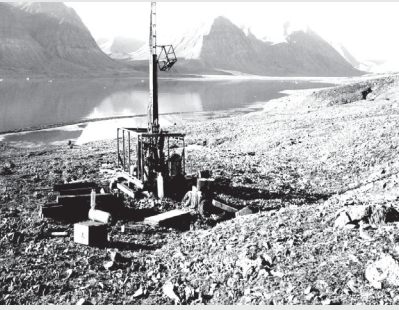


# 16CE302 GEOTECHNICAL ENGINEERING - I



Hours Per Week :

L	T	P	C
3	-	2	4

Total Hours :

L	T	P	WA/RA	SSH/HSB	CS	SA	S	BS
45	-	30	20	48	4	12	2	2

## Course Description and Objectives:

This course offers study of the behaviour of soils under the influence of loading forces, soil-water interaction and knowledge on design of foundations, retaining walls, earth dams, clay liners, and geosynthetics for waste containment. The objective of this course is to provide a basic understanding of the physical and mechanical characteristics of soils and how to relate these to the engineering behavior of soil and understanding of the meaning and measurement of parameters for geotechnical engineering design.

## Course Outcomes:

The Students will be able to:

- understand behavior of soil and classify them
- learn shear strength parameters for field conditions.
- compute and analyse the consolidation settlements.
- understand the principles of compaction and its control.

## SKILLS:

- ✓ *Identify and classify soils.*
- ✓ *Determine permeability coefficients of soils.*
- ✓ *Determine the compaction characteristics of soils.*
- ✓ *Measure the effective stresses in the soils at different conditions.*
- ✓ *Analyze consolidation properties of soils.*
- ✓ *Measure shear strength parameters of soil at different drainage conditions.*

**UNIT - 1****L-9**

**INTRODUCTION:** Soil formation and soil types, Regional soil deposits of India, Phase diagrams, Simple definitions, Important relationships.

**INDEX PROPERTIES:** Grain size distribution, Mechanical analysis – Sieve analysis, Stoke's law, Hydrometer Analysis; Atterberg's Limits, Significance of other soil aggregate properties

**SOIL CLASSIFICATION:** Introduction, Particle size classification as per IS code, Unified soil classification system, Indian standard soil classification system.

**UNIT - 2****L-9**

**PERMEABILITY:** Capillary rise, Darcy's law and its validity, Determination of coefficient of permeability-constant and variable head methods, Indirect methods; Factors affecting permeability, Permeability of stratified soil deposits.

**SEEPAGE THROUGH SOILS:** Total, Neutral and effective stresses, Seepage force, Quick sand condition, Flow nets - Characteristics and Uses.

**UNIT - 3****L-9**

**STRESS DISTRIBUTION IN SOILS:** Introduction, Boussinesq's equation, Vertical stress distribution diagrams, Vertical stress beneath loaded areas, Newmark's influence chart, Approximate stress distribution methods for loaded areas, Westergaard's equation.

**COMPACTION OF SOILS:** Introduction, Laboratory tests, Factors affecting compaction, Effects of compaction on soil properties, Compaction in the field, Compaction specifications and field control.

**UNIT - 4****L-9**

**COMPRESSIBILITY OF SOIL AND CONSOLIDATION:** Introduction, Compressibility, Time-rate of consolidation, Consolidation test, Computation of settlement, Extrapolation of field consolidation curve, Settlement analysis.

**UNIT - 5****L-9**

**SHEAR STRENGTH OF SOILS:** Introduction, Stress at a point, Mohr circle of stress, Mohr-coulomb failure criterion, Measurement of shear strength, Shear strength of clayey soils, Shear strength of sands, Drainage conditions and strength parameters.

**ACTIVITIES:**

- *Classify the given soil according to IS or Unified Soil Classification Systems by performing all the necessary tests in laboratory.*
- *Compare the coefficient's of permeability for different soils.*
- *Compare the compaction characteristics for different soils.*
- *Determine the consolidation properties (rate of consolidation, time taken for completing consolidation etc.) of a given soil.*
- *Find out stresses using newmark's influence chart for a given area.*

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**LABORATORY EXPERIMENTS****LIST OF EXPERIMENTS**

Total hours: 30

1. Determination of water content by oven drying method.
2. Determination of Specific Gravity by
  - a) Density Bottle Method.
  - b) Pycnometer Method.
3. Gradation analysis
  - a) Mechanical Sieve Analysis.
  - b) Hydrometer Analysis.
4. Determination of Atterberg's Limits.
5. Determination of Free Swell Index.
6. Determination of Field Unit Weight by
  - a) Core Cutter Method.
  - b) Sand Replacement Method.
7. Compaction
  - a) Standard Proctor Compaction Test.
  - b) Modified Proctor Compaction Test.
8. Determination of Permeability
  - a) Constant Head Permeability.
  - b) Variable Head Permeability.

**TEXT BOOKS:**

1. B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Soil Mechanics and Foundation", 16<sup>th</sup> edition, Laxmi Publications Pvt. Ltd., New Delhi, 2005.
2. K. R. Arora, "Soil Mechanics and Foundation Engineering", 7<sup>th</sup> edition, Standard Publishers and Distributors, Delhi, 2009

**REFERENCE BOOKS:**

1. Gopal Ranjan and A. S. R. Rao, "Basic and Applied Soil Mechanics", 2<sup>nd</sup> edition, New Age International Pvt. Ltd., New Delhi, 2004.
2. C. Venkatramaiah, "Geotechnical Engineering", 4<sup>th</sup> edition, New Age International Pvt. Ltd., New Delhi, 2012
3. Manoj Datta, S. Gulhati, "Geotechnical Engineering", 1<sup>st</sup> edition, Tata McGraw Hill Education Ltd., 2008.