

GUJARAT TECHNOLOGICAL UNIVERSITY

BE (CIVIL & INFRASTRUCTURE ENGINEERING)

GEOTECHNICAL ENGINEERING-I

SUBJECT CODE: 2154003

B.E. 5th Semester

Type of course: Core Subject in BE (Civil and Infrastructure Engineering)

Prerequisite: NIL

Rationale:

Geotechnical Engineering - I is conceptual applications of soil mechanics. With the help of this knowledge students may be able:

1. To understand various soil types and their index properties
2. To understand physical and mechanical properties of soil
3. To identify factors controlling soil behavior and methods to determine soil properties
4. To understand the behavior of soil under compaction, consolidation, seepage and shear

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P		Theory Marks			Practical Marks			
			ESE (E)	PA (M)		ESE (V)		PA (I)		
				PA	ALA	ESE	OEP			
3	0	2	5	70	20	10	20	10	20	150

Contents:

Sr. No	Topics	Hrs.	% Weightage
1	Introduction: Need for soil engineering studies, Scope and limitation of geo-technical engineering in civil engineering, Geological cycle and soil formation, General characteristics of different types of soils, Overview of different types of soils in Gujarat / India	3	6
2	Index Properties & Plasticity Characteristics: Constituent of soil, phase diagram, Properties and interrelationship between: water density and unit weight, Specific gravity, void ratio, porosity, degree of saturation, air voids, air content, zero air void curve, specific surface, Plasticity characteristics: Liquid limit, Plastic limit, shrinkage limit and its determination, Different indices, field moisture equivalent	6	13
3	Particle Size Analysis: Size and nomenclature of soil particles, sieve analysis, sedimentation analysis, Particle size distribution curve and it's uses	5	10

4	Soil Structure & Classification: Soil Structure properties, conditions for the formation of different structures, particle shape & texture, Soil classification based on constituents and structure, field classification and related practice, grain size distribution and consistency limit, measurements of grain size distribution and consistency limit, Free water and held water, structural water and absorbed water, capillary water, total stress, neutral stress and effective stress	5	10
5	Permeability & Seepage: Darcy's law & its validity, co-efficiency of permeability, determination of coefficient of permeability in field and laboratory, seepage velocity, effective stress, quick sand phenomenon, seepage pressure and piping, flow net,	5	10
6	Compaction: Theory of compaction, factors influencing Compaction, Field compaction, control of compaction in embankment, effect of compaction in engineering properties, quality control tests:Core Cutter and sand replacement, nuclear and proctor penetrometer, determination of relative density	8	17
7	Shear Strength: Mohr strength theory, Mohr-coulomb's strength theory, Direct shear test, Tri-axial compression test, unconfined compression test, vane shear test, Shear test based on drainage condition	8	17
8	Consolidation: Compressibility of soil, definitions and mechanism of consolidation, spring analogy, void ratio and effective stress Relation, Terzaghi's one dimensional consolidation theoretical equation, Time factor, one dimensional consolidation test, laboratory and theoretical time curves, determination of pre-consolidation pressure, Consolidation settlement, rate of settlement, secondary compression	8	17

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20	20	30	15	15	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above

Reference Books:

1. Arora, K.R., Soil Mechanics & Foundation Engineering, Standard Publicaiton, New Delhi.
2. Punamia, B.C., Soil Mechanics & Foundation Engineering; Laxmi Publication Pvt. Ltd., Delhi.
3. VNS Murthy, Soil Mechanics & Foundation Engineering, SaiKripa Technical Consultants, Bangalore.
4. Shroff, A. V., Shah D. Fratta, J. Aguettant, and L. R. Smith, Soil Mechanics Laboratory Testing, Boca Raton, CRC Press, USA, 2007.

5. D. L., Soil Mechanics & Geotechnical Engineering, Oxford & IBH, Delhi.
6. Singh Alam, Soil Engineering, Agion Publishers, Jodhpur.
7. Purshottam Raj, Geotechnical Engineering, Tata McGraw Hill Publication.
8. Purushothama, P. Raj, Soil Mechanics and Foundation Engineering, Pearson Education.
10. Singh, Alam, Soil Mechanics & Foundation Engineering, CBS Publishers & Distributors, New Delhi.
11. Taylor, D.W., Fundamentals of Soil Mechanics, Asia Publishing House, Mumbai.
13. Ranjan Gopal and Rao, A.S.R., Basic and Applied Soil Mechanics, New Age International Prv. Ltd.
15. Braja Das, M., Principles of Geotechnical Engineering, Thomson Asia Pvt. Ltd
16. K. Terzaghi, R. B. Peck and G. Mesri, Soil Mechanics in Engineering Practice, John Wiley & Sons, 1996.
17. J.E. Bowles, Foundation Analysis and Design, McGraw-Hill, 2001.

Course Learning Outcomes:

1. Students will develop ability to identify soil and classify them based on its indexed properties
2. Students will develop skills to determine soil properties and relate the same to workout theoretical soil strength and other strength/stability parameters
3. Will be able to understand basics principles of soil compaction, permeability and soil consolidation and apply the same on to estimate the amount of consolidation and settlement and time required for settlement under a given load.

List of Experiments:

1. Determination of Moisture Content
2. Determination of Specific Gravity
3. Field Density Test
4. Grain Size Analysis
5. Determination of Consistency Limits
6. Density/Relative Density Index
7. Permeability Test
8. Proctor Test
9. Vane Shear Test
10. Direct Shear Test
11. Unconfined Compression Test
12. Consolidation Test

Total number of laboratory sessions: 12

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/

Active learning Assignments (AL) : Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will

allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The Power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.