

INSTITUTE	DIPLOMA STUDIES
PROGRAM	DIPLOMA ENGINEERING (CIVIL ENGINEERING)
SEMESTER	4
COURSE TITLE	SOIL MECHANICS
COURSE CODE	09CI3403
COURSE CREDITS	4

Objective:

- 1 To understand the origin, formation, phase relationships, and physical properties of soil used in civil engineering applications.
- 2 To apply BIS test procedures to determine index and field properties of soil.
- 3 To understand and apply the principles of soil classification, compaction, consolidation, permeability, and shear strength.
- 4 To analyze the bearing capacity behavior of soil and factors affecting it in foundation engineering.
- 5 To develop practical knowledge of soil investigation, improvement, and stabilization methods for geotechnical works.

Course Outcomes: After completion of this course, student will be able to:

- 1 Explain soil formation, major soil deposits, soil phase system, and physical properties relevant to civil engineering works.
- 2 Determine water content, specific gravity, density, particle size distribution, and consistency limits of soil using relevant BIS procedures.
- 3 Classify soils and interpret compaction and consolidation characteristics for engineering applications.
- 4 Determine and interpret permeability and shear strength characteristics of soil using laboratory test data and basic soil mechanics principles.
- 5 Assess bearing capacity of soil and select suitable methods of soil stabilization and improvement for field conditions.

Pre-requisite of course: Mechanics of Structure

Teaching and Examination Scheme

Theory Hours	Tutorial Hours	Practical Hours	ESE	IA	CSE	Viva	Term Work
3	0	2	50	30	20	25	25

Contents : Unit	Topics	Contact Hours
1	Introduction and Physical Properties of soil IS definition of soil, Origin of soil, Formation of soil, Major soil deposit in India, Importance of soil in Civil Engineering as construction material, Field application of Soil Mechanics for foundation design, pavement design, design of earth retaining structures, applications in design of earthen dams in Gujarat and India, Soil as Two and Three Phase System., Fundamental definitions of physical properties- Water content, Bulk density, Dry density, Saturated density, Submerged density, Density of solids, Specific gravity, void ratio, porosity, Degree of saturation, Air content, Percentage air voids, Relative density, Relation between: Void ration and porosity, void ratio, specific gravity and degree of saturation., Determination of water content by oven drying method as per BIS., Determination of specific gravity by Pycnometer as per BIS., Determination of bulk unit weight and dry unit weight by Core Cutter method as per BIS.	12
2	Grading and Consistency of soil Particle size distribution, Mechanical sieve analysis as per IS code, Particle size distribution curve, Uniformity coefficient and coefficient of curvature, Well graded and uniformly graded soils, IS classification of soil., Consistency of soil: stages of consistency, Atterberg's limits of consistency (liquid, plastic and shrinkage limits and various indices)., Determination of liquid limit, plastic limit and shrinkage limit as per BIS.	8
3	Compaction & Consolidation Concept of compaction and consolidation, difference between compaction and consolidation., Compaction: Light and Heavy compaction, zero air void line, O.M.C., Standard proctor test, Modified proctor test, Factors affecting compaction, Field methods of compaction – rolling, ramming and vibration and suitability of various compaction equipment.	6
4	Permeability & Shear Strength of soil Concept and definition of permeability, Darcy's law of permeability, coefficient of permeability, Factors affecting permeability, Determination of coefficient of permeability by constant head and falling head permeability test, Types of Filters. Use of Geofabric as Filters., Concept and definition of shear strength of soil, constituents of shear resistance of soil, definition of cohesion, internal friction, angle of shearing resistance., Coulomb's equation and failure envelope, significance of 'C' and 'f' soil, Introduction to determination of shearing strength of soil in laboratory by direct shear test (drained & undrained)	8

Contents : Unit	Topics	Contact Hours
5	Bearing Capacity of Stabilization of soil Concept and definition of bearing capacity, effect of water table on bearing capacity, Factors affecting bearing capacity and methods to improve bearing capacity of soil, Plate load test – procedure, and limitation of test only., Soil stabilization: Scope and purpose., Methods of soil stabilization – Mechanical and Chemical stabilization, Use of Geo-Synthetic as a stabilizing material, California bearing ratio, C.B.R. test, meaning of C.B.R. value.	8
Total Hours		42

Suggested List of Experiments:

Contents : Unit	Topics	Contact Hours
1	Experiment 1 Determine water content of given soil sample by oven drying method as per IS 2720 (Part 2)	2
2	Experiment 2 Determine specific gravity of soil by pycnometer method as per IS 2720 (Part 3)	2
3	Experiment 3 Determine bulk density and dry density of soil in field by core cutter method as per IS 2720 (Part 29)	2
4	Experiment 4 Determine grain size distribution of given soil sample by sieve analysis as per IS 2720 (Part 4)	2
5	Experiment 5 Determine Liquid Limit and Plastic Limit of given soil sample as per IS 2720 (Part 5)	4
6	Experiment 6 Study of Shrinkage Limit of given soil sample as per IS 2720 (Part 6)	2
7	Experiment 7 Determine OMC and MDD by standard proctor test for a given soil sample as per IS 2720 (Part 7)	4
8	Experiment 8 Determine coefficient of permeability by constant head method (OR Falling head method) as per IS 2720 (Part 17)	4
9	Experiment 9 Determine shear parameters of soil by box shear test (OR Vane Shear Test) as per IS 2720 (Part 13)	4
10	Experiment 10 Study of plate load test	2
Total Hours		28

Textbook :

- 1 Soil Mechanics and Foundation Engineering, B. C. Punmia, Standard Book House,, 2021
- 2 Soil Mechanics and Foundation Engineering,, K. R. Arora,, Standard Book House,, 2011

References:

- 1 Soil Mechanics and Foundation Engineering, Soil Mechanics and Foundation Engineering, V. N. S. Murthy,, CBS Publishers & Distributors., 2007
- 2 Soil Mechanics and Foundation Engineering, Soil Mechanics and Foundation Engineering, S. K. Garg, Publishers, Delhi., 2010
- 3 Soil Mechanics and Foundation Engineering,, Soil Mechanics and Foundation Engineering,, P. N. Modi,, Standard Book House,, 2018
- 4 Soil Mechanics Laboratory Manual,, Soil Mechanics Laboratory Manual,, Braja M. Das,, Oxford University Press., 2010

Suggested Theory Distribution:

The suggested theory distribution as per Bloom's taxonomy is as follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember / Knowledge	Understand	Apply	Analyze	Evaluate	Higher order Thinking / Creative
25.00	35.00	40.00	0.00	0.00	0.00

Instructional Method:

- 1 The course delivery method will depend upon students; content requirements and needs. In addition to conventional teaching method by a blackboard, the teacher may also use any tools such as demonstration, Quiz, brainstorming, MOOCs, etc.
- 2 The internal evaluation will be done based on continuous evaluation of students in the laboratory and classroom.
- 3 Practical examination will be conducted at the end of the semester for evaluation of the performance of students in the laboratory.
- 4 Students will use supplementary resources such as videos, e-courses, virtual laboratory.

Supplementary Resources:

- 1 <https://nptel.ac.in/courses/105103097>
- 2 https://www.youtube.com/results?search_query=nctel+soil
- 3 www.vlab.co.in