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| Image result for nit meghalaya logo | | | | **National Institute of Technology Meghalaya**  An Institute of National Importance | | | | | | | | | | | | | | | | | | | | | | | **CURRICULUM** | | | | | |
| Programme | | | | **Bachelor of Technology in Civil Engineering** | | | | | | | | | | | | | Year of Regulation | | | | | | | | | | **2020-2021** | | | | | |
| Department | | | | **Civil Engineering** | | | | | | | | | | | | | Semester | | | | | | | | | | **V** | | | | | |
| Course  Code | | Course Name | | | | | | | | **Pre requisite** | | | | Credit Structure | | | | | | | | Marks Distribution | | | | | | | | | | |
| L | | T | | | P | C | | INT | | | MID | | | END | | | Total | |
| **CE 313** | | **Ground Improvement Technique** | | | | | | | | **Nil** | | | | **3** | | **0** | | | **0** | **3** | | **50** | | | **50** | | | **100** | | | **200** | |
| Course  Objectives | | 1. To introduce different types problematic soils and to familiarize with different ground improvement techniques for improving these soils. | | | | | | | | | | Course Outcomes | | | | CO1 | | | Identify the type of problems in problematic soils and to suggest different ground improvement techniques to solve these problems. | | | | | | | | | | | | | |
| 1. To impart knowledge of mechanical modification techniques such as deep compaction, blasting, vibrocompaction, dynamic tamping and compaction Piles. | | | | | | | | | | CO2 | | | Understand the importance and suitability of shallow and deep compaction techniques like use of different rollers, dynamic tamping, explosion etc. | | | | | | | | | | | | | |
| 1. To apply knowledge on ground improvement techniques such as drainage and dewatering and grouting techniques on stabilization of expansive soils. | | | | | | | | | | CO3 | | | Understand traditional dewatering system methods and design of drainage and dewatering systems for various civil engineering problems. Design the preloading and vertical drain systems for consolidations. | | | | | | | | | | | | | |
| 1. To give idea on design of dewatering system which is treated as one of the most widely applicable ground improvement techniques. | | | | | | | | | | CO4 | | | Apply the admixtures like cement and lime for treating expansive soil. | | | | | | | | | | | | | |
| 1. To develop the understanding of the students regarding the concept of reinforced earth, geosynthetics and soil reinforcement in ground improvement. | | | | | | | | | | CO5 | | | Understand the importance and suitability of different grouting techniques and grout materials used frequently for underground and foundation constructions. | | | | | | | | | | | | | |
| CO6 | | | Understand the in-situ soil improvement techniques such as use of ground anchors, rock bolts, micro-piles, soil nails, various geo-synthetic materials etc. and to introduce the design and construction techniques of those in-situ soil improvement techniques. | | | | | | | | | | | | | |
| No. | COs | | Mapping with Program Outcomes (POs) | | | | | | | | | | | | | | | | | | | | | | | Mapping with PSOs | | | | | | |
| PO1 | | PO2 | PO3 | PO4 | PO5 | PO6 | | PO7 | | PO8 | | PO9 | | | PO10 | | | PO11 | | PO12 | | | PSO1 | | | PSO2 | | | PSO3 |
| 1 | CO1 | | 2 | | 1 | - | 1 | 1 | 2 | | - | | - | | 3 | | | - | | | - | | 3 | | | **0** | | | **2** | | | **3** |
| 2 | CO2 | | 1 | | - | 1 | - | 3 | - | | - | | - | | 3 | | | - | | | 1 | | 1 | | | **0** | | | **2** | | | **3** |
| 3 | CO3 | | 3 | | 3 | 3 | - | 2 | - | | - | | - | | 1 | | | - | | | 2 | | 3 | | | **0** | | | **3** | | | **3** |
| 4 | CO4 | | 3 | | 1 | - | - | 2 | - | | - | | - | | 2 | | | - | | | 2 | | 1 | | | **0** | | | **2** | | | **3** |
| 5 | CO5 | | 2 | | 1 | - | - | 3 | - | | - | | - | | 2 | | | - | | | 2 | | 1 | | | **0** | | | **2** | | | **3** |
| 6 | CO6 | | 3 | | 2 | 2 | - | 3 | - | | - | | - | | 3 | | | - | | | 2 | | 3 | | | **0** | | | **2** | | | **3** |
| SYLLABUS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| No. | Content | | | | | | | | | | | | | | | | | | | | | | | Hours | | | | | | COs | | |
| I | **Introduction**  Need for Ground Improvement, Different types of problematic soils, Emerging trends in ground Improvement. | | | | | | | | | | | | | | | | | | | | | | | **03** | | | | | | **CO1** | | |
| II | **Mechanical Stabilization**  Shallow and deep compaction requirements, Principles and methods of soil compaction, Shallow compaction and methods. Properties of compacted soil and compaction control, Deep compaction and Vibratory methods, Dynamic compaction. | | | | | | | | | | | | | | | | | | | | | | | **07** | | | | | | **CO2** | | |
| II | **Hydraulic Modification**  Ground Improvement by drainage, Dewatering methods, Design of dewatering systems, Preloading, Vertical drains, Vacuum consolidation, Electro-kinetic dewatering, design and construction methods. | | | | | | | | | | | | | | | | | | | | | | | **07** | | | | | | **CO3** | | |
| III | **Modification by Admixtures**  Cement stabilization and cement columns, Lime stabilization and lime columns. Stabilization using bitumen and emulsions, Stabilization using industrial wastes, Construction techniques and applications. | | | | | | | | | | | | | | | | | | | | | | | **07** | | | | | | **CO4** | | |
| IV | **Grouting**  Permeation grouting, compaction grouting, jet grouting, different varieties of grout materials, grouting under difficult conditions. | | | | | | | | | | | | | | | | | | | | | | | **05** | | | | | | **CO5** | | |
| V | **In Situ Soil Treatment Methods**  Soil nailing and ground anchors, rock anchoring, micro-piles, design methods, construction techniques, Functions and applications of geosynthetics – geotextiles, geogrids, geomembranes; soil reinforcement using strips, bars and geosynthetics. | | | | | | | | | | | | | | | | | | | | | | | **07** | | | | | | **CO6** | | |
| Total Hours | | | | | | | | | | | | | | | | | | | | | | | | **36** | | | | | |  | | |
| **Essential Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. S. K. Gulhati and M. Datta, "Geotechnical Engineering", Tata McGraw Hill. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. H.R. Hausmann, "Principles of Ground Modification", McGraw-Hill Book Company. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. Purushothama Raj. P, “Ground Improvement Techniques”, Firewall Media. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| **Supplementary Readings** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. M. R. Hausmann, “Engineering Principles of Ground Modification”, McGraw-Hill Pub, Co. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. P. Nicholson, “Soil Improvement and Ground Modification Methods”, Butterworth-Heinemann Ltd. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1. R. M. Koerner, “Designing with Geosynthetics”, Prentice Hall Inc. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |