



National Institute of Technology Meghalaya
An Institute of National Importance

CURRICULUM

Programme	Master of Technology	Year of Regulation	2025
Department	Civil Engineering	Semester	I

Course Code	Course Name	Pre-requisite	Credit Structure				Marks Distribution				
			L	T	P	C	INT	MID	END	Total	
CE 545	Environmental Chemistry & Biotechnology	NIL	3	0	0	3	50	50	100	200	
Course Objectives	1. To learn the fundamentals of process kinetics and bioreactors 2. To study about various biological treatment processes and its operations for the wastewater treatment 3. To study about various biological treatment processes and its operations for the wastewater treatment. 4. To explain the design principles and operational problems involved in various biological treatment processes 5. To Design and assess the operation of a biofilm system for wastewater treatment	Course Outcomes	CO1	Able to describe the range of conventional and advanced biological treatment processes for the treatment of bulk organics, nutrients and micro pollutants							
			CO2	Able to design the biological reactors based on biokinetics							
			CO3	Able to select appropriate processes for specific applications, and have some knowledge of practical design considerations							
			CO4	Able to execute and asses the performance of bioreactors in laboratory scale							
			CO5	Able to design and optimise biological wastewater treatment processes.							

SYLLABUS

No.	Content	Hours	COs
I	Introduction: Need for wastewater treatment, Need for sludge treatment, Benefits of biological wastewater treatment, Overview of wastewater treatment processes	4	CO1, CO 2
II	Water and wastewater quality parameter: DO and pH, Solids: total, dissolved, volatile and fixed solids, Organic carbon: BOD, COD and TOC, Nitrogen: Total Kjeldahl Nitrogen (TKN), Ammonia-nitrogen (NH ₃ N), Nitrite-nitrogen (NO ₂ N) and Nitrate-nitrogen (NO ₃ N), Phosphorous, Microbial analysis: Most probable number (MPN)	6	CO2, CO3, CO4
III	Process Analysis: Rate of reaction, Order of reaction, Effect of temperature on reaction rate, Enzyme Reaction and kinetics, Types of reactors: CSTR and plug flow reactor, Reactor analysis, Residence time	7	CO2, CO3, CO4
IV	Biological Systems: Overview and application in wastewater treatment, Biological growth and kinetics, Half-life and doubling time, Yield and decay, Monod's kinetics, Estimation of kinetic parameters.	8	CO4, CO5,
V	Aerobic Process: Suspended growth processes: Ponds and lagoons, Activated sludge process: Process description and its modifications, Substrate utilization and biomass growth, Process design, Hydraulic and Solids residence time, Activated sludge process with and without biomass recirculation, Efficiency and loading criteria, Effect of temperature on process performance, Trouble shooting, Attached growth processes: Rotating biological contactor (RBC), Trickling filter	6	CO4, CO5
VI	Anaerobic Processes: Process description, Process design, Startup and operation, High-rate anaerobic processes, Biofilm and biofloc processes, Loading criteria and biogas generation rate, Biogas yield and composition, Biogas cleanup and use, Trouble shooting and maintenance, Sludge digestion, UASB, SBR etc,	6	CO4, CO5
VII	Downstream Treatment: Need for nutrient removal, Nitrogen removal processes, Biological nitrification and denitrification, Phosphorus removal, Disinfection	5	CO4, CO5
Total Hours		42	

Essential Readings

1. Metcalf & Eddy. Inc. George Tchobanoglous, Franklin Burton, H. David Stensel Wastewater Engineering: Treatment and Reuse. (4th Edition), McGraw-Hill International Edition, New York , 2003
2. Sawyer, C. N., Parkin, G. F. and McCarty, P. L. Chemistry for Environmental Engineering. New York: McGraw-Hill, 2008.
3. Zouboulis A. I., Matis, K. A. Innovative Technologies in Wastewater Treatment, 1st ed., Wiley-VCH, 2020.
4. A. D. Buekens and C. H. Huang, Waste Management: Current Issues and Future Challenges, 2nd ed. London, UK: CRC Press, 2023.

Supplementary Readings

1. Arceivala, S. J. and Asolekar, S. R., Wastewater Treatment for Pollution Control, 3rd Edition, McGraw-Hill Education (India) Pvt. Ltd., New Delhi, 2006.
2. K. Thirugnanasambandham and M. Govindarajan, Waste Management: Concepts, Methodologies, Tools, and Applications, 1st ed. Hershey, PA, USA: IGI Global, 2021.
3. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000