

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	BTech Civil Engineering
Course Code:	2CL401CC25
Course Title:	Geotechnical Engineering
Course Type:	Core
Year of Introduction:	2025-2026

L	T	Practical Component				C
		LPW	PW	W	S	
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Course Learning Outcomes (CLOs):

At the end of the course, the student will be able to –

1. apply concepts of geology to solve civil engineering problems (BL3)
2. classify soils and derive their physical properties (BL4)
3. evaluate permeability and compaction characteristics of soil (BL5)
4. estimate consolidation characteristics and shear strength of soil. (BL5)

Unit	Contents	Teaching hours (Total 30)
Unit-I	Engineering Geology The earth as a planet, scope of geology; geological studies for engineers; basic terminologies: folds, joints, faults, unconformities, overlap stratification.	04
Unit-II	Fundamentals of Soil Mechanics Formation of soil, soil as three-phase system & related properties, index properties, clay mineralogy, consistency limits, classification of soils; stresses in soil: effective stress principle, quick sand condition, vertical stress distribution & pressure isobars.	10
Unit-III	Permeability and Compaction of Soil Permeability: definition, factors affecting, measurement, soil-water properties, concept of flow net; compaction: definition, standard and modified compaction tests, factors affecting, field compaction method.	06
Unit-IV	Consolidation and Shear Strength of Soil Consolidation: spring mass analogy, one-dimensional theory, test results and interpretation; shear strength: definition, shear strength parameters & theory, different shear tests, test results and interpretation.	10

Self-Study:

The self-study contents will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Suggested Readings/ References: Das B.M. and Shobhan K. *Principles of Geotechnical Engineering*, Cengage Learning India Private Limited.
 Arora, K. R. *Soil Mechanics and Foundation Engineering*, Standard Publication.
 Ranjan, G. & Rao, A.S.R. *Basic and Applied Soil Mechanics*, New Age International Publication.
 Gulhati, S. & Datta, M. *Geotechnical Engineering*, Tata McGraw-Hill.
 Knappett, J. A. & Craig, R. F. *Craig's Soil Mechanics*, CRC Press.
 Singh A., *Modern Geotechnical Engineering*, CBS Publishers.
 Singh, P. *Engineering & General Geology*, S. K. Kataria & Sons.

Laboratory work: Laboratory work will be based on the above syllabus with a minimum of 08 experiments/exercises to be incorporated.

Suggested List of experiments:

Sr. No.	Name of Experiments/Exercises	Hours
1	Demonstration of rocks and point load index test	04
2	Determination of field density and water content	04
3	Grain size analysis: sieve analysis and sedimentation analysis	04
4	Determination of liquid & plastic limit	04
5	Determination of permeability of soil	04
6	Determination of compaction characteristics of soil	02
7	Determination of consolidation characteristics of soil	04
8	Determination of shear strength of soil using direct shear test	04