**17CE41E4 – GROUND IMPROVEMENT TECHNIQUES**

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| **Course Category** | Core Elective | **Credits**  | 3 |
| **Course Type**  | Theory | **Lecture - Tutorial - Practical**  | 3 - 0 - 0 |
| **Prerequisite**  | Foundation Engineering and Water Resources Engineering. | **Sessional Evaluation**  | 40 |
| **Semester End Exam Evaluation**  | 60 |
| **Total Marks**  | 100 |

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| **Course****Objectives** | 1. To explain the emerging trends in ground improvement and to demonstrate the various methods of compaction by mechanical stabilization.
2. To analyse the various methods of dewatering.
3. To understand the ground modification by admixtures.
4. To study the various methods of grouting under difficult conditions.
5. To explain the various methods of grouting techniques.
6. To study the various case studies of ground improvement projects.
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|  **Course** **Outcomes** | CO1 | Apply in-situ densification methods for soils. |
| CO2 | Understand dewatering methods. |
| CO3 | Demonstrate the ground modification by admixtures. |
| CO4 | Demonstrate the grouting techniques under different conditions.  |
| CO5 | Analyse in situ soil treatment methods. |
| CO6 | Evaluate case studies of ground improvement projects. |
| **Course****Content** | **UNIT – I****INTRODUCTION:** Need for Ground Improvement – Different types of problematic soils – Emerging trends in ground Improvement.**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.**UNIT – 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.**UNIT – 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.**UNIT – IV****GROUTING:** Permeation grouting – Compaction grouting – Jet grouting – Different varieties of grout materials – Grouting under difficult conditions.**UNIT – V****IN SITU SOIL TREATMENT METHODS:** Soil nailing – Rock anchoring – Micro-piles – Design methods – Construction techniques.**UNIT – VI****CASE STUDIES:** Case studies of ground improvement projects. |
| **Textbooks****and****References** | **TEXTBOOKS:**1. Manfired R. Hausmann, Engineering Principles of Ground Modification, McGraw-Hill Pub, Co.1990.
2. M C. R. Davies, F.Schlosser Ground improvement geosystems.
3. Koerner, R. M. Designing with geosynthetics, Prentice Hall Inc. 1998.

**REFERENCE BOOKS:**1. Moseley M.P. (1993) Ground Improvement, Blackie Academic and Professional, Boca Taton, Florida, USA.
2. Xanthakos P.P, Abramson, L.W and Brucwe, D.A (1994) Ground Control and Improvement, John Wiley and Sons, New York, USA.
3. Robert M. Koerner, Designing with Geosynethetics, Prentice Hall Jercy, USA.
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