GUJARAT TECHNOLOGICAL UNIVERSITY
Integrated Master of Science (Biotechnology)
Semester: 5
Subject Name: Environmental Biotechnology
Subject Code: 1350402

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	8	8	70	30	30	20	150

Prerequisite:
Students should be aware to the concepts of environmental pollution, basic chemistry and microbiology.

Rationale:
The course describes role of microorganisms in recycling soil nutrients, biodegradation of complex plant polymer, sustaining and improving plant growth through improving nutrient availability, production of plant growth promoting substances and inhibiting pathogens. This course also deals with various aspects and impact of our interactions with environment, waste treatment technologies, kinetics and reactors.

Course Content:

Unit No.	Content	No. of Hours	Weightage (%)
1	**Overview of Environmental Biotechnology** Microbial flora of soil, growth, ecological adaptations, interactions among soil microorganisms, the biogeochemical role of soil microorganisms. Environmental monitoring – sampling, physical, chemical and biological analysis, monitoring pollution	15	25
2	**Biological Wastewater Treatment** Wastewater characteristics, the activated sludge process, Design and modelling of activated sludge processes, Aerobic digestion, nitrification, secondary treatment using a trickling biological filter, anaerobic digestion, mathematical modelling of anaerobic digester dynamics, anaerobic de-nitrification, phosphate removal.	15	25
3	**Bioremediation** Introduction, Inorganic wastes, petroleum-based wastes, synthetic organic compounds, phytoremediation, gaseous wastes, desulphurization of coal and oil.	15	25
4	**Treatment of Industrial Wastes** Dairy, pulp, dye, leather, hospital and pharmaceutical industrial waste management. Solid waste management.	8	13
5	**Molecular Biology** Latest elements, developments pertaining to environmental biotechnology	7	12
	Total Hours:	60	

Textbook:

1. Stanier R.Y., Ingraham J.L., Wheelis M.L., Painter R.R., General Microbiology, Mcmillan Publications, 1989.
2. Foster C.F., John Ware D.A., Environmental Biotechnology, Ellis Horwood Ltd., 1987.

Reference Books:

1. Chakrabarty K.D., Omen G.S., Biotechnology And Biodegradation, Advances In Applied Biotechnology Series, Vol.1, Gulf Publications Co., London, 1989.
2. Bailey J.E. &Ollis, D.F. Biochemical Engineering Fundamentals, 2nd Ed., McGraw Hill, 1986
3. Alan Scragg., Environmental Biotechnology, Longman.

Course Outcomes:

No.	Course Outcomes	RBT Level*
1	Analyze environmental pollution and to develop suitable technologies to solve the problems	UN,AP
2	Understand the bases for microbial metabolism of environmental contaminants	UN,RM,AN,EL
3	Apply scientific concepts to environmental problems and their correlation with technological Concepts	UN,RM,AN,EL

*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

Suggested Course Practical List:

1. Estimation of total hardness of water samples
2. Determination of pH, carbonates and nitrates in soil
3. Estimation of Dissolved oxygen and Biological oxygen demand*
4. Estimation of chemical oxygen demand
5. Bioremediation*

List of Laboratory/Learning Resources Required

1. https://onlinecourses.nptel.ac.in/noc22_bt57/preview
2. https://biotechnologycourses.nl/courses/environmental-biotechnology-course/#tab-id-1