNA technology: Biolistics (Particle bombardment) Electroporation, microinjection and Agrobacterium mediated gene transfer. T-plasmid derived vector systems, structure and restriction site. The mechanism of T-DNA transfer from Agro bacterium to plant cells Marker and reporter genes used in plant system Manipulation of gene expression in plants. Isolation and uses of different promoters, production of marker free transgenic plants.

07Hrs.

UNIT-11: Plants transformation Technology: Basis of tumor formation, hairy root, features of Ti and Ri Plasmids, mechanisms of DNA Transfer, role of virulence genes, use of Ti and Ri as vectors, Binary vectors, use of 35S and other promoters. Genetic markers, use of reporter gene with interns, use of scaffold attachment regions, methods of nuclear transformation, viral vectors and their applications, Multiple gene transfers, vector- less of direct DNA transfer. Transformation of monocots, trans gene stability and gene silencing.

06 Hrs.

UNIT-12: Application of plant transformation in plant productivity and performance: Herbicide resistance, Phosphinothricin, Glyphosate, sulfonylurea urea, atrazine, insect resistance/Bt genes, Non Bt like protease inhibitors, alpha amylase inhibitor, virus resistance coat protein mediated, nucleocapsid gene disease resistance, 1-3 B glucanase, RJP antifungal proteins, thionins, PF Proteins, nematode resistance Abiotic stress, post harvest losses, long self life of fruits and flowers use of ACC synthase, polygalactouranase, and ACC oxidase, Male sterile lines, bar and barnase systems. Carbohydrate composition and storage ADP glucose pyrophosphates.

05Hrs.

UNIT-13: Molecular marker aided breeding: RFLP map linkage analysis, RAPD markers. STS micro satellites SCAR(sequence Characterized Amplified Regions)SSCP (Single strand conformational polymorphism) AFLP, QTL, Map based cloning, molecular markers.

04Hrs.

UNIT-14: Plant genomics: Arabidopsis thaliana (Mad-Box gene) as a model for plant genomics and Plant proteomics, Rice genome project Genetic diversity and phylogenetic studies.

02Hrs.

UNIT-15: Chloroplast transformation: Advantage, vector, success with tobacco and potato

04Hrs.

UNIT-16: Metabolic Engineering and Industrial products: Plant secondary metabolites, control mechanisms and manipulation of phenylpropanoid pathway. Alkaloids, industrial enzymes, biodegradable plastics, Polyhydroxy

butyrate, therapeutic proteins, lysosomal enzymes, antibodies, edible vaccines, purification strategies. Oleosin partitioning.

REFERENCES:

01. Bhojwant, S.S., and Razdan, M.K. 1996. Plant Tissue culture. Theory and practice Elsevier Publishers. Amsterdam.
02. Bhan 1998. Tissue culture, Mittal Publications, New delhi.
03. Fu. T.J., G, Singh., and W.R. Curtus, 1999. Plant cell and tissue culture for the production of food ingredients. Kluwer Academic/Plenum Press.
04. Gamborg, O., and Philip, G.C. 1998. Plant cell, tissue and organ culture. Narosa Publishing House.
05. Gupta, P.K. 1996. Elements of Biotechnology, Rastogi Publications, Meerut.

06. Heldt. 1997. Plant Biochemistry and Molecular Biology, Oxford and IBH Publishing Co. Pvt. Ltd., Delhi.
07. Murray, D.R. 1996. Advanced methods in molecular biology, Vol-55, Plant cell eletroporation and electrofusion protocols, Humana press incorp, USA.
08. Ravishankar, G., And Venkatraman, L.V. 1997. Biotechnology applications of Plant tissue and cell culture, Oxford and IBH lpublising Co.Pvt. Ltd.,
09. Gistou, P., and Klu, H. 2004. Hand Book of Plant Biotecnology, Vol.I and II, John Publication.
10. Slatu, A., Nigil, W., Scott and Mark Flower 2003. The Genetic manipulation of Plant, Oxford University Press

PRACTICAL:HCP 3.2

1. Preparation of plant tissue culture media and Organ culture (Shoot tip, node and leaf culture)
2. Callus culture: Initiation and regeneration.
3. Anther culture for the production of haploids.
4. Isolation, culture and fusion of protoplasts
5. Isolation of plant genomic DNA from pea shoot tip/ Cauliflower by CTAB method
6. Agrobacterium culture, selection of transformants
7. Suspension culture and production, separation and estimation of secondary metabolites β - carotene from carrot and anthocyanin from beetroot
8. Study of VAM, isolation of spores, arbuscles and vesicles from roots
9. VAM culture
10. Organic pharming and Mushroom Cultivation
11. Study and culture of biocontrol agents (Trichoderma viridae, Trichoderma harzianum, Aspergillus awamori)

50
Hrs.

SCT: 3.3 b INDUSTRIAL BIOTECHNOLOGY

UNIT-1: Scope of food and industrial biotechnology.

