



GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Geotechnical Engineering

Course / Subject Code: ME01076011

Course / Subject Name : Advanced Soil Mechanics

w.e.f. Academic Year:	2024-25
Semester:	1 st Semester
Category of the Course:	PCC

Prerequisite:	Knowledge of Geotechnical Engineering
Rationale:	This subject is introduced in the first semester as a core subject with a view that student can develop understanding on soil behavior, various developments and calculations of stresses and strain through experimental techniques and mathematical models, shear resistance of soil and related theories, pore pressure calculations and its interpretation, computations of stress paths, consolidation settlements, earth pressure computations and its applications. The above knowledge will be very useful to recognize various soil mechanics problems in field and getting continuous enhancement on futuristic soil-based studies.

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes
01	To understand the identification and classification of soil deposits and to comprehend the principle of the physio-chemical behaviour of soil.
02	To estimate stresses caused due to foundation load of any shape and embankments and settlements and understand the importance of stress path and its applications.
03	To calculate co-efficient of permeability both lab and field in horizontal, vertical and radial flow in isotropic and anisotropic soil and interpret the given flow net.
04	To estimate earth pressure in active and passive condition for any given case analytically and graphically. Analyze retaining walls and diaphragm walls, anchors and soil nailing.

Teaching and Examination Scheme:

Teaching Scheme (in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/ Practical		
				ESE (E)	PA/ CA (M)	PA/CA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150



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Course Content:

Unit No.	Content	No.of Hours	%of Weightage
1.	Stresses and Displacements in Soil: Soil as elastic body – Concept of effective stress – Equations of Equilibrium in soil mass – Principal stresses and strains – Problems of plane stresses and strains – Stresses distributions by Boussinesq’s and Westergaard’s theory – Newmark’s influence chart – Influence of anisotropy on stress distribution – Application	8	17
2.	Shear Resistance of soil: Stress-Strain relationship in soil – Failure criteria – Mohr - Coulomb’s failure theory – Shear parameters under different drainage conditions – Pore pressure in saturated and unsaturated conditions – Analytical predictions of pore water pressure – stress dilatancy theory – results of plain strain shear tests – Forces on shear parameters – Stress path; Drained and undrained stress path; Stress path with respect to different initial state of the soil; Stress path and its applications – Rheological models.	13	31
3.	Mechanics of Consolidation: Phenomenon of consolidation – Terzaghi’s theory of one dimensional consolidation with mathematical solution – Method to determine pre compression history – Applications to estimate consolidation settlements – Introduction to creep and stress relaxation by rheological models.	10	23
4.	Flow through soils: Basics of flow through soils – one dimensional, radial and spherical flow cases – Seepage forces – Quick Sand and Piping – Flow nets of confined and unconfined flow by relaxation techniques – Phreatic surface by conformal mapping – Flow nets for anisotropic non homogenous soils.	7	15
5.	Earth Pressures: Theories of earth pressure and retaining walls – Application of earth pressure theories – Soil Nailing and Anchors – excavations, bracing, Diaphragm walls.	7	14
Total		45	100

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom’s Taxonomy)



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References/Suggested Learning Resources:

(a) Books:

1. Scott R F, "Principles of Soil Mechanics", Addition Wesley Publishing Co. Inc
2. Harr M E, "Foundation of Theoretical Soil Mechanics", McGraw Hill Book Co., New York
3. Kaniraj S R, "Design Aids in Soil Mechanics & Foundation Engineering", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1988
4. Terzaghi, Peck and Mesri "Soil Mechanics in Engineering Practice" 1996
5. Bowles J E "Foundation Analysis & Design" McGraw Hill Inc. New York, 1988
6. Atkinson J.H, Bdransby P.L "Mechanics of soils "
7. Capper P., Leonard, Cassie W Fisher," Mechanics of Engg Soils
8. Jumikies Alfred R,"Mechanics of soil fundamentals for advanced study
9. Lambe William T, Whitman Robert V,"Soil Mechanics
10. Yong Raymond N, Warkentin Beeno P,"Introduction to soil behaviour

(b) Open source software and website:

1. NPTEL lecture series
2. MIT open source material

Suggested Course Practical List:

List of Experiments:

1. Co-efficient of permeability for layered soil
2. Box shear test
3. Triaxial test
4. Unconfined compression test
5. Consolidation test
6. Critical Voids ratio test

List of Laboratory/Learning Resources Required:

Major Equipment:

1. Dynamic triaxial testing machine
2. Box shear testing machine
3. Unconfined compression testing machine
4. Permeability test apparatus
5. Critical voids ratio test apparatus



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Suggested Project List:

- 1) Visit of NABL accredited soil/rock testing laboratory/research station
- 2) Collection of soil samples up to 10m depth, determination of various index and engineering soil properties and preparation of soil testing report using software
