

B.Sc., Biotechnology: Choice based credit system

B.Sc., -IV Semester W.E.F. 2020-21

BT-401 (i) 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 ,applications of tissue culture-micro propagation; Somatic embryogenesis; synthetic seed production; protoplast culture and somatic hybridization - applications. Cryopreservation,Plant secondary metabolites-concept and their importance

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 – glyphosphate, 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; 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, Concept of Gene therapy, Concept of transgenic animals – Merits and demerits -Ethical issues in animal biotechnology

Unit V

Bioethics,Biosafety and IPR

Bioethics in cloning and stem cell research, Human and animal experimentation, animal rights/welfare. Bio safety-introduction to biological safety cabinets; primary containment for biohazards; biosafety levels; GLP,GMP, 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.

PLANT AND ANIMAL BIOTECHNOLOGY-PRACTICALS

- plant culture media and composition of MS media
 - Raising of aseptic seedlings
 - Induction of callus from different explants
 - Plant propagation through Tissue culture (shoot tip and Nodal culture)
- Establishing a plant cell culture (both in solid and liquid media)
- suspension cell culture
- Cell count by hemocytometer.
- Establishing primary cell culture of chicken embryo fibroblasts.
- Animal tissue culture – maintenance of established cell lines.
- Animal tissue culture – virus cultivation.
- Estimation of cell viability by dye exclusion (Trypan blue).
- ELISA – Demonstration

List of Reference Books ;

1. Introduction to Plant Tissue Culture., M.K. Razdan ,2003, Science Publishers
2. Plant Tissue Culture, kalyan Kumar De, 199 M7, New Central Book Agency
3. Plant Tissue Culture : Theory and Practice By S.S. Bhojwani and A. Razdan, 1998
4. Biotechnology – By U. Satyanarayana ; 1997
5. Plant Cell, Tissue and Organ Culture, Applied and Fundamental Aspects By Y.P.S. Bajaj and A. Reinhard , 2001
6. Introduction to Plant Tissue Culture, M. K. Razdan, 2003, Science Publishers
7. A Textbook of Biotechnology, R C Dubey, S. 2014, Chand Publishing
8. Elements of Biotechnology, P. K. Gupta, 1994, Rastogi Publications
9. R. Ian Freshney, “Culture of animal cells – A manual of basic techniques” 4th edition, John Wiley & Sons, 2000 ,Inc, publication, New York
10. Daniel R. Marshak, Richard L. Gardner, David Gottlieb “Stem cell Biology” edited by Daniel 2001, Cold Spring Harbour Laboratory press, New York
11. M.M. Ranga, Animal Biotechnology; Agrobios (India) , 2006.

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BT-401 (ii) 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, Biotrickling filter. 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.

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 (Lactic acid, citric acid), Amino acids (Glutamic acid, Aspartic acid and Lysine). Fermentation by microbes for food additives: dairy products (Cheese, Yogurt), beverages (Beer, Wine) and antibiotics (Streptomycin, Penicillin)

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

ENVIRONMENTAL AND INDUSTRIAL BIOTECHNOLOGY -PRACTICALS

- Detection of coliforms for determination of the purity of potable water.
- Determination of total dissolved solids of water
- Determination of Hardness and alkalinity of water sample.
- Determination of dissolved oxygen concentration of water sample
- Determination of biological oxygen demand of sewage sample
- Determination of chemical oxygen demand (COD) of sewage sample.
- Isolation of industrially important microorganisms from soil.
- Isolation of amylase producing organisms from soil.
- Production of α – amylase from *Bacillus* Spp. by shake flask culture.
- Production of alcohol or wine using different substrates.
- Estimation of citric acid by titrimetry.

List of reference books;

1. K. Vijaya Ramesh, Environmental Microbiology, 2004,MJP Publishers, Chennai.
2. A.G. Murugesan, C. Raja Kumari, Environmental Science & Biotechnology - Theory & Techniques, 2005,MJP Publishers
3. Environmental microbiology by Raina M.Maier Ian L.Pepper & Charles P.Gerba,2000,Academic press
4. Environmental Chemistry, A.K. De. Wiley Eastern Ltd.,2001, New Delhi
5. Introduction of Biodeterioration, D. Allsopp and K.J. Seal, ELBS/Edward Arnold,2008
6. Power un seen: How microbes rule the world. By Dixon, B. Freeman/ Spectrum, 1994,Oxford.
7. Environmental Microbiology. By. Mitchell. R. Wiley,1992, New York
8. Introduction to Environmental Sciences, Y. Anjaneyulu ,2004, BS Publications
9. Industrial Microbiology by A.H.Patel,2009
10. Prescott & Dum (2002) Industrial Micrbiology, Agrabios (India) ,2005,Publishers
11. Creueger W. & Crueger A.A Text of Industrial Microbiology,2000, 2nd Edition, Panima Publishers corp.