B.Sc., Biotechnology: Choice based credit system

B.Sc., -IV Semester W.E.F. 2021-22

Paper IV

Plant and Animal Biotechnology

Course Objectives

The objectives of this course are to introduce students to the principles, practices and application of animal biotechnology, plant tissue culture, plant and animal genomics, genetic transformation.

Unit – I: Plant tissue culture techniques & secondary metabolites production

Plant tissue culture: totipotency, media preparation – nutrients and plant hormones; sterilization techniques; establishment of cultures – callus culture, cell suspension culture- Plant secondary metabolites- concept and their importance, applications of tissue culture- micro propagation; Somatic embryogenesis; synthetic seed production; . Cryopreservation,

Unit – II: Transgenesis and Molecular markers

Plant transformation technology- Agrobacterium mediated Gene transfer (Ti plasmid), hairy root features of Ri plasmid, Transgenic plants as bioreactors. Herbicide resistance – glyphosate, Insect resistance- Bt cotton, Molecular markers - RAPD, RFLP and DNA fingerprinting- principles and applications.

Unit – III: Animal tissue culture techniques

Animal cell culture: cell culture media and reagents; culture of mammalian cells, tissues and organs; primary culture, secondary culture, cell lines, stem cell cultures, applications of stem cells; Tests: cell viability and cytotoxicity, Cryopreservation. Transfection methods (calcium phosphate precipitation, electroporation, Microinjection) and applications.

Unit – IV

Transgenic animals & Gene Therapy

Production of vaccines, diagnostics, hormones and other recombinant DNA products in medicine (insulin, somatostatin, vaccines), IVF in farm animals, Concept of Gene therapy, Concept of transgenic animals – Merits and demerits -

Unit V

Bioethics, Biosafety and IPR

Bioethics in cloning and stem cell research, human and animal experimentation, animal rights/welfare (CPCSEA guidelines). Bio safety-introduction to biological safety cabinets;

primary containment for biohazards; biosafety levels; Introduction to GLP Introduction to IP-Types of IP: patents, trademarks & copyright.

Student Learning Outcomes

Students should be able to gain fundamental knowledge in animal and plant biotechnology and their applications.

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Paper V

Environmental & Industrial Biotechnology

Learning Objective

This course aims to introduce fundamentals of Environmental Biotechnology. The course will also give an insight in introducing major groups of microorganisms and their industrial applications

Unit – I: Pollution Types and Control

Environmental Biotechnology-Environmental Pollution: Types of pollution, air pollution & its control through Biotechnology, Biofilters, Bioscrubbers, Water pollution and its management: Measurement of water pollution, sources of water pollution. Microbiology of waste water treatment, aerobic processes, activated sludge, oxidation ponds, trickling filters and rotating biological contactors. Anaerobic processes: Anaerobic digesters, upward flow anaerobic sludge blanket reactors.

UNIT-II: Bioremediation

Biodegradation and Bioremediation – Concepts & principles of Bioremediation, Bioremediation of Hydrocarbons and its applications Degradation of pesticides and other toxic chemicals by microorganism. Role of genetically Engineered microbes, Concept of Phytoremediation, environmental safety guidelines.

UNIT III: Biofuels

Bio fuels-biogas, microbial groups involved in biogas production & interactions, factors affecting biogas production, Biofertilizers, Vermiculture. Introduction to nanotechnology and its applications

Unit IV: Basic principles of Microbial technology

Industrially important microbes, its screening, selection and identification. Maintenance and preservation of industrially important microbial cultures. Strain Improvement, Basic concepts of fermentation; Design of fermenter and applications.

Unit V: Commercial Production of Microbial products

Microbial technology products and applications; Microbial production of Organic acids (, citric acid), Amino acids (Glutamic acid). Fermentation by microbes for food additives: dairy products (Cheese), beverages (Wine) and antibiotics (Penicillin)

Student Learning Outcomes Students should be able to gain fundamental knowledge in animal and plant biotechnology and their applications.