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| Image result for nit meghalaya logo | **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** |
| CourseCode | Course Name | Pre requisite | Credit Structure | Marks Distribution |
| L | T | P | C | INT | MID | END | Total |
| **CE 567** | **Landfill Engineering** | **None** | **3** | **0** | **0** | **3** | **50** | **50** | **100** | **100** |
| **Course****Objectives** | 1.To enable the students to learn about the components of Landfill management system2.To make students understand the importance and operation of components of Landfill, facilities for resource recovery and waste disposal3. To impart the student knowledge of landfill design as per the guidelines of standards in compliance with the regulatory agencies. | **Course Outcomes** | CO1 | Students will be able to plan and design the facilities for disposal of different kinds of solid waste |
| CO2 | Students will be able to contribute in construction and operation of the waste disposal facilities |
| CO3 | Students will be able to comprehend and Interpret key in situ processes relating to gas, hydrology and geotechnical issues within a closed landfill |
| CO4 | Students will be able to plan the environmental monitoring around the waste disposal facilities. |
| CO5 | Students will be able to design the Waste Management Facilities. |
| SYLLABUS |
| No. | Content | Hours | COs |
| I | **Introduction:**  Introduction to Solid, Hazardous, and Radioactive Waste Disposal and Containment; Types of Landfill; Landfilling practice for different types of solid wastes; Environmental impacts of landfill. | 3 | CO1 |
| II | **Landfill regulations and guidelines:**Estimation of landfill quantities, landfill site location, Environmental control systems for landfills, Landfill barrier system components, Liner system design, Landfill cover systems. | 8 | CO1, CO2 |
| III | **Microbiological processes in landfills:**Biological decomposition in landfills; Anaerobic decomposition processes; **Production phases of typical landfill gas.** | 4 | CO2 |
| IV | **Leachate and gas production:**Leachate production; basic principles of leachate generation; Sources of key contaminants within leachate; Effects of biodegradation processes on leachate composition; Predicting gas composition / contaminant emissions; Factors influencing migration of landfill gases and its long term behaviour. | 9 | CO3, CO4 |
| V | **Design of landfills:**Types of barrier materials; Liners and Cover systems; Leachate collection system; Gas collection system; Stability considerations; Continuous Environmental monitoring around landfills; Case studiesGeosynthetics in Landfills: Covers and liners for landfills-material aspects and stability considerations; Performance and failure of environmental control systems for landfills. | 7 | CO3, CO5 |
| VI | **Landfills: Closure, Aftercare and Economy:**Landfill closure constraints; Post-closure management of sites; End uses of closed landfills; Potential options for site development; Economic returns from a closed landfill; **Landfill** bio-mining. | 5 | CO5 |
| **Total Hours** | **36** |  |
| **Essential Readings** |
| 1. Reddy, K.R., and Adams, J.A., Sustainable Remediation of Contaminated Sites, Momentum Press, New York, 2015.
2. Qian, X., Koerner, R., and Gray, D.H., Geotechnical aspects of landfill design and construction, Prentice Hall, 2002.
3. Sarsby, R., Environmental Geotechnics, Thomas Telford, 2000.
4. Daniel, D.E., Geotechnical practice for waste disposal, Chapman and Hall, 1993.
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| **Supplementary Readings** |
| 1. Townsend, T.G., Powell, J., Jain, P., Xu, Q., Tolaymat, T., and Reinhart, D., Sustainable Practices for Landfill Design and Operation (Waste Management Principles and Practice, Springer Nature (1st ed.) 2015.
2. Yong, R. N., Catheriene, M., and Fukue, M., Geoenvironmental Sustainability, CRC Press, 2007.
3. Bagchi,A., Design of landfills and integrated solid waste management, John Wiley & Sons, Inc., USA, 2004
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