

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –III (2016-17)

Paper I: CC9 (M3BT01CT09): ENVIRONMENTAL BIOTECHNOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 15

Applications of microbes in biodegradation and bioremediation: Microbial degradation of cellulose, lignin, pesticides, xenobiotics and other recalcitrant chemicals, petroleum and hydrocarbons and its ecological significance. Bioprospecting and bioleaching, Bioaccumulation of heavy metals ions from industrial effluents.

Unit II

Credit hours: 10

Biomagnification and degradative plasmids, biotransformation. Biodeterioration and its control. Biological control and biopesticides. definition, significance, types , sources, manufacture, use and mode of action. Entomopathogenic fungi, viral insecticides. significance of *Bacillus thuringiensis* in biocontrol.

Unit III

Credit hours: 15

Microbes and pollution :waste water; Types, Sources, Microbiology. Methods of waste water treatment. Eutrophication: Definition, causes and effects. Algal blooms, Red tides. Solid waste: Source, types and characterization. Methods of treatment: Physical, chemical, biological, aerobic, anaerobic, primary, secondary and tertiary treatments. Use of genetically engineered organisms for control of pollution.

Unit IV

Credit hours: 10

Bioconversion of Solid Waste: Composting, vermi composting and vermi culture. Microbial biofertilizers: types, sources, manufacture and significance. Green manuring, Mycorrhizae as fertilizers: Rhizobia and other symbiotic and non symbiotic nitrogen fixing microbes as

biofertilizer. Application of microbes as biofertilizers. Significance and application of PSB (Phosphate Solubilizing Bacteria) and PGPR (Plant Growth Promoting Rhizobacteria).

Unit V

Credit hours: 10

Microbes as biological weapons, Role of microbes in production of Biofuels. Biogas production and factors affecting methane formation. Biosensors: Principle, working, Types of biosensors Applications of biosensors in environmental monitoring. Application of microbes as biosensors.

Suggested Readings

1. Mooray Moo-Young. (Eds). Comprehensive Biotechnology (Vol. I, II, III) Pergamon Press, England.
2. Metcalf and Eddy. Waste water engineering treatment and uses. McGraw Hill.
3. Jogdand, S.N. Environmental Biotechnology. Himalaya Publication House.
4. De, A.K. Environmental Chemistry. Wiley Eastern Ltd.
5. Abbasi and Abbasi. Renewable Energy Sources and their environmental impact. Prentice Hall of India, Pvt. Ltd.
6. Chatterji, A.K. Introduction to Environmental Biotechnology. Prentice Hall of India.
7. Thakur, I. S. Text Book of Environmental Biotechnology. I. K. International Publisher, New Delhi.
8. Mohapatra, P. K. Text Book of Environmental Biotechnology. I. K. International Publisher, New Delhi.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –III (2016-17)

Paper II: CC10 (M3BT02CT10): ANIMAL BIOTECHNOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Animal Cell Culture: Historical events, equipments, Materials & Techniques of animal cell culture. Types of animal cell culture. Culture Media: Natural & Artificial media, balanced salt solutions, Serum and protein free defined Media & their applications. Physiochemical properties of different constituents of culture Medium. Control, testing and storage of media. Maintenance of cell culture.

Unit II

Credit hours: 15

Biology of cultured cells : Cell adhesion & proliferation, Differentiation , origin of cultured cells. Characterization of the cultured cell, cell transformation, cell synchronization. Culture procedure for tumor cells & specialized cell viz: Epithelial cells, Neuronal cells & Hematopoietic cells.

Unit III

Credit hours: 10

Primary culture: Types, Isolation of tissue, Disaggregation of tissue. Cell lines: Nonenclature, Designation, Selection & Maintenance of cell lines. Cell cloning & cell separation. Animal cell culture, scale up: Scale up in suspension & Scale up in Monolayer culture.

Unit IV

Credit hours: 15

Contamination: Sources of contamination, routes & monitoring for contamination, cross contamination. Cryopreservation: Need for cryopreservation, Stages of Cryopreservation,. Quantitation: Cell counting, Measurement of Growth, Measurement of cell death & Cytotoxicity Assays.

Unit V**Credit hours: 10**

Molecular techniques in cell culture: In situ molecular hybridization, Somatic cell fusion & hybridomes, DNA transfer or transfection methods & transgenic animals. Production from cell culture.

Suggested Readings

1. Masters, J. Animal Cell Culture. Panima.
2. Freshney, I. Culture of Animal Cell. John Wiley.
3. Martin, C. (Ed). Animal Cell Culture Techniques. Springer.
4. Mather and Barnes. (Ed). Methods in Cell Biology. Vol. 5-7, Animal Cell Culture Method. Academic Press.
5. Paul, J. Animal Tissue Culture.
6. Butler, M. and Dawson, M. Lab Fax : Cell Culture. Bios Scientific Publications.
7. Jenkins, N. Animal Cell Biotechnology. Panima Books Distributors.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR**M. Sc. BIOTECHNOLOGY SEMESTER –III (2016-17)****Paper III: CC11 (M3BT03CT11): PLANT BIOTECHNOLOGY (THEORY)****TOTAL HOURS: 60****CREDITS: 4****Unit I****Credit hours: 10**

Development of Plant Biotechnology. Principles of Plant Tissue Culture: totipotency, differentiation. Design of laboratory and commercial tissue culture facility. Procedures in tissue culture: fumigation, wet and dry sterilization, ultraviolet sterilization, ultrafiltration and surface sterilization. Culture media: types, composition and preparation. Role of Plant growth

regulators/retardants in plant tissue culture media. Explants for tissue culture: shoot tip, axillary buds, leaf discs, cotyledons, inflorescence and floral organs.

