

25HCET402	GEOTECHNICAL INVESTIGATION	Category	L	T	P	R	Credit	Year of Introduction
		Honours	4	0	0	0	4	2025

Preamble: This course exposes the students to various methods of soil exploration, to recognize weak soils based on the soil investigation reports and to analyze suitable remedial measures to improve the properties of weak soils. After this course, students will be able to recognize practical problems in real-world situations and respond accordingly.

Prerequisite: Nil

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

CO	Course Outcomes	Knowledge Level
CO1	Explain objectives and planning of site investigation and choose suitable subsurface exploration methods as per IS guidelines.	K2 Understand
CO2	Describe soil sampling methods, sampler parameters, and procedures for proper collection, handling, and extrusion of samples.	K2 Understand
CO3	Apply penetration test procedures and corrections, execute N-values, and develop boring logs with soil profile and groundwater table.	K3 Apply
CO4	Explain geophysical methods and their applications in groundwater estimation and borehole stabilization.	K2 Understand

Mapping of course outcomes with program outcomes and program specific outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	-	-	-	-	-	2	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	2	1	-
CO3	2	3	-	-	-	-	-	-	-	-	-	2	2	1
CO4	1	1	-	-	-	1	-	-	-	-	1	1	1	2
Avg	2	1.75	-	-	-	1	-	-	-	-	1	1.75	1.5	1.5

Mapping of course outcomes with Knowledge and Attitude Profile (WK)

	WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
CO1	*	*	*	*	*		*		
CO2	*	*	*	*					
CO3	*	*	*	*					
CO4	*	*	*	*	*		*	*	

Wks Mapped with the course

WK1	WK2	WK3	WK4	WK5	WK6	WK7	WK8	WK9
*	*	*	*	*		*	*	

Mark Distribution:

Total Marks	CIE Marks	ESE Marks	ESE Duration
100	40	60	2.5 hrs

Continuous Internal Evaluation Pattern:

Attendance	: 5 marks
Continuous Assessment Test	: 20 marks
Continuous Assessment Assignment/field visit	: 15 marks

SYLLABUS

Module 1 (12 hrs)

Site investigation and soil exploration - Introduction and practical importance – objectives - Planning of a sub-surface exploration program – Reconnaissance – Preliminary investigation. Subsurface exploration – direct methods – Open pits and trenches - Semi direct methods – Borings - Auger boring – Shell and Auger Boring – Wash boring, percussion drilling and rotary drilling – advantages and disadvantages - Guidelines for choosing spacing and depth of borings [I.S. guidelines only]

Module 2 (14 hrs)

Soil sampling – Undisturbed, disturbed, and representative samples –Chunk and tube samples – Factors affecting sample disturbance and methods to minimize them –Area ratio - Inside clearance – Outside clearance - Recovery ratio –Ball check valve – Numerical Problems -Handling and transportation of samples – Extrusion of samples. Types of samplers – Thin-walled sampler – Piston sampler – Split spoon sampler – Methods for collection of sand samples from beneath the water table - Core retainers.

Module 3 (15 hrs)

Sounding and Penetration Tests - Standard Penetration Test – Procedure - Corrections to be applied to observed N values – Numerical examples - Factors influencing the SPT results and precautions to obtain reliable results – Merits and drawbacks - Correlations of N value with various engineering and index properties of soils - Static Cone Penetration Test and Dynamic Cone Penetration Test - Merits and drawbacks - Boring log - soil profile - Location of Water table.

Module 4 (15 hrs)

Geophysical methods – Seismic refraction method – Procedure, uses, limitations –Solution of numerical problems to estimate the velocity of seismic waves and the thickness of the upper layer of a two-layered soil system - Electrical resistivity method – Electrical profiling and electrical sounding – Procedure, uses, limitations Stabilization of boreholes, Groundwater level estimation.

Field study/Industrial Visit

Students shall visit a construction site to observe and document bore logs and soil profile. A detailed technical report is mandatory for internal assessment.

Text Books:

1. Gopal Ranjan and Rao A.S.R.(2002). “Basic and Applied Soil Mechanics”. New Age International (P) Limited. New Delhi.
2. Venkata Ramaiah(2000), “Geotechnical Engineering”, Universities Press (India) Limited, Hyderabad.

Reference Books:

1. Arora K.R(2006). “Geotechnical Engineering”. Standard Publishers Distributors.New Delhi, 2006.
2. Joseph E. Bowles(1988).Foundation Analysis and Design”. Mc. Graw Hill Inc. New York.
3. Purushothamaraj P.(2013), Soil Mechanics and Foundation Engineering. Dorling Kindersley (India) Pvt. Ltd.
4. Terzaghi, K., Peck, R. B., & Mesri, G. (1996). Soil Mechanics in Engineering Practice (3rd ed.). John Wiley & Sons.

END SEMESTER EXAMINATION – MODEL QUESTION PAPER

Course Code	25HCET402
Course Name	GEOTECHNICAL INVESTIGATION
Max. Marks: 60	Duration: 2.5 Hours

Part A				
<i>(Answer all questions. Each question carries 3 marks)</i>				
Qn No.	Question	Marks	CO	BL
1	Outline the objectives of site investigation in geotechnical engineering.	3	1	L2
2	Differentiate between preliminary investigation and detailed investigation.	3	1	L2
3	Explain chunk sampling and tube sampling	3	2	L2
4	Explain the function of a ball check valve in soil samplers.	3	2	L2
5	Differentiate between Static and Dynamic Cone Penetration Tests.	3	3	L2
6	Summarize the uses of SPT.	3	3	L2
7	Differentiate between electrical profiling and electrical sounding.	3	4	L2
8	Describe the principle of the seismic refraction method.	3	4	L2
Part B				
<i>(Answer any one full question from each Module. Each carry 9 marks)</i>				
Module I				
Qn No.	Question	Marks	CO	BL
9.a	Explain the stages involved in planning a subsurface exploration program.	3	1	L2
9.b	Summarize the IS guidelines for determining the spacing and depth of borings.	6	1	L2
OR				
10.a	Describe the direct methods of subsurface exploration with suitable applications.	3	1	L2
10.b	Explain the importance of reconnaissance in site exploration.	6	1	L2
Module II				
Qn No.	Question	Marks	CO	BL
11.a	Distinguish thin-walled, piston, and split-spoon samplers.	3	2	L2
11.b	Describe the different types of soil samples and their engineering applications.	6	2	L2
OR				

12.a	Explain the procedure for handling, transportation, and extrusion of soil samples.	3	2	L2
12.b	Describe area ratio, inside clearance, outside clearance, and recovery ratio	6	2	L2
Module III				
Qn No.	Question	Marks	CO	BL
13	An SPT conducted below the groundwater table yielded an observed N-value of 24 in fine sand. If the overburden correction factor is 1.2, calculate the corrected N-value.	9	3	L3
OR				
14	During an SPT conducted at a depth of 6 m, the number of blows recorded for three successive 150 mm penetrations were 8, 12, and 15. Determine the Standard Penetration Number (N-value).	9	3	L3
Module IV				
Qn No.	Question	Marks	CO	BL
15	Explain the principle and procedure of the seismic refraction method.	9	4	L2
OR				
16	Describe the techniques used for groundwater level estimation and their importance.	9	4	L2