

NIRMA UNIVERSITY

Institute:	Institute of Technology
Name of Programme:	B Tech Civil Engineering
Course Code:	
Course Title:	Foundation Engineering
Course Type:	Core
Year of Introduction:	2025-2026

L	T	Practical Component				C
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Course Learning Outcomes (CLOs):

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

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| 1. examine the properties of soils using field investigation | (BL5) |
| 2. design shallow foundation | (BL6) |
| 3. analyse deep foundation | (BL4) |
| 4. evaluate stability of retaining structure and slopes | (BL5) |
| 5. select appropriate ground improvement techniques. | (BL3) |

Unit	Contents	Teaching Hours (Total 45)
Unit-I	Soil Investigations Methods, stages, planning, sampling, field tests, modern field-testing methods, report.	06
Unit-II	Earth Pressures and Retaining Wall Introduction, earth pressure analysis: submerged soil, levelled and inclined backfill, stability analysis for retaining walls, cuts and excavation.	06
Unit-III	Shallow Foundations Bearing capacity analysis: analytical methods, using penetration tests, factors affecting; Settlement: causes, analysis, factors affecting, control measures; Design of Foundation: selection, propositioning, base pressure.	12
Unit-IV	Deep Foundation Introduction to deep foundations; Pile foundation: classification, load carrying capacity, negative skin friction; Pile groups: efficiency and settlement, Pile load test.	08
Unit-V	Stability of Slope Slope stability analysis: infinite and finite slopes, factors affecting stability and remedial measures.	05
Unit-VI	Ground Improvement Techniques Introduction, need, chemical and mechanical stabilization, soil reinforcement.	04
Unit-VII	Advances in Geotechnical Engineering Introduction to earthquake geotechnical engineering, geo-environmental engineering, transportation geotechnics, Instrumentation and monitoring.	04

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:

- Gulhati, S., & Datta, M. *Geotechnical Engineering*, Tata McGraw-Hill.
- Das, B. M. *Principles of Foundation Engineering*, C.B.S Publishers
- 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.
- Saran, S., *Analysis and design of Substructure*, Oxford IBH Publishing Co.
- Som, N., *Theory and Practice of Foundation Design*, Prentice Hall.
- Bowles, J.E. *Foundation Analysis and Design*, McGraw Hill.

Suggested List of experiments

Laboratory work will be based on the above syllabus with a minimum 09 experiments/exercises to be incorporated. The students in a suitable group size will design and perform one experiment as a part of laboratory work.

Sr. No.	Name of Experiments/Exercises	Hours
1.	Collection of Undisturbed and Disturbed Sample	02
2.	Standard Penetration Test	02
3.	Plate Load Test	02
4.	Block Vibration Test	02
5.	Determination of Shear Strength of Soil: Unconfined compressive strength test, Vane shear test, Triaxial compression test	06
6.	California Bearing Ratio Test	02
7.	Free Swell Index and Swelling Pressure Test	02
8.	Design of Foundations	06
9.	Computer Applications in Foundation Engineering	04

