BTPE3007 ENVIRONMENTAL BIOTECHNOLOGY (3-0-0)

Module - I: (08 Hours)
Environmental Foundations: Biodiversity & Socio-Economic Dynamics Concept of biodiversity, human-driven environmental degradation, socio-economic impacts. Global issues: climate change, energy-environment nexus, Indian context. Role of engineers in environmental management. Natural Resources: Water resources: Hydrological cycle, lakes, streams, marine/groundwater, ecological flow, fluid dynamics, water quality. Soil: Composition, physico-chemical properties, classification, land-use, conservation. Mineral resources. (8 Hours).

Module - II: (08 Hours)
Analytical Techniques Water/Wastewater Analysis Parameters: TDS, pH, conductivity, ions (Na^+, K^+, Fe^{2+}), acidity/alkalinity, hardness, DO, Cl^-, SO_4^{2-}, As in groundwater.Wastewater: Suspended/dissolved solids, COD, BOD, TKN. Air Pollution Assessment Parameters: SPM, RPM, NO_2, SO_2, settlable dust.

Module - III: (08Hours)
Microbial Ecology & Biosensors Soil Microbiology Lab methods for microbial counts, limitations, characterization.Coliform detection in water, microbial degradation of pollutants. Biosensors Principles: Photometric, electrochemical, ion-channel, piezoelectric. Environmental monitoring applications.

Module - IV: (08 Hours)
Bioremediation & Waste Management Bioremediation Strategies In situ and solid-phase technologies, air pollutant biodegradation. Waste Handling Solid waste: Generation, storage, processing, transport, disposal. Hazardous waste: Characteristics, risk assessment, thermal/containment disposal, radioactive waste.

Module - V: (08 Hours)
Advanced Applications & Emerging Tech (New Module) Biotechnological Solutions Biofertilizers, biopesticides, phytoremediation. Genetic Engineering Recombinant DNA tech for pollutant degradation. Wastewater Innovations Activated sludge, biofilm reactors, membrane bioreactors. Emerging Tech Nanobiotechnology, microbial fuel cells, biosurfactants. Regulatory Frameworks Environmental risk assessment, biosafety protocols, policy compliance.

Course outcomes (Cos)
1. Explain the role of microorganisms in the biodegradation and bioremediation of environmental pollutants
2. Apply biotechnological tools and techniques for waste management and pollution control.
3. Analyze the mechanisms of microbial metabolism relevant to environmental applications.
4. Evaluate the use of genetically engineered organisms for environmental sustainability.
5. Design solutions for environmental problems using biotechnological approaches, such as biofilters, biosensors, and bioreactors.

Program outcomes (Pos)-
1) Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and engineering specialization to solve complex environmental biotechnology problems.
2) Problem Analysis: Identify, formulate, review research literature, and analyze complex environmental problems using biotechnological principles.
3) Design/Development of Solutions: Design biotechnological solutions and systems that meet specified environmental needs with appropriate consideration for public health, safety, and environmental sustainability.
4) Conduct Investigations: Use research-based knowledge and methods including design of experiments, data analysis, and interpretation to investigate environmental biotechnology challenges.
5) Modern Tool Usage: Create, select, and apply appropriate techniques and modern tools including prediction and modeling to complex biotechnological activities.

Program Specific Outcomes (PSOS)-

1. Apply principles of microbiology and molecular biology for addressing environmental issues such as waste treatment, pollution control, and resource recovery.
1. Demonstrate skills in handling instruments and technologies used in environmental biotechnology, including bioreactors and biosensors.
2. Develop innovative and sustainable biotechnological strategies for cleaner production and green technology.
3. Integrate ethical, regulatory, and safety aspects in the application of biotechnology for environmental purposes.
4. Engage in lifelong learning and research in the evolving field of environmental biotechnology to solve real-world environmental problems.

Books:

1. Microbial Ecology by Atlas and Bartha (Pearson Education)
2. Introduction to Environmental Impact Assessment by Glasson Taylor
3. Environmental Toxicology by Wright and Wellbourne (Cambridge University Press)
4. Standard Methods for the Examination of Water and Wastewater (American Public Heath Association)