SEMESTER S4

SOIL MECHANICS AND FOUNDATIONS

Course Code	PCAGT402	CIE Marks	40
Teaching Hours/Week (L: T:P: R)	3:1:0:0	ESE Marks	60
Credits	4	Exam Hours	2 Hrs. 30 Min.
Prerequisites (if any)	None	Course Type	Theory

Course Objectives:

1. To understand the importance of soil mechanics in engineering, index properties and its determination.
2. To understand effective pressure of soil, permeability and compressibility of soil
3. To analyse stress distribution, shear strength and lateral earth pressure of soil
4. To evaluate stability of infinite and finite slope
5. To understand the bearing capacity of soil and different kinds of foundations used in engg constructions

KTU SPECIAL

SYLLABUS

Module No.	Syllabus Description	Contact Hours
1	**Soil engineering and index properties:** Soil and soil engineering, history of soil mechanics, Soil as a 3 phase system, Index properties: void ratio - specific gravity - dry density - porosity - water content - saturated unit weight - submerged unit weight - degree of saturation. **Determination of index properties of soils:** Determination of water content by oven drying–Specific gravity using pycnometer and specific gravity bottle - Grain size analysis by sieve analysis, hydrometer analysis and pipette analysis - Atterberg limits and	11

	indices – Visual identification by simple field tests – Field density by core cutter and sand replacement methods. **Classification of soils:** Necessity - Principles of classification - I.S. classification – Plasticity charts – Group index.	
2	**Soil water:** Modes of occurrence – adsorbed and capillary water types - Total stress -Effective stress – Pore pressure - Pressure diagrams. **Permeability:** Definition - Darcy's law - Factors affecting permeability – Laboratory determination - Stratified soils: average permeability. **Compaction:** Definition and objectives of compaction – Standard and Modified Proctor tests- Concept of OMC and maximum dry density - Zero air voids line - Factors influencing compaction - Effect of compaction on soil properties - Field compaction methods – Proctor needle for field control. **Consolidation:** Definition –Spring analogy for primary consolidation - Terzaghi's theory of one dimensional consolidation – Concepts of coefficient of compressibility - Coefficient of volume change and compression index – Laboratory consolidation test - e-log p curves.	**11**
3	**Stress distribution in soil:** Stress due to self weight, concentrated load - Boussinesq equations, pressure distribution diagrams, vertical pressure under a uniformly loaded circular area. **Shear strength:** Definition - Mohr's strength and stress circles - origin of planes - Mohr's envelope - Mohr- Coulomb strength theory –Direct shear test – introduction to triaxial shear test- Measurement of pore pressure -Total and effective stress strength parameters - UCC test - Vane shear tests - Choice of test conditions for field problems. **Lateral earth pressure**: Earth pressure at rest - Active and passive earth pressure for cohesionless and cohesive soils - Rankine's and Coulomb's theories - Point of application of earth pressure for cases of with and without surcharge in cohesionless and cohesive soils - Culmann's and Rebhan's graphical construction	**11**

KTU SPECIAL

	for active earth pressure- **Stability of slopes**: Slope failure, base failure and toe failure - Swedish circle method – Φ = 0analysis and c = 0 analysis - Friction circle method - Taylor's stability number -Stability charts.	
4	**Bearing capacity of soils:** Definitions related to foundations and bearing capacity, Minimum depth of foundation - Rankine's analysis, type of bearing capacity failures, effect of water table on bearing capacity, IS code method for computing bearing capacity. **Shallow foundations:** type of foundations, Spread footing, Safe bearing pressure, Settlement of footings. **Pile foundations:** type of piles, Pile driving, load carrying capacity of piles, dynamic formulae, Static formulae, Pile load tests, Penetration tests. **Well foundations:** Caissons, Shape of wells and component parts, Depth of well foundation and bearing capacity, forces acting on a well foundation.	**11**

Course Assessment Method

(CIE: 40 marks, ESE: 60 marks)

KTU SPECIAL

Continuous Internal Evaluation Marks (CIE):

Attendance	Assignment/ Microproject	Internal Examination-1 (Written)	Internal Examination- 2 (Written)	Total
5	**15**	**10**	**10**	**40**

End Semester Examination Marks (ESE)

In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions

Part A	Part B	Total
• 2 Questions from each module. • Total of 8 Questions, each carrying 3 marks **(8x3 =24marks)**	• Each question carries 9 marks. • Two questions will be given from each module, out of which 1 question should be answered. • Each question can have a maximum of 3 sub divisions. **(4x9 = 36 marks)**	**60**

Course Outcomes (COs)

At the end of the course students should be able to:

	Course Outcome	Bloom's Knowledge Level (KL)
CO1	Understand the importance of soil mechanics in engineering, index properties and its determination.	**K2**
CO2	Understand the concept of effective pressure of soil, permeability and compressibility of soil	**K2**
CO3	Analyse stress distribution, shear strength and lateral earth pressure of soil	**K3**
CO4	Evaluate stability of infinite and finite slope	**K3**
CO5	Understand the bearing capacity of soil and different kinds of foundations used in engineering constructions	**K2**

Note*: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create*

KTU SPECIAL

CO-PO Mapping Table (Mapping of Course Outcomes to Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2							1	
CO2	3	3	1	1								
CO3	3	3	1									
CO4	2	3	2	2								
CO5	2	3	2	2							1	

Note: *1: Slight (Low), 2: Moderate (Medium), 3: Substantial (High), -: No Correlation*

Text Books				
Sl. No	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
1	Text Book of Soil Science.	Biswas, T.D. and Mukherjee, S.K.	Tata McGraw Hill Publishing Co., New Delhi	
2	. Introductory Soil Science.	Das.D.K	Kalyani Publishers, New Delhi	
3	Nature and Properties of Soils.	Brady, N.C	Pearson	

KTU SPECIAL