GUJARAT TECHNOLOGICAL UNIVERSITY

BRANCH NAME: GEOTECHNICAL ENGINEERING
SUBJECT NAME: ADVANCED SOIL MECHANICS
SUBJECT CODE:3714307
M.E. Semester-I

Type of course: Core I

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.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	% 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 – Applications.	07	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 and its applications – Rheological models.	09	22
3	**Stress path;** Drained and undrained stress path; Stress path with respect to different initial state of the soil; Stress path for different practical situations	04	09

4	**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.	09	22
5	**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.	06	14
6	**Earth Pressures:** Theories of earth pressure and retaining walls - Application of earth pressure theories – Soil Nailing and Anchors - excavations, bracing, Diaphragm walls	07	16

Reference 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

Course Outcome:

After learning the course the students should be able to:

1. Calculate stresses caused due to foundation load of any shape and embankments and settlements.
2. Understand the behavior of soil under shear; calculate shear resistance from laboratory test results.
3. Know importance of stress path and its applications.
4. Calculate co-efficient of permeability in horizontal, vertical and radial flow in isotropic and anisotropic soil.
5. Interpret the given flow net.
6. Calculate earth pressure in active and passive condition for any given case analytically and graphically.
7. Understand the concept of strutted excavations, applications of soil nailing and anchors.
8. Analyze retaining walls and diaphragm walls

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

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

List of Open Source Software/learning website:

- NPTEL lecture series
- MIT open source material