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| **IV Year I Semester** | **L** | **T** | **P** | **C** |
| **Code: 17CE731** | **3** | **1** | **0** | **0** |

# GROUND IMPROVEMENT TECHNIQUES
## (Dept.Elective-I)

**Course Learning Objectives**

The objectives of this course are:

1. To make the student appreciate the need for different ground improvement methods adopted for improving the properties of remoulded and in-situ soils by adopting different techniques such as in situ densification and dewatering methods.
2. To make the student understand how the reinforced earth technology and soil nailing can obviate the problems posed by the conventional retaining walls.
3. To enable the students to know how geo textiles and geo synthetics can be used to improve the engineering performance of soils.
4. To make the student learn the concepts, purpose and effects of grouting.

**Course Outcomes**

By the end of the course, the student should be able to:

1. Gain the knowledge of various methods of ground improvement and their suitability to different field situations.
2. Understands the concepts of dewatering.
3. Understands the process of Stabilization of soils.
4. Design a reinforced earth embankment and check its stability.
5. Know the various functions of Geo synthetics and their applications in Civil Engineering practice.
6. Understand the concepts and applications of grouting.

**SYLLABUS**

**UNIT- I**

**In-situ densification methods-** in situ densification of granular soils- vibration at ground surface and at depth, impact at ground and at depth – in situ densification of cohesive soils – pre loading – vertical drains – sand drains and geo drains – stone columns.

**UNIT –II**

**Dewatering** – sumps and interceptor ditches – single and multi stage well points – vacuum well points – horizontal wells – criteria for choice of filler material around drains – electro osmosis

**UNIT- III**

**Stabilization of soils** – methods of soil stabilization – mechanical – cement – lime – bitumen and polymer stabilization – use of industrial wastes like fly ash and granulated blast furnace slag.

**UNIT- IV**

**Reinforcement of earth** – principles – components of reinforced earth – design principles of reinforced earth walls – stability checks – soil nailing.

**UNIT-V**

**Geosynthetics**– geotextiles–types–functions, properties and applications– geogrids , geomembranes and gabions -properties and applications.

**UNIT-VI**

**Grouting**–objectivesofgrouting–groutsandtheirapplications–methodsof grouting– stage of grouting– hydraulic fracturing in soils and rocks – post grout tests

**TextBooks:**

1. Ground Improvement Techniques, Purushotham Raj,Laxmi Publications, New Delhi.
2. GroundImprovementTechniques,NiharRanjanPatro,VikasPublishingHouse(p) Limited, New Delhi.
3. AnintroductiontoSoilReinforcementandGeosynthetics,G.L.SivaKumarBabu,Universities press.

**References:**

1. GroundImprovement, M.P. Moseley,BlackieAcademic and Professional,USA.
2. Designingwith Geosynethetics, R. M Koerner, PrenticeHall