SOIL MECHANICS

Year-III **Semester-V**

Teaching Schedule Hours/Week					Examination Schedule						Total Marks
					Final				Internal Assessment		
					Theory		Practical		Theory Marks	Practical Marks	
Credit Hours	L	T	P	Total	Duration	Marks	Duration	Marks	40	25	125
3	3	3	2/2	7	3 Hrs.	60	-	-			

Note: **L:** Lecturer **T:** Tutorial **P:** Practical

Course Objective:

The objective of this course is to provide the students concepts and nature of soil with relating to index and engineering properties of soil. It will also provide the knowledge about the slope stability.

Course Content:

1.0 Physical and Index Properties of Soils **(7 hrs)**

1.1 Soil as a three –phase material
1.2 Index properties of soil
1.3 Determination of various index properties

2.0 Soil Identification and Classification **(4 hrs)**

2.1 Field identification of soils
2.2 Soil Classification: Descriptive, Textural, ISCS, MIT, USCS, AASHTO and Boundary classification of soil
2.3 Practical implications of the soil classification system

3.0 Soil Compaction **(3 hrs)**

3.1 Compaction process and compaction theories
3.2 Moisture – density relationship and degree of compaction
3.3 Laboratory determination of compaction characteristics
3.4 Field compaction and compaction control
3.5 Effects of compaction on engineering behaviour of soils

4.0 Soil – Water Interaction (4 hrs)

4.1 Mode of occurrence of water in soils
4.2 Surface tension and the capillary phenomenon
4.3 Flow of water through the soil mass
4.4 Permeability of soils
4.5 Determination of the coefficient of permeability: laboratory and field methods
4.6 Pumping tests through confined and unconfined aquifers
4.7 Effects of water on swelling and shrinkage of soils

5.0 Principles of Effective Stress (3 hrs)

5.1 Stresses in subsoil
5.2 Effective stress principle
5.3 Physical interpretation of effective stress equations of the static and flow conditions
5.4 Quick sand phenomenon and remedial measures

6.0 Seepage Analysis (5 hrs)

6.1 Two dimensional fluid flow
6.2 Conditions for continuity of flow
6.3 Laplace's equation, flow nets and their principles
6.4 Boundary conditions
6.5 Flow nets and their application
6.6 Laplace's equation for an Isotropic soil and its application
6.7 Deflection of flow lines at the interface of two different soils
6.8 Phreatic line in an earth dam
6.9 Design of filter

7.0 Stress Distribution in Soils (4 hrs)

7.1 State of stress at a point in the subsoil
7.2 Stress from elastic theories
7.3 Boussinesq's theory of stress distribution
7.4 Extension of Boussinesq's analysis to uniformly loaded areas
7.5 Newmark's charts and its uses in computing stresses
7.6 Elastic settlement and contact pressure

8.0 Shear Strength of Soils (5 hrs)

8.1 Concept of shear strength
8.2 Principal planes and principal stresses
8.3 Mohr – Coulomb theory of shear strength
8.4 Mohr's stress Circle and failure envelop
8.5 Relation between Principal stresses at failure
8.6 Types of shear tests
8.7 Vane shear test
8.8 Shear strength of sands
8.9 Shear strength of saturated and unsaturated clays

9.0 Consolidation and Settlement (6 hrs)

9.1 Behaviour of soil under compressive loads
9.2 Settlement of structures resting on soil: its nature, causes and remedial measures
9.3 The consolidation process and Terzaghi's spring Analogy.
9.4 Primary and secondary consolidation
9.5 One Dimensional Consolidation test
9.6 Compressibility of soil
9.7 Normally consolidated (NC) clays, over consolidated (OC) clays and pre-consolidation pressure
9.8 Determination of field pressure – void curve
9.9 Estimation of consolidation settlement
9.10 Rate and degree of consolidation
9.11 Terzaghi's theory of one dimensional consolidation
9.12 Determination of coefficient of consolidation
9.13 Estimation of rate and magnitude of settlement

10.0 Stability of Slopes (4 hrs)

10.1 Introduction
10.2 Critical surfaces and factors of safety
10.3 Method of stability analysis
10.4 Stability Analysis of Infinite slopes
10.5 Stability Analysis of finite slopes
10.6 Methods of slices

Laboratories:

Eight Laboratory exercises will be performed in this course. Theyare:

(i) Hydrometer analysis- Sedimentation analysis
(ii) Determination of Atterberg limit of soil
(iii) Use of in – situ density core cutter and the method of sand replacement
(iv) Determination of optimum moisture content and maximum dry density
(v) Variable head permeability test
(vi) Unconfined compression test
(vii) Direct shear test
(viii) UU triaxial test

References:

- "A Text Book of Soil Mechanics", Dr. Sehgal, S. B. CBS Publishers and Distributors, New Delhi,1988.
- " Soil Mechanics in Engineering practice" , Terzaghi, K and Peck, R.B. , John Wiley, 2nd Edition,New York, 1967.

- "Soil mechanics and Foundation engineering" Dr. K.R.Arora
- Soil mechanics and Foundation engineering" B.C. Punmia
- "Geotech Engineering" V.N.S. Murthy

Evaluation Scheme: Marks Division

Question Type	No. of Questions	Marks	Total Marks
Short	4	2	8
Medium	7	4	28
Long	3	8	24
Total			60