

Branch Name:	CIVIL ENGINEERING
Program Code:	ET106
Course Title:	Soil Mechanics
Course Code:	2ET1060401T
Pre-requisite Course:	Basic knowledge of civil engineering.

Course Objectives:

- To study about physical and chemical properties of soil.
- To study about compaction and consolidation of soil.
- To understand the shear strength of soil.
- To study about failure of slope and stability of slope.
- To analyze the stress distribution and earth pressure theoretically and graphically.

Teaching and Examination Scheme:

Credit	Teaching Scheme Hours per week				Evaluation Scheme (Marks)								Total (Marks)
					Theory (Marks)				Practical (Marks)				
	L	T	P	Total	SEE		CCA		SEE		CCA		
					Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	
3	3	-	-	3	24	60	16	40	-	-	-	-	100

Course Contents:

Unit No	Topic	Total Hours	Weight age (%)
01	Overview of Geology and Geotechnical Engineering Geology: Branches of Geology, Importance of geology in civil engineering, Fault & Fold Rocks: Igneous rock, Sedimentary rocks & Metamorphic rocks Soil: Field applications	4	10
02	Properties of Soil Soil as a three-phase system: Three phase diagrams, Water content, Unit weight of soil, Specific gravity, Inter relationships Particle size distribution: Laboratory analysis, Particle size distribution curve, Relative density Consistency of soil: Atterberg limits Classification of soils: IS classification system & Textural classification	4	10
03	Permeability and Seepage Permeability of soil: Darcy's law of permeability, Constant & Falling head Coefficient of permeability, Permeability of stratified deposits Seepage analysis: Seepage pressure, Concept of effective stress, Seepage velocity, Seepage through earthen structures	6	15
04	Shear Strength of Soil Shear strength of soil: Components of shearing resistance, Classification of soils Mohr-Coulomb failure theory Modified Mohr-Coulomb failure theory Determination of shear strength	6	15

05	Compaction and Consolidation Compaction: Introduction, Types of compaction, Plotting compaction curve, OMC & MDD, Factors affecting compaction, Suitability of various compaction equipment Consolidation: Definitions and mechanism of consolidation, Spring analogy, Void ratio and effective stress relation, Related indices, Assumptions of Terzaghi's one dimensional consolidation theory, Time factor, One dimensional consolidation tests, Laboratory and theoretical time curves, Determination of pre-consolidation pressure, Estimation of consolidation settlement and rate of settlement for uniform pressure increment in a clay layer. Difference between compaction and consolidation	5	10
06	Stability of Slopes: Introduction: Infinite and finite slopes, factor of safety & type of slope failure Stability of infinite slopes Stability of finite slopes: forms of slip surfaces, limit equilibrium method, critical stage instability analysis, effects of tension crack and submergence	5	10
07	Earth Pressure Lateral earth pressure: Types of lateral earth pressure, Difference between Active and Passive earth pressure Rankine's and Coulomb's earth pressure Rebhann's and Culmann's Graphical methods: Determination of lateral earth pressures under different conditions.	6	15
08	Stress Distribution of Soils Causes of stress in soil, geostatic stress, Boussinesque's equation, Stress distribution diagrams, New-mark's influence chart, Westergard's equation, Stresses due to triangular and other loadings, Mohr Column Theory and Laboratory Tests i.e. Direct Shear Test	6	15

Reference Books:

