

**(ELECTIVE – B/II)**  
**4/4 B.Tech. SEVENTH SEMESTER**

**CE7T6B**

**GROUND IMPROVEMENT TECHNIQUES**

**Credits: 3**

**Lecture: 3 periods/week**

**Internal assessment: 30 marks**

**Tutorial: 1 period /week**

**Semester end examination: 70 marks**

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**Objectives:**

- To get knowledge on expansive soils, ground improvement techniques, reinforced earth retaining structures, drainage and dewatering and grouting techniques.
- To get familiarize about different methods of ground improvement in cohesive and granular soil.
- To understand the expansive soil properties and apply the same for the design of structures on expansive soils.

**Learning outcomes:**

At the end of course the student will be able to:

- Learn many ground improvement techniques including vibro flotation and preloading including sand drains
- Learn grouting methods in Civil Engineering applications
- Solve the field problems related to problematic soils and solve the problems using the above ground improvement techniques
- Design drainage, dewatering for the field problems
- Design and construct reinforced earth retaining structures

**UNIT – I**

**DEWATERING:**

Methods of de-watering- sumps and interceptor ditches- single, multi stage well points - vacuum well points- Horizontal wells-foundation drains-blanket drains- criteria for selection of fill material around drains –Electro-osmosis

**UNIT –II**

**GROUTING:**

Objectives of grouting- grouts and their properties- grouting methods- ascending, descending and stage grouting hydraulic fracturing in soils and rocks- post grout test.

**UNIT – III**

**IN-SITU DENSIFICATION METHODS IN GRANULAR SOILS:**

Vibration at the ground surface, Impact at the Ground Surface, Vibration at depth, Impact at depth.

**UNIT - IV**

**IN-SITU DENSIFICATION METHODS IN COHESIVE SOILS:**

Preloading or dewatering, Vertical drains – Sand Drains, Sand wick geodrains – Stone and lime columns – thermal methods.

**UNIT – V**

**STABILISATION:**

Methods of stabilization-mechanical-cement- lime-bituminous-chemical stabilization with calcium chloride, sodium silicate and gypsum

#### **UNIT – VI**

##### **REINFORCED EARTH:**

Principles – Components of reinforced earth – factors governing design of reinforced earth walls – design principles of reinforced earth walls.

#### **UNIT – VII**

##### **GEOSYNTHETICS:**

Geotextiles- Types, Functions and applications – geogrids and geomembranes – functions and applications.

#### **UNIT - VIII**

##### **EXPANSIVE SOILS-PILING TECHNIQUES:**

Problems of expansive soils – tests for identification – methods of determination of swell pressure. Improvement of expansive soils – Foundation techniques in expansive soils – under reamed piles.

### **Learning resources**

#### **Text books:**

1. Engineering Principles of Ground Modification by Hausmann, M.R., McGraw-Hill International Edition, 1990.
2. Ground Improvement Techniques, (2<sup>nd</sup> edition) by Purushotham Raj., Laxmi Publications, New Delhi, 2005.

#### **Reference books:**

1. Ground Improvement by Moseley, M.P., Blackie Academic and Professional, Boca Taton, Florida, USA, 1993.
2. Ground Control and Improvemen” by Xanthakos, P.P., Abramson, L.W and Brucwe, D.A., John Wiley and Sons, New York, USA, 1994.
3. Designing with Geosynthetics, (6<sup>th</sup> edition) by Robert Koerner M., Prentice Hall New Jercy, USA, 2012.