

Name of Faculty	:	Faculty of Engineering & Technology
Name of Program	:	Master of Technology (M. Tech) – Environment Engineering
Course Code	:	1MEE01
Course Title	:	Green Technologies for Process Industries
Type of Course	:	Professional Core
Year of Introduction	:	2023-24

Prerequisite	:	Green technology aims to minimize environmental harm from human-made materials and processes, including waste reduction and responsible chemical disposal to protect the environment and its ecosystems.
Course Objective	:	The principles of Green Technology demonstrate how chemical production could be achieved without posing hazard to human health and environment while at the same time being efficient and profitable.
Course Outcomes	:	At the end of this course, students will be able to:
	CO1	Describe the principles of Green Technology and Sustainable development.
	CO2	Summarize the concept of waste involving waste minimization, treatment and recycling.
	CO3	Predict the fate of different chemicals in environment and assessing risk evaluation of Environmental Chemicals.
	CO4	Analyze the quality of water for discharging into water bodies along with identification of biodegradation of minerals and detergents.
	CO5	Describe various components of atmosphere and mentioning the after effect of pollution caused by acid rain, smog and GHGs
	CO6	Organize systematically green route of synthesis and process adopted in Industries.

Teaching and Examination Scheme

Teaching Scheme (Contact Hours)			Credits	Examination Marks				
L	T	P		Theory Marks		Practical Marks		Total Marks
SEE	CIA	SEE	CIA					
4	0	0	4	70	30	00	00	100

Legends: L-Lecture; T-Tutorial/Teacher Guided Theory Practice; P-Practical, C-Credit, SEE-Semester End Examination, CIA-Continuous Internal Assessment (It consists of Assignments/Seminars/Presentations/MCQ Tests, etc.)

Course Content

Unit No.	Topics	Teaching Hours	Weightage	Mapping with CO
1	Introduction of Green protocol: Need, Goal and Limitation of Green Technology, Principles of Green Technology with their explanations and examples. Sustainable development, atom economy, reduction of toxicity	10	15%	CO1
2	Waste: Production, Prevention, Problems and Source of waste, cost of Waste, Waste minimization technique, waste treatment and recycling.	5	10%	CO2
3	Environmental chemicals: Chemical speciation – speciation of lead, mercury, arsenic and chromium. Structure and property – activity relationship, fate of organics in the environment – transformation reactions. Risk evaluation of environmental chemicals, Biochemical effects of arsenic, lead, mercury and pesticides.	10	15%	CO3
4	Water and Biodegradation: Analysis of water and water quality parameters – concept of pH, measurement of acidity, alkalinity, hardness, residual chlorine, chlorides, DO, BOD, COD, fluoride and nitrogen. Biodegradation – biodegradation of carbohydrates, proteins, fats and oils and detergents	10	15%	CO4
5	Atmosphere: Structure of atmosphere, chemical and photochemical reactions in the atmosphere. Ozone Chemistry: formation and depletion of ozone layer, oxides of nitrogen and sulphur. Acid rain mechanism of formation and effects. Photochemical smog, and sulfurous smog. Greenhouse effect, global warming, greenhouse gases.	10	15%	CO5
6	Green Synthesis and Industrial Process: Green oxidation and photochemical reactions, Microwave and Ultrasound assisted reactions, Synthesis of Green Reagents, Green solvents. Pollution statistics from various industries, polymer industry, textile industry, greener approach of dyeing, ecofriendly pesticides, pharmaceutical industry, wastewater treatment.	15	30%	CO6

Suggested Distribution of Theory Marks Using Bloom's Taxonomy

Level	Remembrance	Understanding	Application	Analyse	Evaluate	Create
Weightage	25	25	20	15	10	5

NOTE: This specification table shall be treated as a general guideline for the students and the teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books

Sr. No.	Name of Reference Books
1	Ahluwalia, V.K. Green Chemistry: Environmentally Benign Reactions, Ane Books India, New Delhi, 2006.
2	C.N Sawyer, P.L McCarty and G.F Parkin, Chemistry for Environmental Engineering and Science, 5th ed. Tata McGraw-Hill, 2003
3	Das, A. K. Environmental Chemistry with Green Chemistry, Books and allied (P) Ltd.
4	Sanghi, R. and Srivastava, M.M. Green chemistry: Environment Friendly Alternatives, Narosa Publishing House
5	Paul Anastas, John C. Warner, John Warner Joint; Green Chemistry: Theory and Practice New Ed Edition; Oxford University press, USA, 2000