Lok Jagruti Kendra University
University with a Difference

Diploma in Civil Engineering

LJ Polytechnic

Course Code:025050303

Soil Engineering

Programme / Branch Name	Diploma in Civil Engineering					
Course Name	Soil Engineering				**Course Code**	025050303
Course Type	HSSC	BSC	ESC	PCC	OEC	PEC

Legends: HSSC: Humanities and Social Sciences Courses BSC: Basic Science Courses
ESC: Engineering Science Courses PCC: Program Core Courses
OEC: Open Elective Courses PEC: Program Elective Courses

1. Teaching and Evaluation Scheme

Teaching Hours / Week				**Evaluation Scheme**			
L	**T**	**P**	**Total Credit**	**CCE**	**SEE (Th)**	**SEE (Pr)**	**TOTAL**
3	0	2	4	50	50	50	150

Legends:
L: Lectures T: Tutorial P: Practical
CCE: Continuous & Comprehensive Evaluation
SEE (Th): Semester End Evaluation (Theory)
SEE (Pr): Semester End Evaluation (Practical)

2. Prerequisites

- ✓ No prerequisites

3. Rationale

Soil Engineering, soil mechanics or geotechnical engineering is one of the youngest disciplines of civil engineering involving the study of soil, its behaviour, and application as an engineering material. The term ‘soil engineering’ is currently used to cover a much wider scope implying that it is a practical science rather than a purely fundamental or mathematical one. The field of soil engineering is very vast. A civil engineer has many diverse and important encounters with soil. Apart from testing and classification of various types of soils to know their physical properties, the knowledge of soil mechanics is particularly helpful in the designs of foundations, rigid and flexible pavements, underground and earth retaining structures, embankments, and earth dams. At the diploma level students areexpected to study these aspects of the soil to develop their understanding to apply their knowledge in the construction industry.

4. Objectives

- ✓ To impart knowledge on the various factors governing the engineering behaviour of soils and the suitability of soils for various soil engineering applications.
- ✓ To evaluate soil characteristics and to identify the behaviour and failure criteria of soils.
- ✓ To evaluate shear strength and compressibility parameters of soils.
- ✓ To understand the concept of soil hydraulics.
- ✓ To understand the field and laboratory tests on various types of soils for the determination of soil properties.

5. Contents

Unit No.	Unit Name	Topics	Learning Outcomes	% Weightage	Hours
1.	**Elementary Properties & Classification of Soil**	1.1.Introduction 1.1.1. Importance of Soil Engineering 1.1.2. Soil and Soil Engineering 1.1.3. History of Development of Soil Mechanics 1.1.4. Field of Soil Mechanics 1.1.5. Soil Structure	• Explain the Soil Formation Cycle and Types of Soil. • Knowledge About Different Types of Soil Structure.	35	16
		1.2. Index Properties &Relationships 1.2.1. Soil as a Three-Phase System 1.2.2. Water Content, Density, Unit Weight, Specific Gravity, Voids Ratio, Porosity, Degree of Saturation, and Density Index 1.2.3. Functional Relationships 1.2.4. Examples	• Explain Phase Diagram of Soil. • DiscussVarious Index Properties of Soil for their Classification and Use. • Describe Interrelationships of Index Properties of Soil.		
		1.3. Classification of Soil 1.3.1. General 1.3.2. Particle Size Classification 1.3.3. Particle Size Distribution 1.3.4. Consistency of Soils 1.3.5. Shrinkage Limit 1.3.6. Laboratory Experiments 1.3.7. Examples	• Discuss Indian Standard Classification System (ISCS). • Explain Particle Size Distribution Curve and Coefficients (CU and CC). • Classify Soil Based on Consistency Limits.		
2.	**Soil Compressibility**	2.1. Introduction-Consolidation 2.2. Terzaghi's Theory of One-Dimensional Consolidation 2.3. Secondary Consolidation 2.4. Introduction-Compaction 2.5. Standard Proctor Test 2.6. Modified Proctor Test 2.7. Field Compaction	• Assumptions on Terzaghi's Theory of One-Dimensional Consolidation. • Explain the Difference Between Compaction and Consolidation. • Determination of OMC and MDD of Soil by Appropriate	15	7

