M Sc biotechnology course of study

Course Title: Environmental Biotechnology
Course No.: BT 613
Credits: 3

Objectives

- To familiarize the students with the recent development in the environmental biotechnology in relation to environment research.
- To familiarize Microbial biotechnology applicable in pollution monitoring, bioremediation of polluted environment and solid waste management

Molecular techniques in Environmental research **4 hr**

Molecular genetic and molecular biology approaches to the environmental and ecological research problems. Application of the techniques: their advantages and limitations including organism typing. Biodiversity and biotechnology (with emphasis on conservation Biodiversity technology).

Environmental microbiology **5 hr**

Interaction of microbes with their immediate surroundings, i. e soil and water, and plant and animal hosts. Adaptation of microbes in extreme environments. Properties of microbes exploited for human benefit. Techniques used to track genetically engineered microbes in the environment, Interaction of plant parasitic microbes with their hosts.

Microbial biotechnology **4 hr**

Pollution monitoring (e.g. use of bacterial and viral pesticides, biosensors to detect environmental pollutants), the role of genetic engineering in biomonitoring and bioremediation. Biomineralization (microbially induced metal deposits). MOS in mineral recovery and detection Biological bleaching. Biosensors.

Microbial interaction **7 hr**

Environmental determinants that control microbial growth and activity. Study of organisms that survive and function in physiochemical stress and constrain of the ecosystem (Plant and animal). Extremophile organisms as source of enzymes. Microbial interaction for recovery of production of cometalism product. Roles of these organisms in the transformation of energy and cycling of nutrients in ecosystems. Study of detrivorous organisms. Positive and negative ways of microbial interactions.

Pollution microbiology **6 hr**

Interactions between microorganisms and naturally occurring organic matter. Degradation and persistence of environmental pollutants. Mechanisms of organic matter decomposition and pollutant degradation with particular emphasis in environmental systems. Application of these processes in biological treatment of chemically contaminated ecosystems. Bio-cleaning technologies (degradation of lignin and plastic, removal of spilled oil and grease deposits)

Contaminated Land and Bioremediation **6 hr**

Typical contamination problems. Methodologies for assessing the extent and seriousness of contamination. Bioremediation, Applicability and effectiveness of bioremediation techniques compared to other remediation processes. Biotechnology for pollution abatement. Treatment of solid waste for rapid degrading technology. Hazardous waste control technology. Restoration of soil contaminated with heavy metals by the use of microbes.

Environmental toxicology **4 hr**

Xenobiotic chemicals in the environment. Their sources, effects and exposure of biota. Modes of action accompanied by examples of chemical toxicity in the environment.

Water and Wastewater Engineering **7 hr**

Physical and chemical pretreatment processes. Chemical oxidization and reduction. Biological treatment of sewage and industrial affluent. Immobilized cells and enzymes for waste water treatment. Sedimentation. Precipitation and flocculation. Filtration and membrane processes.

Environmental radioactivity **2 hr**

Origins and behaviour of natural and artificial radionuclides in the environment. Their radiological consequences and the practices required to minimize these. Their application to the understanding of natural processes.