

GANPAT UNIVERSITY					
FACULTY OF DIPLOMA ENGINEERING					
Programme	Diploma in Civil Engineering				
Semester	IV		Version	1.0.0.0	
Effective from Academic Year		2026-27	Effective for the batch Admitted in		JULY 2025
Course code	1CI4104	Course Name	Geotech Engineering		

I. TEACHING-LEARNING AND ASSESSMENT SCHEME																			
Course Type	Course code	Course Title	Teaching & Learning Scheme									Examination Scheme							
			Credit				Actual Contact Hrs/week			SLH	Total Learning Hrs/Week	TH			PR			SLA	Total
			CL	TL	LL	Total	CL	TL	LL			CE	SEE	Total	CE	SEE	Total		
DSC	1CI4104	Geotech Engineering	3	0	1	4	3	0	2	3	8	40	60	100	30	20	50	20	170

Abbreviation:	CL- Classroom Learning	TL - Tutorial Learning	LL - Laboratory Learning
	SLH - Self Learning Hours	NLH - Notional Learning Hours	SLA - Self Learning Assessment
	FA - Formative Assessment (Term work +Mid Sem Exam +Attendance)		SA - Summative Assessment

II. PRE-REQUISITES				
Basic knowledge of Geology and properties of fluids.				
III. INDUSTRY / EMPLOYER EXPECTED OUTCOMES				
Evaluate various soil properties required for design of foundation.				
IV. COURSE LEARNING OUTCOMES				
The course content should be taught and implemented with an aim to develop different skills leading to the achievement of the following competencies and course learning outcomes: CO1. Understand the fundamentals of Geology and acquire basic knowledge of soil formation and Geological characteristics of different types in given situation. CO2. Measure the physical, Index properties and its interrelationship of given soil sample and classify Soil based on various methods of classification. CO3. Comprehend the Principal and methods of compaction of soil to determine parameters of a given Soil sample. CO4. Evaluate the permeability, seepage and the shear strength parameters of a given soil sample. CO5. Undertake the objectives of investigation and exploration of soil techniques and to determine the Bearing capacity of a given soil strata. The practical should be carried out in such a manner that students are able to acquire different learning out comes from covered course.				
V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT:				
Name of Unit	Theory Learning outcomes (TLO's) aligned to CO's	Learning Content mapped with Theory Learning outcomes (TLO's) & CO's	Marks	Hours
Unit-1 Introduction	TLO 1. Discuss soil formation cycle & general characteristics of soil. TLO 2. List structures where soil is use dam Construction material. TLO 3. Describe soil-formation in Geological cycle. TLO 4. State the types of failures due to soil in	1.1 History 1.2 List structures where soil is used as construction material. 1.3 Soil-formation in Geological cycle. 1.4 Name the types of failure due to soil in civil engineering structure. 1.5 Foundation as branch of civil engineering. 1.6 Selection of foundations and its failures.	02	02

	Civil Engineering structure.			
Unit-2 Index Properties and Relations	TLO 2.1 Explain phase diagram of Soil. TLO 2.2 Discuss various index properties of soil for the purpose of their classification & Uses. TLO 2.3 Describe interrelationship between different index properties.	2.1 Constituents of Soils, Phase Diagram. 2.2 Definitions' of void ratio, porosity, degree of saturation, moisture content, specific gravity, unit weight, density index, air content. 2.3 Derivations of Functional relationships 2.4 Numerical	12	08
Unit3 Classification of Soil and Identification	TLO 3.1 Discuss methods of Classification. TLO 3.2 Describe method of I.S. Classification of Soil. TLO 3.3 Classify Soil based on Consistency Limits	3.1 Classification of soil (Grain size) as per Indian Standard. 3.2 Mechanical Analysis of soils. 3.3 Grading Curves and different coefficients i.e. CU and CC. 3.4 Difference between clay, silt, sand and gravel. 3.5 Define the Atterberg's Limits like Liquid, Plastic and Shrinkage Limits. 3.6 Field identification test for coarse grained and fine grained soils.	10	08
Unit-4 Permeability	TLO 4.1 Explain the concept of permeability & its implications with respect to use of soil. TLO 4.2 Determine 'permeability' of given soil. TLO 4.3 Comprehend the concept of Seepage Analysis in relation to 'quicksand condition' with examples.	4.1 Permeable and Impermeable soils 4.2 Darcy's Law. 4.3 Factors affecting permeability. 4.4 Coefficient of permeability. 4.5 Laboratory determination of Permeability of Soil & Relative 4.6 Numerical.	08	05
Unit-5 Compaction	TLO 5.1 Comprehend the principle and methods of compaction of soil. TLO 5.2 Differentiate between compaction and consolidation with examples. TLO 5.3 Determine MDD & OMC of soil by conducting appropriate test.	5.1 Definition and scope 5.2 Maximum dry density and O.M.C 5.3 Proctor test (a) Light compaction (b) Heavy compaction test 5.4 Factors affecting compaction 5.5 Difference between compaction and consolidation 5.6 Role of O.M.C in the field 5.7 Methods of compaction 5.8 List the Equipment for compaction. 5.9 Relative Numerical.	10	06