		Methods 2.8. Factors Affecting Compaction 2.9. Effect of Compaction on Soil Properties 2.10. Laboratory Experiments 2.11. Examples	Test. • Explain Field Compaction Methods and Rolling Equipment.		
3.	**Soil Hydraulics**	3.1. Introduction- Permeability and Seepage 3.2. Head, Gradient, and Potential 3.3. Darcy's Law 3.4. Factors Affecting Permeability 3.5. Determination of Coefficient of Permeability 3.6. Seepage Pressure 3.7. Upward Flow: Quick Condition 3.8. Applications of Flow Net 3.9. Laboratory Experiments 3.10. Examples	• Explain the Concept of Permeability of Soil. • Determination of Permeability of Soil. • Explain Quick Sand Condition. • Explain Properties and Applications of Flow Net.	15	6
4.	**Strength & Bearing Capacity of Soil**	4.1. Shear Strength of Soil 4.1.1. Introduction 4.1.2. Theoretical Considerations: Mohr's Stress Circle 4.1.3. Mohr-Coulomb Failure Theory 4.1.4. Measurement of Shear Strength 4.1.5. Direct Shear Test 4.1.6. Examples	• Discuss Terms Related to Shear Strength of Soil. • Explain Types of Soils Based on Total Strength (ϕ-soil, C-soil and C-ϕ soil). • Explain Shear Test Based on Drainage Conditions.	20	9
		4.2. Bearing Capacity of Soil 4.2.1. Definitions 4.2.2. Minimum Depth of Foundation: Rankine's Analysis 4.2.3. Types of Bearing Capacity Failures 4.2.4. Terzaghi's Analysis 4.2.5. Plate Load Test 4.2.6. Examples	• Explain Methods for Improving Bearing Capacity of Soil. • Explain Different Methods for Calculating Bearing Capacity. • Explain Plate Load Test.		

5.	**Site Investigation & Sub-Soil Exploration**	5.1. Introduction 5.2. Site Exploration 5.3. Methods of Site Exploration 5.4. Soil Samples and Samplers 5.5. Disturbed and Undisturbed Sampling 5.6. Penetration and Sounding Tests 5.7. Geophysical Methods	• Explain Purpose and Planning of Sub-soil Exploration. • Discuss Methods of Site Exploration • Explain Types of Soil Samplers.	15	4
				Total Hours	**42**

6. List of Practicals / Exercises

The practicals/exercises have been properly designed and implemented in an attempt to develop different types of skills so that students can acquire the competencies/program outcomes. Following is the list of practicals/exercises.

Sr. No.	Practical / Exercises	Key Competency	Hours
1.	Determination of water content by an oven-drying method.	Laboratory Test For Index Property of Soil.	2
2.	Determination of field density anddry unit weight by the core-cutter method.	In-Situ Laboratory Test for Index Property of Soil.	2
3.	Determination of field density anddry unit weight by sand replacement method.	In-Situ Laboratory Test for Index Property of Soil.	2
4.	Determination of specific gravity of soil by pycnometer.	Laboratory Test for Index Property of Soil.	2
5.	Determination of grain size distribution by sieving.	Laboratory Test for the Grain Size Distribution of Soil.	4
6.	Determination of consistencylimits i.e., liquid limit, plasticlimit, shrinkage limit.	Laboratory Test for ConsistencyTest of Soil.	6
7.	Determination of OMC and MDD by proctor test.	Laboratory Test for Light Compaction of the Soil.	2
8.	Determination of permeability by constant head test.	Laboratory Test for the Coefficient of Permeability of the Soil.	2
9.	Determination of permeability by falling head test.	Laboratory Test for the Coefficient of Permeability of Coarse-Grained Soil.	2
10.	Determination of shear parameters by direct shear test.	Laboratory Test for Shear Parameters of Soil.	2
11.	Determination of ultimate bearing capacity by plate load test.	Field Test for Shallow Foundations.	2
		Total Hours	**28**

7. Suggested Specification Table for Evaluation Scheme

Unit No.	Unit Name	Distribution of Topics According to Bloom's Taxonomy					
		R %	U %	App %	C %	E %	An %
1.	Elementary Properties & Classification of Soil	40	25	5	0	15	15
2.	Soil Compressibility	50	30	10	0	0	10
3.	Soil Hydraulics	10	35	25	0	20	10
4.	Strength & Bearing Capacity of Soil	20	30	15	5	15	15
5.	Site Investigation & Sub-Soil Exploration	30	40	0	0	15	15

Legends: R: Remembering U: Understanding
App: Applying C: Creating
E: Evaluating An: Analyzing

8. Textbooks

1) Soil Mechanics and Foundations by Dr. B. C. Punmia, Ashok Kumar Jain & Arun Kumar Jain, Laxmi Publications (P) Ltd.

9. Reference Books

1) Soil Mechanics and Foundation Engineering by Dr. K. R. Arora, Standard Publishers.
2) Textbook of Soil Mechanics and Foundation Engineering by V. N. S. Murthy, UBS Publisher.
3) Soil Mechanics in Engineering Practice by KerlTerzaghi, Ralph B. Peck & Gholamreza Mesri, A Wiley-Interscience Publication.

10. List of Publications

1) IS:2720Methods of Test for Soils.
2) IS:1498-1970 Classification and Identification of Soils for General Engineering Purpose.
3) IS:1892-1979 Code of Practice for Subsurface Investigation for Foundations.
4) IS:2809-1972 Glossary of terms and Symbols relating to Soil Engineering.
5) IS:6403-1981 Code of Practice for Determination of Bearing Capacity of Shallow Foundations.
6) Soil Mechanics Laboratory Manual by Braja M. Das.

11. Open Sources (Website, Video, Movie)

1) www.nptel.ac.in
2) www.issmge.org
3) www.easyengineering.net