**M.Sc., (Final) BIOTECHNOLOGY**

##### III SEMESTER

**BT 3.1 : CELL CULTURE TECHNOLOGY AND TISSUE ENGINEERING**

**UNIT-I**

Plant tissue culture technology: culture media – composition and preparation. Factors governing *in vitro* behavior, Somatic embryogenesis, organogenesis and plant regeneration. Culture types. Micro propagation, Haploids, somaclonal variations, , metabolite production in cultures. Isolation of protoplasts, protoplast fusion and culture. Somatic hybridization.

**UNIT-II**

Animal cell and tissue culture. Primary culture, balanced salt solutions and simple growth medium. Serum and protein free defined media. Cell lines, primary and established cell line cultures. Basic techniques of mammalian cell culture in vitro. Tissue and organ culture. Production and use of artificial tissues and organs – Skin, liver and pancreas. Apoptosis - mechanism and significance.

**UNIT-III**

The biology of stem cells – Different types of stem cells – embryonic stem cells, fetal tissue stem cells, adult stem cells; stem cell differentiation, stem cell plasticity – Differentiation versus stem cell renewal. Isolation and propagation of embryonic stem cells; chimeras; generation of knockout mice and knock-in technology.

**UNIT-IV**

Hematopoietic stem cells and bone marrow transplantation: Cells for hematopoietic reconstitution – Cord blood stem cells; cells for adoptive cellular immunotherapy; bone marrow transplantation - advantages and disadvantages. Allogenic, autologous, syngenic and congenic transplantation. Clinical applications of stem cell therapy; neurodegenerative diseases – Parkinson’s disease, Alzheimers, spinal cord injury and other brain syndromes.

**Last unit is meant for Assignments only**

**BOOKS RECOMMENDED:**

01. Plant tissue culture – theory and practice by Bhojwani S.S.

02. Plant cell culture – A practical approach by Dixion R.A.

03. Culture of Animal cells by R.I.Freshney. Wiley – Liss.

04.Animal Cell Culture – A Practical approach Ed. by John R.W.Masters (IRL Press).

05. Animal cell culture techniques, Ed. Martin Clynes, Springer.

06. Plant Cell, Tissue and Organ Culture, By Reinert, J. and YPS Bajaj (Springer – Verlag).

07. Plant tissue and cell culture, by Street, HE (Blackwell).

08. Stem cells in regenerative medicine by Audet (Springer).

09. Cell and tissue reaction engineering by Eibl (Springer).

**BT 3.2: PLANT BIOTECHNOLOGY**

**UNIT-I**

Plant Genetic engineering: Gene cloning techniques, Techniques for gene transfer into plants. Mechanism of gene transfer by TI and RI plasmids as vectors. Reporter genes, transient gene assays and identification of transgenic plants. Molecular markers and their significance. RFLP, , AFLP and QTL in plants. RAPD for molecular mapping and crop improvement.

**UNIT-II**

Agricultural Biotechnology: Engineering of herbicide tolerance in plants, production of disease resistant plants by gene transfer; Development of insect resistant plants. Biotechnological strategies for engineering stress tolerance.

**UNIT-III**

Altering protein and oil quality traits in seeds. Chloroplast transformation – advantages in tobacco and potato, plants for expression of bacterial, viral and eukaryotic genes. Edible vaccines and plantibodies. The genetic manipulation of crop yield by enhancement of photosynthesis.

**UNIT-IV**

Algal Biotechnology: Laboratory culture of micro algae. Large scale biomass production. Marine micro algae/sea weeds and their products. Edible sea weeds and their cultivation. Biofertilizers – Blue green algal fertilizers – Azolla, Anabaena, symbiotic association. Sea weed fertilizers. Mycorrhizal biofertilizers, bacterial fertilizers. Biopesticides in agricultural production.

**Last unit is meant for Assignments only**

**BOOKS RECOMMENDED:**

01. Plant Biotechnology by A. Slater, N.W. Scott and M.R. Fowler (Oxford University press).

1. Biotechnology in Agriculture by Swaminathan, M.S (Mc. Milllan India Ltd).
2. Biotechnology and its applications to Agriculture, by Copping LG and P.Rodgers (British Crop Projection).
3. Plant Biotechnology, by Kung, S.and C.J.Arntzen (Butterworths).

