SEMESTER II

Name of the Programme: M.Sc. Biotechnology

Course Code: GBT–506

Title of the Course: ENVIRONMENTAL BIOTECHNOLOGY

Number of Credits: 3

Effective from AY: 2022-23

Pre-requisites for the Course:	No prerequisite is required	
Course Objectives:	The objective of this course is to 1) impart knowledge on Biotechnological applications. 2) Understand the steps to tackle environmental issues emerging due to industrialization and globalization.	
Content:	**MODULE I** ● Introduction to environmental biotechnology: ● Basic concept of environment and its components. Biotechnology for environment; definitions and facts. ● Environment pollution**:** Sources of pollution and their environmental impact. Hazardous wastes: Definition, sources and characteristics, categorization, generation, collection, transport, treatment and disposal. Municipal solid wastes: Collection, segregation and transport of solid wastes, handling and segregation of wastes at source. ● Monitoring environmental pollution**:** Air, water and soil sampling, Analyses of samples. Physical, chemical, biological and molecular methods for the measurement of pollution. Robust techniques and innovative new concepts for identifying and screening of toxins and pathogens in the environment (genetic and biochemical kits and reagents, CRISPR–Cas technology, and cellular models). ● Nucleic acid based techniques for analyses of diversity, structure and dynamics of microbial community in wastewater treatment, Concept of biomarkers. ● Environmental impact assessment, Biodiversity and its conservation.	**No. of hours** 15

	MODULE II ● Waste Water Treatment systems**:** primary, secondary and tertiary treatments; Biological Treatment Processes, Biochemistry and Microbiology of Aerobic and Anaerobic Treatment, Bioreactors for waste water treatment, Disinfection and Disposal, Macrophytes in water treatment, treatment using constructed wetlands. ● Treatment of Typical Industrial Effluents: Dairy, Distillery, Sugar, and Antibiotic Industries. ● Solid waste management**:** Treatment of municipal, biomedical and agricultural solid waste. ● Biochemical processes and advanced methods: Methane generation by anaerobic digestion, composting, Vermicomposting, Biofertilizers. ● Treatment of solid waste at wastewater treatment plants: Advanced methods - Anaerobic co-digestion of the sewage sludge with liquid wastes such as septage, Novel composting methods (such as terra preta of the sludge (biomass).	15
	MODULE III ● Resource management and environment conservation: ● Basic concept of saving of resources and energy through biotechnology; Prevention of eutrophication using macroalgae; biological control of mosquitos. ● Bioresource technology for clean environment: ● Integrated waste management: Biomass (wood waste, agricultural waste, municipal solid waste, manufacturing waste, and Sewage sludge) as source of energy and bio-fuels. Microalgae as a source for Biodiesel. Biodegradable plastic. ● Environmental Pollution control: concepts of bioremediation, bioaugmentation, biostimulation, biodegradation, biosorption, Bio-mineralization.	15
Pedagogy:	Lectures, tutorials, assignments, demonstrations.	

References/ Readings:	1. A. K. Chatterjee, Introduction to environmental biotechnology. PHI, India, 2000. 2. M. Colin, Marine Microbiology: Ecology and applications. Second edition. Garland science, 2011. 3. R. B. King, J. K. Sheldon, and G. M. Long, Practical Environmental Bioremediation: The Field Guide, Lewis Publishers. CRC Press, 2019. 4. S. M. Meena, and M. M. Naik, Eds., Advances in Biological Science Research: a practical app. Elsevier, 2019. 5. H. J. Rehm, and G. Reed, Eds), Biotechnology, a comprehensive treatise, 1999. 6. T. Satyanarayana, B. Johri, and T. Anil, Eds., Microorganisms in Environmental Management. Springer Publishers, 2012. 7. A. Scragg, Environmental Biotechnology. Pearson Education Limited, Oxford University Press, 2005. 8. J. M. Willey, L. M. Sherwood, C. J. Woolverton, Prescott,s Microbiology. Mcgraw-Hill Education, 2017.
Course Outcomes:	1. Students will be able to apply their knowledge to analyse environmental pollution. 2. Student will be able to evaluate the environmental pollution and decide about treatment methods. 3. Students will be able to relate the apply the biotechnology knowledge to environmental issues. 4. Students will be able to apply their knowledge for the application of biotechnological processes and find solutions for betterment of environment and sustainable development of the society.

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