1. Arora, K.R., "Soil Mechanics and Foundation Engineering," Standard Publishers Distributors, Delhi, 2008.
2. Gulhati, S. K.; Datta, M." Geotechnical engineering, Tata McGraw-Hill, New Delhi, 2005.
3. Sowers G.B. and Sowers G.F."Soil Mechanics and Foundations", Collier Macmillan Company, Toronto, Canada, 1970
4. IS 1892-1979 (Reaffirmed 2002): Code of practice for subsurface investigations for foundation
5. IS 2720 (Part VII) – 1980 (Reaffirmed 2011): Methods of test for soils, Part VII Determination of water content-dry density relation using light compaction
6. IS 2720 (Part VIII) – 1983 (Reaffirmed 2006): Methods of test for soils, Part VIII Determination of water content-dry density relation using heavy compaction
7. IS 2720 (Part XVI) – 1987 (Reaffirmed 2016): Methods of test for soils, Part XVI Laboratory determination of CBR
8. Craig, R.F., "Soil Mechanics", Van Nostrand Reinhold Co. Ltd., London, 1978.
9. Das, B.M., "Principles of Geotechnical Engineering", PWS-KENT Publishing Co., Boston, 1985.
10. Das, B.M., 'Advanced Soil Mechanics', Mc Graw-Hill Book Co., New York, 1985.
11. Das, B.M., "Introduction to Soil Mechanics", Galgotia Publication, New Delhi, 1983.
12. Deere, D.U., "Geological consideration", Chapter in Rock mechanics in Engineering Practice, edited by Stagg, M.G. and Zienkiewics, O.C., Wiley, 1968.
13. Deere, D.U., and R.P. Miller, "Engineering Classification and Index Properties for Intact Rock",
14. Tech. Rep. No. AFWL-TR 65-116, Air Force Weapons Lab., Kirtland Air Base, New Mexico, 1966.
15. Hough, B.K., "Basic Soils Engineering", Ronald Press Co., New York, 1969.
16. Housel, W.S., "A Practical method for the Selection of Foundation Based on Fundamental Research in Soil Mechanics", Research Bulletin, No. 13, University of Michigan, Ann Arbor, 1929.
17. Huntigton, W.C., "Earth Pressure and Retaining Walls", John Wiley & Sons, New York, 1957.
18. Hvorslev, M.J., "Subsurface Exploration and Sampling of Soils for Civil Engineering Purposes". US. Waterways Experiment Station, Vicksburg, Miss, 1949.
19. Jumikis, A.R. "Soil Mechanics", D. Van Nostrand Co., Princeton, NJ, USA, 1962.
20. Lambe, T.W. and Whitman, R.V. "Soil Mechanics", John Wiley & Sons, Inc., NY, 1969.

21. McCarthy. D.F. “Essentials of Soil Mechanics and Foundations”, Reston Publishing Company, Reston, Va, USA, 1977.
22. Murthy, V.N.S. Soil Mechanics and Foundation Engineering, Dhanpat Rai and Sons, Delhi-6, 2nd ed., 1977
23. Singh A. & Punmia, B.C. “Soil Mechanics and Foundations”, Standard Book House, Delhi-6, 1970.

Course Learning Outcomes (CLO):

1. Identify types of rocks and sub soil strata of earth.
2. Interpret the physical properties of soil related to given construction activities.
3. Use the results of permeability and shear strength test for foundation analysis.
4. Interpret the soil bearing capacity results.
5. Compute optimum moisture content values for maximum dry density of soil through various tests.

Course Learning Outcomes (CLO): On completion of this course, the students will be able to:

CLO	Description	Bloom's Taxonomy Level
CLO1	Identify types of rocks and sub soil strata of earth.	L-1
CLO2	Interpret the physical properties of soil related to given construction activities.	L-2
CLO3	Use the results of permeability and shear strength test for foundation analysis.	L-3
CLO4	Interpret the soil tests and results.	L-5
CLO5	Compute optimum moisture content values for maximum dry density of soil through various tests.	L-4

L1- Remember, **L2-** Understand, **L3-** Apply, **L4-** Analyze, **L5-** Evaluate, **L6-** Create

Mapping of CLOs with POs & PSOs

	Program Outcomes (POs)												Program Specific Outcomes (PSOs)		
Course Learning Outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CLO1	H	M	L	L	L	L	H							M	
CLO2	H	H	M	H	L	L	H							M	
CLO3	H	H	M	H	L	L	H							M	
CLO4	H	H	M	H	L	L	H							M	
CLO5	H	H	M	H	L	L	H							M	

H: High, **M:** Medium, **L:** Low