

Paper IX: Recombinant DNA Technology

Introduction to gene cloning and its uses, tools and techniques plasmids and other vectors. DNA, RNA, cDNA.

Restriction enzymes and other reagents: techniques, laboratory requirement, safety measures.

Purification of DNA from bacterial, plant and animal cells, manipulation of purified DNA.

Introduction of DNA into living cells and their screening.

Application of cloning in gene analysis (obtaining clone of a specific gene, studying gene location, structure expression).

Expression of foreign genes in prokaryotes and eukaryotes.

Production of proteins from cloned genes: gene cloning in medicine (pharmaceutical agents such as insulin, growth hormones, plasminogen activator, clotting factors, interferon, recombinant vaccines), gene therapy for genetic diseases.

Nucleic acid, oligonucleotide and immunoscreening of libraries and other probes.

Isolation and characterization of clones.

Analysis of DNA by Southern blotting

Analysis of RNA by Northern blots hybridizations

Analysis of proteins by Western blot techniques

Dot blots and slot blots,

RFLP

AFLP

PCR: Basic principles and its modification application and uses.

Paper X: Plant Biotechnology

Introduction to *in vitro* methods: Terms and definitions, use of growth regulators. Beginning of *in vitro* cultures in our country (ovary and ovule culture, *in vitro* pollination and fertilization. Embryo culture, embryo rescue after wide hybridization and its applications. Endosperm culture and production of triploids.

Introduction to the processes of embryogenesis and organogenesis and their practical applications: Clonal multiplication of elite species (Micropropagation) axillary bud, shoot-tip and meristem culture, Haploids and their applications. Somaclonal variations and applications (Treasure your exception). Practical applications of tissue and organ culture (summarizing the practical applications of all the above mentioned techniques). Single-cell suspension, cultures and their applications in selection of variants/mutants with or without mutagen treatment (of haploid culture preferable).

Introduction to protoplast isolation: Principles and applications. Testing of viability of isolated protoplasts. Various steps in the regeneration of protoplasts. Somatic hybridization-an introduction. Various methods for fusing protoplasts, chemical and electrical. Use of markers for selection of hybrid cells. Practical application of hybridization (hybrids vs cybrids)

Use of plant cell, protoplasts and tissue culture for genetic manipulation of plant: Introduction to *A. tumefaciens*, tumor formation on plants using *A. tumefaciens* (monocots vs. dicots). Roots formation using *A. rhizogenes*. Practical applications of genetic transformation.

Transgenic plants for the production of human therapeutics, edible vaccines, herbicide insect and pest resistant; stress tolerant.

Paper XI: Animal Biotechnology

General metabolism.

Special secondary metabolites/products (insulin, growth hormone, interferon, t-plasminogen activator, activator, factor VIII etc.)

Expressing cloned proteins in animal cells.

Over production and processing of chosen protein. The need to express in animal cells.

Production of monoclonal antibodies.

Growth factors promoting proliferation of animal cells (EGF, FGF, PDGF, IL-1, IL-2, NGF, erythropoietin).

Bioreactors for large scale culture of cells. Transplanting cultured cells.

Preservation and maintenance of animal cell lines. Cryopreservation and transport of animal germ plasm (i.e. semen, ovum and embryos).

Transgenic animals.

In vitro fertilization and embryo transfer.

Paper XII: Environmental Industrial Biotechnology**Renewable and non-renewable resources.**

Conventional fuel and their environmental impacts (firewood and animal wastes, coal, petroleum and animal oils).

Modern fuels and their environmental impacts (methanogenic bacteria and biogas, microbial hydrogen production, conversion of sugars to ethanol, the gas, experiment, solar energy converter- hopes from the photosynthetic pigments).

Possibility of plant based petroleum industry and cellulose degradation for combustible fuel.

Treatment of municipal wastes and industrial effluents.

Degradation of pesticides and other toxic chemicals by microorganism. *B. thuringiensis* and Biopesticides.

Enrichment of ores by microorganisms (Bioaccumulation and Biopesticides).

Biofertilisers (nitrogen fixing microorganisms, mycorrhiza).

Environmental impacts and assessment of transgenic organism.

Bio-assessment of environmental quality.

Fermentation: The fermentation industry, selection of industrial microorganisms, production process, fermentation, media aeration, pH, temperature batch versus continuous culture, immobilized enzymes, downstream processing and product recovery, food industry waste as fermentation substrate, solid state fermentation.

Dairy: *In vitro* fertilization and embryo transfer in livestock; transgenic cows; lactose utilization; fermented dairy products.

Paper XIII: Genomics and proteomics

Genomics

- Genome evolution and phylogenetics
- The origin of genomes
- Acquisition of new Genes
- DNA sequencing chemical and enzymatic methods
- The origins of introns
- Restriction mapping
- DNA & RNA fingerprinting
- The Human Genome

Proteomics

- Basic principles of protein structure.
- Modeling of three-dimensional structure of a protein from amino acid sequences.
- Modeling mutants.
- Evaluating protein structure.
- Designing proteins.
- Analysis of nucleic acid/ protein sequence and structure data, genome and proteome data using web-based tools.

Syllabus for Entrepreneurship Development Course

50 Marks : 3 Hours

	Periods
01. Need, scope and characteristics of entrepreneurship, special schemes for Technical Entrepreneurs, STED	2
02. Identification of opportunities	1
03. Exposures to demand - based, resource based, service base Import substitute and export promotion industries.	2
04. Market survey techniques.	2
05. Need scope and approaches for project formulation	1
06. Criteria for the principles of product selection and development	2
07. Structure of project report	3
08. Choice of technology, plant and equipment	3
09. Institutions, financing procedure and financial incentives	2
10. Financial ratio and their significance	2
11. Books of accounts, financial statements and funds flow analysis	4
12. Energy requirement and utilisation	2
13. Resource Management Men, Machine and Materials	3
14. Critical path Method (CPM) & project evaluations review	1
15. Techniques (PERT) as planning tools for establishing SSI.	1
16. Creativity and innovation	1
17. Problem solving approach	1
18. Strength weakness opportunity and threat (SWOT) techniques	3
19. Socio-economic feasibility of the project	3
20. Layout & process planning for the product	3
21. Quality control/Quality assurance and testing of product	4
22. Elements of Marketing & Sales Management	2
23. Nature of	2
24. Packaging and advertising	2
25. After sales service	2
26. Pricing and pricing	2
27. Management of self and understanding human behavior	2
28. Success in small scale industries and their remedial measures	2
29. Coping with uncertainties, stress management and positive reinforcement.	1
30. Licensing, registration	2
31. Municipal bye laws and insurance coverage	4
32. Important provisions of Factory act, sales of goods	1
33. Pollution control	2
34. Social responsibility and business ethics	2
35. Income tax, sales tax and excise laws	2