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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 513** | **Solid and Hazardous Waste Management** | **NIL** | **3** | **0** | **0** | **3** | **50** | **50** | **100** | **200** |
| Course Objectives | 1. The objective of this course is to get on broader understandings on various aspects of solid waste management (starting from its generation to processing with options for reuse and recycle, transport, and disposal) practiced in different municipalities.
2. To characterize the waste and apply the knowledge of laws for municipal solid waste management, for handling of biomedical wastes and for handling of plastic wastes.
3. To apply the knowledge of mathematics, science, and engineering for effective solid waste collection systems, for waste collection route optimization and for processing of solid waste.
4. **To design composting systems, maintain and operate the aerobic and anaerobic composting process for effective organic waste recycling.**
5. To manage construction and operations of landfill facilities, energy recovery systems and management of leachate systems.
 | Course Outcomes | CO1 | Able to learn basic concepts of solid waste management, beginning from source generation to waste disposal in a system of municipality organizational structure. |
| CO2 | Able to describe the components of solid waste management and the laws governing it. |
| CO3 | Able to understand the processes involved in solid and hazardous waste management |
| CO4 | Able to understand how quantitative risk assessments are conducted for toxic substances and their adverse effects on living organisms and the environment, and the limitations of the results of these analyses |
| CO5 | Able to identify the most common techniques for preventing, minimizing, recycling, disposing and treatment of waste and their application on site remediation |
| CO6 | Able to explain the operation, and maintenance of sanitary landfill |
| **SYLLABUS** |
| **No.** | **Content** | **Hours** | **COs** |
| I | **Solid Waste Management**1. Evolution of Solid Waste Management: Sources/Types and Characteristics; Generation; Handling, Separation, storage, and Processing at source
2. Collection and Transportation: Primary and secondary collection; Transfer and Transport
3. Processing and Treatment: Separation and unit operations; Chemical Transformation (combustion/incineration); Biological treatment (Composting, Anaerobic digestion)
4. Special Waste: E-waste management, Plastic and Bio-medical waste management, Street sweeping waste
5. Disposal and Legislation: Landfilling; Rules and legislation; Integrated solid waste management (ISWM)
 | **20** | CO1, CO2, CO3 |
| II | **Hazardous Waste Management**1. Evolution of Hazardous Waste Management: Definition; sources/types, generation; classification; Magnitude of problem; Risk assessment
2. Collection, processing, and treatment: on-site storage, collect and transportation; Physical, Chemical, Thermal and Biological treatment processes
3. Hazardous waste disposal: Ground water contamination; disposal methods (Secured landfill, combustion, Solidification and Stabilization);
 | **16** | CO3, CO4, CO5, CO6 |
| Total Hours | **36** |  |
| **Essential Readings** |
| 1. Tchobanoglous, G., Theisen and Vigil, Integrated Solid Waste Management: Engineering Principles and Management Issues, McGraw Hill, 1993. |
| 2. Vesilind, P. A., Worrel, W. A. and Reinhart, D. R., Solid Waste Engineering, Thomson Brooks/Cole, 1st Ed., 2002. |
| **Supplementary Readings** |
| 1. Nicholas, P., & Cheremisinoff, P. D. (2005). Handbook of solid waste management and waste minimization technologies. Imprint of Elsevier Science. |
| 2. P. Aarne Vesilind, William Worrel and Reinhart, Solid Waste Engineering, Thomson Brooks, Cole. |
| 3. CPHEEO, Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organization, Government of India, New Delhi, 2000. |