	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 540	**Environmental Catalysis**	**NIL**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	1. Introduce students to the fundamentals of catalysis in abating pollutant emissions and developing future environmentally friendly energy technologies. 2. Reinforce the students existing knowledge of catalysis chemistry and catalytic reactor engineering. 3. Introduce the student to modern catalytic pollution abatement and emerging "green" catalytic processes. The student will be introduced to both the chemistry occurring on the catalyst as well as the engineering of the catalytic system. 4. Provide the student an overview of modern catalyst preparation, performance testing and surface characterization techniques. 5. The discussion will cover both the chemistry occurring on the catalyst surface as well as the engineering involved in the overall process	Course Outcomes	CO1	Able to explain catalysis chemistry and catalytic reactor engineering
			CO2	Able to understand the modern catalytic pollution abatement and emerging "green" catalytic processes;
			CO3	Able to know different kinds of catalytic materials and their structural properties.
			CO4	Able to know different kinds of catalyst characterization techniques and data analysis from each technique
			CO5	Be able to uunderstand catalyst structural and activity correlations

SYLLABUS

No.	Content	Hours	COs
I	**Introduction:** Industrial Wastewater Characteristics, Toxic chemicals from industry, Preliminary and Primary Treatment, Unit Operations and Unit Basic concepts in catalysis and green chemistry, industrially important catalysts and processes such as oxidation, processing of petroleum and hydrocarbons, synthesis gas and related processes	9	CO1, CO2
II	**Catalyst Materials and Preparation:** Catalyst preparation and catalyst characterization, Surface reactivity and kinetics of reaction on surfaces, poisoning and regeneration.	9	CO2, CO3, CO4
III	**Reactor Design for Environmental Catalysis:** Exhaust gas catalysts for different kinds of vehicles, control of stationary emissions (VOC, NOx, SOx), design of units for abatement of nitrogen oxides and VOC, catalytic combustion, Catalytic Converters, production of motor fuels with low content of sulfur and aromatics, hydrogen generation from various fuels for fuel cell vehicles and for emission abatement, Emission Control Strategies, Diesel Engine Emission Control & Diesel Engine Design.	12	CO2, CO3, CO4
IV	**Green Energy Catalysis:** Market aspects, and green production, Reactor modelling, Emphasizes the chemistry and engineering aspects of catalytic processes along with problems arising in industry, Catalyst deactivation kinetics and modelling.	12	CO4, CO5,
	Total Hours	**42**	

Essential Readings

1. J. M. Grasselli, A. Savitzky, and J. T. Yates, Catalysis: From Principles to Applications, 2nd ed., Amsterdam, Netherlands: Elsevier, 2022
2. R. A Sheldon, I. Arends, U. Handfield 'Green Chemistry and Catalysis'.
3. S. K. Sharma and A. Mudhoo, Green Chemistry for Environmental Remediation, Hoboken, NJ: Wiley-Scrivener, 2022

Supplementary Readings

1. R. Schlögl, Chemical Energy Storage and Environmental Catalysis, Cambridge, U.K.: RSC Publishing, 2020
2. Ronald M. Heck, Robert J. Farrauto, Suresh T. Gulati, Catalytic Air Pollution Control (CAPC) , Third Edition, 2016
3. J. M. Grasselli, A. Savitzky, and J. T. Yates, Catalysis: From Principles to Applications, 2nd ed., Amsterdam, Netherlands: Elsevier, 2022.