

## GEOTECHNICAL ENGINEERING

Course Code	21CV54	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2+2+0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	3	Exam Hours	3

**Course objectives:**

This course will enable students to

1. Appreciate basic concepts of soil mechanics as an integral part in the knowledge of civil engineering.
2. Comprehend basic engineering and mechanical properties of different types of soil.
3. Become broadly familiar with geotechnical engineering problems such as, flow of water through soil medium and terminologies associated with geotechnical engineering.
4. Assess the improvement in mechanical behavior by densification of soil deposits using compaction.
5. Model and measure strength-deformation characteristics and bearing capacity of soils

**Teaching-Learning Process (General Instructions)**

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Video tube, NPTEL materials
2. Quiz/Assignments/Open book test to develop skills
3. Encourage collaborative learning in the class with site visits related to subject and impart practical knowledge

**Module-1**

**Introduction :** Phase Diagram, phase relationships, definitions and their inter relationships. Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis, Atterberg's Limits, consistency indices. Activity of clay, Field identification of soils, Plasticity chart, BIS soil classification. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-2**

**Permeability:** Darcy's law- assumption, coefficient of permeability and its determination in laboratory, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation  
**Effective Stress** Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-3**

**Compaction:** Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties.  
**Consolidation:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption, Consolidation characteristics of soil ( $C_c$ ,  $a_v$ ,  $m_v$  and  $C_v$ ). Laboratory one dimensional consolidation test, characteristics of  $e$ -log ( $\sigma'$ ) curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-4**

**Shear Strength:** Concept of shear strength, Mohr-Coulomb Failure Criterion, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotropy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test, Tests under different drainage conditions. (08 Hrs)

**Teaching-Learning Process**

Chalk and talk, PPT presentations, Youtube videos, visit to near by sites

**Module-5**

**Bearing Capacity of Soil:** Determination of bearing capacity by Terzaghi's and BIS method (IS:6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effects of water table and eccentricity on bearing capacity of soil.

**Foundation Settlement:** Types of settlements and importance, Computation of Immediate, consolidation and creep settlements, permissible, differential and total settlements. (08 Hrs)

<b>Teaching-Learning Process</b>	Chalk and talk, PPT presentations, Youtube videos, visit to near by sites
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#### Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Determine the index properties of soil and hence classify the soil
2. Assess the compaction and consolidation characteristics of soil
3. Determine the permeability of soils and assess the seepage in hydraulic structures
4. Evaluate shear parameters of the soil using shear tests
5. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure

#### Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% ( 18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

##### Continuous Internal Evaluation:

Three Unit Tests each of 20 Marks (duration 01 hour)

1. First test at the end of 5<sup>th</sup> week of the semester
2. Second test at the end of the 10<sup>th</sup> week of the semester
3. Third test at the end of the 15<sup>th</sup> week of the semester

Two assignments each of 10 Marks

4. First assignment at the end of 4<sup>th</sup> week of the semester
5. Second assignment at the end of 9<sup>th</sup> week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for 20 Marks (duration 01 hours)

6. At the end of the 13<sup>th</sup> week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be scaled down to 50 marks

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

##### Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.

The students have to answer 5 full questions, selecting one full question from each module

#### Suggested Learning Resources:

##### Text Books

1. Punmia B.C., "Soil Mechanics and Foundation Engineering, Laxmi Publications Co., India.
2. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India
3. Murthy V.N.S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York

##### Reference Books:

1. Bowles J.E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co. Pvt. Ltd., India.
3. R.B. Peck, W.E. Hanson & T.H. Thornburn, "Foundation Engineering", Wiley Eastern Ltd., India.
4. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India.
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

#### Web links and Video Lectures (e-Resources):

- Online study material
- NPTEL video lectures

#### Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of field equipment's to learn the onsite field test of soil
- Visit to a site and learn importance of soil investigation

*[Signature]*

H.O.D.

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CREDIT DISTRIBUTION SCHEME: UG AUTONOMOUS BT COURSE - 2021												
Sl. No.	COURSE CODE	SEMESTER							AUTONOMOUS UG SCHEME	YII REG. LATIO	YII	TOTAL
		I	II	III	IV	V	VI	VI				
01	ESL 101	3	3	3	3	3	3	3	15	15	15	15
02	ESL 102	3	3	3	3	3	3	3	15	15	15	15
03	ESL 103	3	3	3	3	3	3	3	15	15	15	15
04	ESL 104	3	3	3	3	3	3	3	15	15	15	15
05	ESL 105	3	3	3	3	3	3	3	15	15	15	15
06	ESL 106	3	3	3	3	3	3	3	15	15	15	15
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