

Approval: 9th Senate Meeting

Course Number: CE 505

Course Name: Engineering of Ground Modification

Credits: 3-0-0-3

Prerequisites: CE 302 - Geotechnical Engineering

Intended for: UG/PG

Distribution: Discipline Core

Semester: Odd/Even

Preamble: With the increasing issues and problems in ground, there is a requirement of ground improvement to ensure proper working of the structures and facilities to be provided on them. To suit the ground to the requirement, there is a requirement of the ground to be modified. The technique of ground modification depends on various conditions, according to which a suitable method needs to be adopted. The details of all the current modification techniques along with the application and adoptability conditions have been presented in this course.

Course Outline: The requirement of the ground modification is highlighted in the introduction. An outline of the characterization of ground improvement techniques are discussed in this module. Later, the various aspects related to the mechanical, hydraulic, physical and chemical modifications to bring in stabilization in the ground are discussed in the subsequent topics. Further, an introduction to the geosynthetics and their applications are presented in brief along with the recent developments in this area.

Modules:

1. Introduction to Engineering Ground Modification: Need and objectives, Identification of soil types, In-situ and laboratory tests to characterize problematic soils; Mechanical, Hydraulic, Physico-chemical, Electrical, Thermal methods and their applications.
(7 contact hours)
2. Mechanical Modification – Principles of soil densification – Properties of Compacted soil, Compaction control tests, Specification of compaction requirements, Blasting Vibrocompaction, Dynamic Tamping and Compaction piles. **(8 contact hours)**
Hydraulic Modification – Objectives and techniques, traditional dewatering methods and their choice, Design of dewatering system, Electro-osmosis, Filtration, Drainage and seepage control with Geosynthetics, Preloading and vertical drains, Electro-kinetic dewatering. **(8 hours)**
3. Physical and Chemical Modification – Modification by admixtures, Shotcreting and Guniting Technology, Modification at depth by grouting, Crack Grouting and compaction grouting, Jet grouting, Thermal Modification, Ground freezing. **(9 lectures)**

4. Modification by Inclusions and Confinement - Soil reinforcement, underpinning, In-situ ground reinforcement, ground anchors, rock bolting and soil nailing, sand bags, crib walls, bin walls, gabion walls. **(7 lectures)**

5. Introduction to geosynthetics – Applications. **(3 lectures)**

Text Books:

- a) Peter G. Nicholson, 'Soil Improvement and ground modifications methods', Elsevier, 2015.
- b) P. Purushothama Raj, 'Ground improvement Techniques', Laxmi Publications, 2005.
- c) Hausmann, M. R., 'Engineering Principles of Ground Modifications', McGraw Hill publications, 1990.

Reference books:

- a) John A. Hudson, 'Ground Improvement Case Histories', Elsevier, 2005.
- b) C. A. Raison, 'Ground and Soil Improvement', ICE publications, 2004.