Unit II

Credit hours: 15

Initiation and maintenance of callus and suspension culture, single cell clones, somaclonal variations and their detection. Micropropagation: direct and indirect morphogenesis, organogenesis, somatic embryogenesis, and clonal propagation, caulogenesis, rhizogenesis, acclimatization, transfer and establishment of whole plants in soil.

Unit III

Credit hours: 10

Protoplast isolation, culture and fusion. Selection of hybrid cells and regeneration of hybrid plants; symmetric and asymmetric hybrids; cybrids. Anther and pollen culture; production of haploid plants and homozygous lines. *In vitro* pollination, embryo culture and embryo rescue. Synthetic seed production.

Unit IV

Credit hours: 10

Agrobacterium mediated gene transfer: Molecular biology of *Agrobacterium* infection, Ti plasmid, organization of T DNA, integration of T DNA into plant genome, vectors derived from pTi: cointegrate pTi vectors and binary vectors. Cryopreservation and germplasm conservation.

Unit V

Credit hours: 15

Growth of plant cells in bioreactors, Production of active molecules, chemicals and secondary metabolites from plant cell cultures, metabolic engineering for secondary metabolites. Extraction of alkaloids and steroids, selection for cells for higher yields, cloning, mechanism of production. Application of plant biotechnology for production of quality oil and industrial enzymes. Elicitors and hairy root cultures for production of useful metabolites.

Suggested Readings

1. Robert Smith. Plant tissue culture : Techniques and Experiments. South Asia Edition.
2. Gamborg and Phillip. Plant Cell, Tissue and Organ Culture. Narosa.

3. Dixon and Gonzales. Plant Cell Culture. Panima.
4. Narayanswamy. Plant Cell and Tissue Culture. McGraw Hill.
5. Bhojwani, S.S. and Rajdan, M.K. Plant Tissue Culture : Theory and Practices a revised Edition. Elsevier.
6. Razdan, M.K. Introduction to plant tissue culture. Oxford & IBH Publishers.
7. Chawla, H.S. Introduction to Plant Biotechnology. Oxford & IBH Publishers.
8. Dey, K.K. Plant Tissue Culture.

MOHANLAL SUKHADIA UNIVERSITY, UDAIPUR

M. Sc. BIOTECHNOLOGY SEMESTER –III (2016-17)

Paper IV: CC12 (M3BT04CT12): FERMENTATION TECHNOLOGY (THEORY)

TOTAL HOURS: 60

CREDITS: 4

Unit I

Credit hours: 10

Fermentation processes: types; batch culture, continuous culture, fed-batch culture, Applications and examples. Growth kinetics, Measurement of growth (cell number, indirect and direct methods), Effects of temperature, pH, high nutrient concentration on growth and product formation. TDT, TDP, Death Kinetics.

Unit II

Credit hours: 15

Bioreactors and Fermentors: Design and components, types, functions, Maintenance of aseptic conditions, Reactors for specialized applications. Sterilization of Bioreactors, nutrients, air supply, products and effluents, process variables and control, physical and chemical environment sensors. Media and materials required for industrial process-sources, formulation, antifoams and optimization. Sterilization of media.

Unit III

Credit hours: 10

Scale up, Downstream processing: Introduction, removal of cells and solid matter. Foam reparation, precipitation, centrifugation, cell disruption. Product recovery processes and unit operations. Microorganisms used in industrial processes, Screening, Isolation, Preservation, Strain improvement and storage of industrially important microorganisms. Inoculum development for large scale bioprocess.

Unit IV

Credit hours: 15

Production of commercially important products: Enzymes, organic acids, amino acids, Vitamins B12, hormones, Antibiotics, Steroids. Yeast: types and applications, productions of bread, pre fermentating, fermentative and post fermentative practices. Alcoholic beverages: types and production. Starter cultures and their biochemical activities. Application of microbial enzymes in food industry.

Unit V

Credit hours: 10

Microbial spoilage of food and poisoning. bacterial and mycotoxins. Principles and methods of food preservation. Microbiological quality standards of food. Regulatory practices and policies: FDA, EPA, HACCP, ISI. Detection and Enumeration of microbes in Foods. Food plant sanitation. Indicator organisms, coliform bacteria, probiotics; organisms and significance. Prebiotics and synbiotics. Microbial anti oxidants. Biosurfactants as emulsifiers, Applications of microbial polysaccharides as stabilizers and thickeners, flavors etc.

Suggested Readings

1. Hui, Y. Handbook of Food and Beverage Fermentation Technology (Food Science and Technology).
2. Rastogi, S.C. Biotechnology: Principles And Applications.
3. Panday, A. Advances in Fermentation Technology.
4. Stanbury, P.F. Principles of fermentation Technology