UNIT – 6 Shear Strength	TLO 6.1 Explain different terms used in the context of ‘shear strength’ of soil. TLO 6.2 Evaluate shear parameters of various types of soil, with their practical significance.	6.1 Importance of determination of shear Strength. 6.2 Definition of Cohesion, Angle of Internal Friction, Angle of Repose. 6.3 Types of soil C-soil, ϕ -soil, C- ϕ soil. 6.4 Coulomb’s Equation. 6.5 Shear stress of soil & Relative Numerical.	05	05
UNIT – 7 Bearing Capacity	TLO 7.1 Explain concept of bearing capacity of soil. TLO 7.2 Describe various methods to determine bearing capacity of soil. TLO 7.3 Explain the concept & occurrence mechanism & effect of ‘Liquefaction’ of soil.	7.1 Concept of Ultimate Bearing Capacity, Safe Bearing Capacity, Allowable Bearing Capacity, Factors affecting Bearing Capacity. 7.2 Bearing capacity of various soils. 7.3 Methods of improving bearing capacity of soils. 7.4 Methods for determining bearing capacity of soils. 7.5 Foundation on soils of various bearing capacity. 7.6 Liquefaction 7.7 Earth Pressure: Active and passive earth pressure & Relative Numerical.	08	07
UNIT – 8 Soil Investigation and Exploration	TLO 8.1 Purposes of exploration of soil. TLO 8.2 Planning of exploration program, Soil samples and collection. TLO 8.3 Field penetration Test: SPT. TLO 8.4 Explain various geophysical investigation methods.	8.1 Discuss various methods & appropriate use for investigation & exploration of soil.	05	04

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL

Sr. No.	Practical/Laboratory Learning Outcome (LLO)	Practical Titles	Relevant COs
1	LLO 1.1 Use oven drying method to determine the percentage of moisture content in given soil specimen.	Determine field moisture content of soil	CO2
2	LLO 1.2 Undertake the core cutter method to find bulk and dry unit weight of given soil sample in field.	Determine bulk density and dry density of soil by core cutter method	CO2
3	LLO 1.3 Use a pycnometer method for determining specific gravity of a given soil sample to classify its type.	Determine specific gravity of sand by pycnometer.	CO2
4	LLO 1.4 Undertake the sand replacement method to find bulk and dry unit weight of coarse-grained soils.	Determine bulk density and dry density of soil by sand replacement method.	CO2

5	LLO 1.5 Classify type of soil based on grain size distribution.	Conduct Sieve analysis of given soil for its classification.	CO2
6	LLO 1.6 Identify given soil based on plasticity chart.	Determine consistency Limits i.e. Liquid limit, Plastic limit, Shrinkage limit.	CO2
7	LLO 1.7 Find coefficient of permeability of soil through coarse grained soil.	Determine permeability of soil by constant head method	CO4
8	LLO 1.8 Find coefficient of permeability of soil through fine grained soil.	Determine permeability of soil by falling head method	CO4
9	LLO 1.9 Perform standard proctor test to determine parameters such as OMC, MDD and amount of compaction.	Determine OMC and MDD by Proctor Test	CO3
10	LLO 1.10 Perform shear box test.	Determine shear parameters of soil by box shear test	CO3

VII. SUGGESTED MICRO PROJECT / ASSIGNMENTS / ACTIVITIES FOR SELF LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

- Collect the data of various rock specimen such as igneous, sedimentary, metamorphic and compare their properties with respect to geotechnical Engineering.
- Observe open source videos for determination of Shrinkage limit of soil sample as per I.S. 2720 (Part- V) and write a procedure.
- Determine bearing capacity of soil using assumed value of liquid limit and plastic limit and show calculations (Workout bearing capacity of soil using established co relation.)
- Enlist minimum five compaction equipments along with their description.
- Enlist various soil stabilization techniques and write information of any three (including sketches).
- Summarize in the form report on the importance of piles including sketches and case studies.
- Write a report on role of Geophysical Exploration in civil Engineering.

Micro project

- Collect minimum five types of rock specimen in your area and compare their properties with respect to geotechnical Engineering aspect
- Visit nearby site having excavation pits and write short note about it strata by visual inspection.
- Collect minimum three samples of soil in your area and compare them for any three properties of Soil.
- Visit nearby reclamation land and study the stabilization method.
- Identity two different locations and suggest the appropriate stabilization methods (soil-cement, soil-lime, soil-flyash etc.) to improve its engineering properties.
- Study different free open sources software available for Geotechnical Engineering.

Mini projects

- Collect the photograph and information of anchors (stabilization of slopes) used to avoid over turning of structure.
- Collect the photographs and information on Causes, Effects and Types of Landslides.

- Visit nearby two sites to classify soil based on field tests.

VIII. LIST OF INSTRUMENTS / EQUIPMENT / TRAINER BOARD

1	Core Cutter
2	Hot Air Oven
3	Sand Pouring Cylinder
4	Pyconometer Bottle
5	Permeability Apparatus
6	Set of IS Sieves
7	Casagrande Apparatus.
8	Electronic Weighing Balance
9	Heavy & Light Proctor Test Apparatus

IX. LIST OF REFERENCE BOOKS

Sr.No.	Title	Author	Publication
1	Soil Mechanics & Foundation	Dr. B C Punamia	Laxmi Publication
2	Soil Mechanics & Foundation	Dr. K.R.Arora	Standard Book House
3	Geotechnical Engineering	Ramamurthy, T.N. & Sitharam, T.G.	S Chand

X. LINK OF LEARNING WEB RESOURCE

1	www.issnge.org
2	www.springer.com
3	www.britannica.com
4	www.trb.org
5	https://youtu.be/N2J-tvEeI4c?si=SgQPoICSbFAuOVLd
6	https://youtu.be/l6vk0EM4yPg?si=-M6WwrpxOlZYHy94

XI. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE

Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	Introduction	CO1	2	1	1	0	2
2	Index Properties and Relations	CO2	8	2	5	5	12
3	Classification of Soil and Identification	CO2	8	4	4	2	10
4	Permeability	CO4	5	2	4	2	8