3Hrs.

UNIT-2: Microbiological examination of food, principles of food preservation (Sterilization, pasteurization, canning and packing). Importance of microorganisms in food production.

6Hrs.

UNIT-3: Factors affecting the growth and survival of micro-organisms in food: Microbial growth, intrinsic and extrinsic factors and productive food microbiology.

4Hrs.

UNIT-4: Microbiology of food: Cereal products, brewing, fermented food products, protein products, food additives and ingredients, fruits, vegetables, meat and sausage product, large scale cultivation of edible mushrooms.

6Hrs.

UNIT-5: Fermentation of mild products and its analysis.

4Hrs.

UNIT-6: Biological nitrogen fixation: mass production and field application of biofertilisers: Rhizobium, Azotobacter, Azospicillam, Cyanobacteria, Azolla, Vesicular and Arbuscular Mycorrhiza (VAM).

4Hrs.

UNIT-7: Microbiological assays: Microbiological assay of vitamins, antibiotics and aminoacids. Advantages and disadvantages of microbiological assays.

4Hrs.

UNIT-8: Bacterial agents of food borne illness: Salmonella, Clostridium, Vibrio, Shigella and E.Coli.

4Hrs.

UNIT-9: Non bacterial agents of food borne illness: Protozoa, algae, fungi, helminthes,

PRACTICALS HCP: 3.1

01. Transformation.
02. Conjugation.
03. Southern blotting.
04. SDS-PAGE and Western blotting.
05. PCR.
06. Restriction mapping.
07. Electrophoresis of restriction digested plasmid DNA, Restriction mapping and determination of molecular weight of digested DNA fragment
08. Ligation of DNA and analysis by electrophoresis
09. DNA amplification by PCR and RAPD
10. Preparation of competent cells and transformation by CaCl₂ method and Selection of Transformed colony by X-Gal method
11. Determination of molecular weight of proteins by SDS PAGE and analysis by Western blotting
12. Analysis of DNA by Southern blotting
13. Isolation of DNA from bacteria, plant and animal tissue.
14. Isolation of plasmid DNA from bacteria

IIIrd SEMESTER

HCP-3.6 ENTREPRENEURSHIP AND STARTUP STUDIES

About Course:

Course Objectives: This course enables the students to: Develops awareness about the biotechnology enterprise, Provides exposure of management principles and the global scenario of biotechnology industries, and helps Develop skills to work in interdisciplinary team.

Course Outcomes: (CLO):

Students will be able to

1. Prepare project report for biotechnology entrepreneurship.
2. Address the market challenges for a new enterprise.
3. Setup enterprise for new biotechnology product.
4. Assess the global market scenario of their product.

Detail Contents:

Unit I: Concept of entrepreneurship, fundamentals of marketing, market analysis.

Unit-II: Entrepreneurship Traits & Motivation: Growth of entrepreneurship, The marketing and selling of Biotechnology products, Establishment and marketing of biotechnology company, Effective advertising.

Unit-III: Entrepreneurial Development: Training, Institution in aid of entrepreneur, Power and importance of Positioning of a company name and product.

Unit-IV: Start-up: Setting up of a small industry, layout of the company, instrumentation, manpower, location of an enterprise, steps of starting small industry, Incentive & subsidies for industry, Problems of entrepreneurship, The Art of Negotiation, Workable marketing and the strength of distribution. Opportunities and lessons in international marketing.

Unit-V: Problem and Solution of Entrepreneurship: Risk and benefit, Steps involved in commercialization of a biotechnological product, Case studies.

REFERENCE BOOKS:

1. Dynamics of Entrepreneurial development & management; Vasant Desai, Himalay. Publications.
2. Entrepreneurship reflection & investigation; M.S. Bisht & R.C. Mishra, Chugh Publication.
3. Entrepreneurship development in India; Samiuddin, Mittal Publication.
4. Innovation, Product Development and Commercialization: Case Studies and Key Practices for Market.
5. Science Business: The Promise, the Reality, and the Future of Biotech by Gary P. Pisano Harvard Business School Press: 2006.
6. Design and Marketing of New Products by Urban and Hauser, ISBN 0-13-201567-6.
7. Putting Biotechnology to Work: Bioprocess Engineering (1992) Commission on Life Sciences, The National Academy Press.