Soil Mechanics and Foundation Engineering
EG 2204 CE

Year: II **Total: 7 Hrs. /week**
Semester: II **Lecture: 4 Hrs./week**
Tutorial: 2 Hrs./week
Practical: Hrs./week
Lab: 2/2 Hrs./week

Course Description:
This course is intended to give student a brief introduction to the field of soil mechanics & Foundation Engineering and use of the basic data for analyzing various soil problems common to the civil engineering.

Course Objectives:
After the completion of this course, students will be able to:
1. Understand the fundamental and relevant principles of soil mechanics and Foundation Engineering
2. Have an overall picture of the behavior of soil
3. Describe the nature of some of the soil problems encountered in civil engineering and
4. Formulate the basic technique and to develop the methodologies to solve the soil problem.

Course Contents:

Theory

Unit 1:Introduction: **[2 Hrs.]**
- 1.1 Definition of soil
- 1.2 Soil mechanics
- 1.3 Importance of soil mechanics
- 1.4 Origin of soil, Formation of soil, transportation of soils

Unit 2:Basic Terminology and Interrelations: **[4 Hrs.]**
- 2.1 Introduction
- 2.2 Phase diagrams
- 2.3 Void ratio, porosity, degree of saturation, unit weight, density, air content and percentage air voids
- 2.4 Interrelations

Unit 3:Index properties of Soil: **[6 Hrs.]**
- 3.1 Introduction
- 3.2 Specific gravity
- 3.3 Water content
- 3.4 Particle size distribution
- 3.5 Consistency of soils
- 3.6 Determination of field density

Unit 4:Soil Classification: **[6 Hrs.]**
- 4.1 Purpose of soil classification
- 4.2 M.I.T classification system
- 4.3 Textural soil classification
- 4.4 Unified soil classification system
- 4.5 Field identification of soil

Unit 5:Soil Water and Effective Stress **[9 Hrs.]**
- 5.1 Types of soil water

5.2 Water table
5.3 Permeability, factors affecting permeability of soil
5.4 Seepage through soils
5.5 Darcy's Law
5.6 Determination of coefficient of permeability: laboratory methods
5.7 Principle of effective stress
5.8 Quick sand condition
5.9 Approximate stress distribution method for loaded areas

Unit 6:Compaction: [4 Hrs.]

6.1 Introduction, purposes of compaction
6.2 Standard proctor test
6.3 Field compaction methods
6.4 Factors affecting compaction
6.5 Compaction control

Unit 7:Consolidation: [9 Hrs.]

7.1 Introduction, difference between consolidation and compaction
7.2 Primary and secondary consolidation
7.3 Settlement
7.4 Terzaghi's spring analogy
7.5 The standard one-dimensional consolidation test
7.6 Pressure-void ratio curves
7.7 Define co-efficient of compressibility
7.8 Define co-efficient of volume change
7.9 Expression to obtain consolidation settlement

Unit 8:Shear Strength of Soils: [6 Hrs.]

8.1 Introduction
8.2 Principle plane and principle stress
8.3 Mohr's circle for two-dimensional stress system
8.4 Mohr-Coulomb failure theory
8.5 Determination of shear strength parameter
8.6 Direct shear test
8.7 Unconfined compression test

Unit 9:Earth Pressure Theory: [5 Hrs.]

9.1 Introduction
9.2 Different types of lateral earth pressures
9.3 Introduction to Rankine's earth pressure theory (Active and passive earth pressure in cohesive and cohesionless soil)
9.4 Types of retaining walls
9.5 Principles of the design of retaining walls

Unit 10: Bearing Capacity: [9 Hrs.]

10.1 Introduction
10.2 Types of foundation
10.3 Basic definition
10.4 Gross and net foundation pressure
10.5 Terzaghi's bearing capacity theory
10.6 Bearing capacity of footing with finite dimensions
10.7 Effect of water table on bearing capacity
10.8 Settlement of foundation

Tutorials

Unit 2: Basic terms and Interrelationship [10 Hrs.]
Unit 3: Particle size distribution and consistency Index [1 Hrs.]
Unit 5: Determination of Coefficient of permeability and effective stress [5 Hrs.]
Unit 6: Calculation of Dry density, moisture content, plotting of compaction curve [3 Hrs.]
Unit 7: Coefficient of compressibility and volume change [1 Hr.]
Unit 8: Mohr column failure theory [3 Hrs.]
Unit 9: Determination of Active earth and passive earth pressure by Rankine's earth pressure theory [4 Hrs.]
Unit 10: Determination of Bearing capacity based on Terzaghis' bearing capacity theory [3 Hrs.]

Practical (Laboratory)

1. Perform sieve analysis of Coarse-grained soil (1 session)
2. Determine specific gravity by Pycnometer method (1 session)
3. Determine liquid limit and plastic limit (1 session)
4. Determine field density by Sand replacement method and Core cutter method (1 session)
5. Perform compaction test: Standard proctor test (1 session)
6. Perform direct shear test (1 session)
7. Perform unconfined compression test (1 session)

Text books:

1. K.R Arora, "*Soil Mechanics and Foundation Engineering*", Standard Publishers Distributors, Nai-sarak, New Delhi

References:

1. V.N.S Murthy "*A Text Book of Soil Mechanics and Foundation Engineering* in *SI Units* "UBS Distributors Ltd. New Edition
2. Prof.T. N Ramamurthy, Prof.T. G Sitaram "*Geotechnical Engineering, Soil Mechanics"* S. Chand Publishing, New Delhi, New Edition.
3. Dr. Sehgal "A text book of soil mechanics" S.B CBS Publishers and Distributors, New Delhi, New Edition
4. Prof. Dr. Ramakrishna Poudel, Asst. Prof Ramesh Neupane "A Text book of soil mechanics", M.E. Nepal Pvt. Ltd, Kathmandu

Evaluation Scheme

The questions will cover all the chapters in the syllabus. The evaluation scheme will be as indicated in the table below:

Unit	Title	Hrs. (L+T)	Marks Distribution
1	Introduction	2	2
2	Basic terminology and interrelations	14	12
3	Index Properties of soil	7	6
4	Soil classification	6	6
5	Soil water and effective stress	14	12
6	Compaction	7	6
7	Consolidation	10	8
8	Shear strength of soils	9	8
9	Earth pressure theory	9	8
10	Bearing capacity	12	12
	Total	**90**	**80**

Note: Attempt any five questions out of six. All questions have (a) and (b) sub- questions.