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|  | | | **National Institute of Technology Meghalaya**  An Institute of National Importance | | | | | | | | | | **CURRICULUM** | | |
| Programme | | | **Master of Technology** | | | | | Year of Regulation | | | | | **2018-19** | | |
| Department | | | **Civil Engineering** | | | | | Semester | | | | | **I** | | |
| Course Code | | Course Name | | Pre-requisite | | Credit Structure | | | | Marks Distribution | | | | | |
| L | T | P | C | INT | | MID | END | | Total |
| **CE 579** | | **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 | | | | | | | | | | 8 | | | CO1, CO2 | |
| II | **Catalyst Materials and Preparation:**  Catalyst preparation and catalyst characterization, Surface reactivity and kinetics of reaction on surfaces, poisoning and regeneration. | | | | | | | | | | 8 | | | 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. | | | | | | | | | | 10 | | | 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. | | | | | | | | | | 10 | | | CO4, CO5, | |
| Total Hours | | | | | | | | | | | **36** | | |  | |
| **Essential Readings** | | | | | | | | | | | | | | | |
| 1. Catalytic Chemistry: Bruce Gates. | | | | | | | | | | | | | | | |
| 1. R. A Sheldon, I. Arends, U. Handfield ‘Green Chemistry and Catalysis’. | | | | | | | | | | | | | | | |
| 1. M. A. Vennices ‘Kinetics of catalytic reactions | | | | | | | | | | | | | | | |
| **Supplementary Readings** | | | | | | | | | | | | | | | |
| 1. Ronald M. Heck, Robert J. Farrauto, Suresh T. Gulati, Catalytic Air Pollution Control (CAPC) , Third Edition, ISBN:9780470275030 |Online ISBN:9781118397749 | | | | | | | | | | | | | | | |
| 1. John Meurig Thomas, W. John Thomas; Principles and Practice of Heterogeneous Catalysis (PPHC), 2nd Edition, ISBN: 978-3-527-31458-4, | | | | | | | | | | | | | | | |