## BT 3.3: ANIMAL BIOTECHNOLOGY

**UNIT-II**

Types and causes of male and female infertility, sperm collection, Cryopreservation, artificial insemination, Oocyte recovery, superovulation, oocyte maturation in vitro, In vitro fertilization in humans and cattle. Embryo culture, embryo transfer in farm animals. Immunocontraception - hormonal methods. Biotechnological approaches for the management of pests, mosquitoes and nematodes. Live stock improvement

**UNIT-II**

Production of transgenic animals - mice, sheep and fish. Molecular pharming and animal cloning. Somatic cell nuclear transfer in humans – Legal and ethical aspects. Potential applications of transgenic animals – Animal models for diseases and disorders. Transgenic poultry and transgenic insects as bioreactor.

**UNIT-III**

The concept of aquatic biotechnology and blue revolution. Economically important aquatic resources from fresh water, brackish water and marine habitats – the finfish, shellfish, lime fish, algae, corals, and holothurians. Bioactive compounds from corals. Fish bioproducts. Pearl culture technology – principles and applications.

**UNIT-IV**

Aquaculture - Fresh water fish culture practices and types. Freshwater prawn culture. Brackish water fish, shrimp and crab culture practices. Fresh water fish hatchery and seed production. Hypophysation and induced breeding techniques. Eyestalk oblation. Techniques involved in transgenic fish production. Post harvest technology. Diagnosis of shrimp & fish diseases caused by bacterial, fungal and viral pathogens using molecular methods.

**Last unit is meant for Assignments only**

**BOOKS RECOMMENDED:**

01. Elements of Biotechnology by PK Gupta (Rastogi & Co).

02. Biotechnology by Kashav. T (Wiley Eastern Ltd).

03.Concepts in Biotechnology by Balasubrahmanian et. al.,(University press).

04.Principles and practices of aquaculture by TVR Pillay.

05.Coastal aquaculture by Santhanam.

06.Fisheries of India by CBL Srivatsava.

07.Molecular Biotechnology by Glick.

**BT 3.4: MEDICAL AND ENVIRONMENTAL BIOTECHNOLOGY**

**UNIT-I**

Health care products. Products from recombinant DNA Technology - insulin, growth hormone, factor VIII, tissue plasminogen activator, interferons, lymphokines and Hepatitis-B vaccines.

# UNIT – II

Disease diagnosis: DNA probes, Enzyme probes - glucose oxidase, lactate oxidase, monoamine oxidase. PCR amplification and diagnosis - Applications in forensic medicine. Genetic diseases and gene therapy. Current strategies for development of vaccines against HIV, Malaria, Tuberculosis.

**UNIT – III**

Environmental pollution – types, sources and control. Reduction of environmental impact of industrial effluents, chemical herbicides and fertilizers. Removal of oil spills. Environmental monitoring. Bioremediation - solid and liquid waste treatment. Biomass and energy production. Bioleaching – Microbial recovery of metals. Microbiology of waste water treatment.

**UNIT-IV**

Environment and energy: Renewable sources of energy – Biogas, waste materials, energy crops, cellulose. Production of energy and fuel using microorganism – Biofuels and Biodiesel. Global environmental problems: Ozone depletion, UV-B, Green house effect. Biodiversity - benefits to mankind - Conservation; Ecology and sustainable development.

**Last unit is meant for Assignments only**

**BOOKS RECOMMENDED:**

01. Biotechnology by B.D.Singh (Kalyani).

02. Ecology and Environment by PD Sharma.

03. Fundamentals of Ecology, by Odum, EP (Mc Graw Hill)

04. Environmental Biotechnology by Forster, C.F. and Wase D.A.J. (Ellis Horwood).

05. Biotechnological innovations in environmental management by Leach, CK and Van Dam- Mieras, MCE (Butterworth-Herinemann, Oxford (Biotol Series).

06. Molecular Biology and Biotechnology by Meyers, RA, A comprehensive Desk reference (VCH Publishers).

07. Biotechnology by U. Satyanarayana (Books & Allied (P) Ltd).