GEOTECHNICAL ENGINEERING

IV Semester: CE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
ACE006	Core	3	1	-	4	30	70	100
Contact Classes: 45	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 60		

OBJECTIVES:

The course should enable the students to:

I. Identify the type of soil based on index properties of soils, soil formation & its structure
II. Recognize the importance of permeability for calculating the seepage through soils. Find out the coefficient of permeability using various laboratory & field tests.
III. Analyze the stress at any point below the ground surface due to self weight and externally applied load. Interpret the importance of consolidation and compaction on the settlement of footing.
IV. Recognize the importance of shear strength in load carrying capacity of soil. Calculate the shear strength of soil using various laboratory tests.

COURSE LEARNING OUTCOMES (CLOs):

1. Calculate the unit weights in various field conditions using different relationships
2. Examine water content, specific gravity, bulk density and dry densities of a soil using various laboratory and field tests.
3. Identify the type of soil present in the site by using particle size distribution curve & other index properties of soils as per IS soil classification system
4. Find the Atterberg limits of soils which is used in classifying the fine grained soils
5. Understand the permeability of soil & find out the range of coefficient of permeability in various soil types.
6. Explain the importance of permeability in calculation of seepage through earthen dams, amount of water to be pumped when the soil is excavated below ground water table.
7. Evaluate the coefficient of permeability using falling head tests and constant head tests
8. Evaluate the coefficient of permeability using pumping in and pumping out tests
9. Calculate the stresses beneath the ground level due to self weight of soil
10. Analyze the importance of total, neutral and effective stress in load carrying capacity of soil
11. Sketch the total, neutral and effective stress distribution diagram for various field conditions
12. Explain quick sand condition, its occurrence and its significance
13. Understand the importance of flow net in calculating seepage loss, uplift pressure, exit hydraulic gradient
14. Calculate the stress below the ground due to externally applied load using Boussinesq's theory
15. Calculate stress due to load using Westergaard's and approximate method of stress distribution
16. Importance of compaction in reducing the immediate settlement, improving the load carrying capacity
17. Determining the maximum dry density and optimum moisture content of soil using standard proctor test soil. List the various field equipments used for compacting the different types of soils.
18. Recognize the importance of consolidation in settlement calculation & calculate the consolidation settlement especially in clayey soils.
19. Determination of consolidation parameters of a soil using laboratory test such as using square root of time fitting method, logarithmic square method and height of solids method.
20. Understand the shear failure criteria proposed by Mohr-coulomb and shear parameters of soil
21. Determination of shear strength of soil using direct shear test and tri-axial test in various drainage

conditions.

22. Recognize the behavior of soil in normal, over and under consolidated soil. Understand the concept of dilatancy in sandy soil.
23. Posses the Knowledge and Skills for employability and to succeed in national and international level competitive examinations.

UNIT-I	INTRODUCTION AND INDEX PROPERTIES OF SOILS	Classes: 09

Soil formation, clay mineralogy and soil structure, moisture content, weight-volume relationships, relative density. Grain size analysis, sieve analysis, principle of hydrometer method, consistency limits and indices, I.S. classification of soils.

UNIT-II	PERMEABILITY, EFFECTIVE STRESS AND SEEPAGE THROUGH SOILS	Classes: 09

Capillary rise, flow of water through soils, Darcy's Law, permeability, factors affecting permeability, laboratory & field tests for determination of coefficient of permeability, permeability of layered soils; Total, neutral and effective stress, upward and downward seepage through soils, quick sand condition, flow nets: characteristics and uses.

UNIT-III	STRESS DISTRIBUTION IN SOILS & COMPACTION	Classes: 09

Boussinesq's and Westergard's theories for point load, uniformly loaded circular and rectangular areas, pressure bulb, variation of vertical stress under point load along vertical and horizontal plane, Newmark's influence chart for irregular areas.

Mechanism of compaction, factors affecting compaction, effects of compaction on soil properties, field compaction equipment and compaction quality control.

UNIT-IV	CONSOLIDATION	Classes: 09

Types of compressibility, immediate settlement, primary consolidation and secondary consolidation, stress history of clay, e-p and e-logp curves, normally consolidated soil , over and under consolidated soil, pre-consolidation pressure and its determination, Terzaghi's 1-D consolidation theory, coefficient of consolidation square root time and logarithm of time fitting methods, computation of total settlement and time rate of settlement.

UNIT-V	SHEAR STRENGTH OF SOILS	Classes: 09

Importance of shear strength, mohr and coulomb failure theories, types of laboratory tests for strength parameters, strength tests based on drainage conditions, strength envelops, shear strength of sands, dilatancy, critical void ratio, liquefaction, shear strength of clays.

Text Books:

1. Braja M. Das, "Principles of geotechnical engineering" Cengage learning publishers, 2002
2. VNS Murthy, "Soil mechanics and foundation engineering", CBS publishers and distributors, 2003.
3. Gopal Ranjan and ASR Rao, "Basic and Applied Soil Mechanics", New age international Pvt. Ltd, New Delhi, 2000.

Reference Books:

1. C. Venkataramiah, "Geotechnical engineering", New Age International Pvt. Ltd, 2002.
2. Manoj dutta and Gulati, "Geotechnical engineering", Tata Mc Grawhill publishers New Delhi, 2005.
3. K.R .Arora, "Soil mechanics and foundation engineering", standard publishers and distributors, New Delhi, 2005.
4. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, "Soil mechanics and foundation", Laxmi publications Pvt. Ltd, New Delhi, 2005.

Web References:
1. http://nptel.ac.in/courses/105107120/1# 2. http://www.nptel.ac.in/courses/105105105/ 3. http://www.nptel.ac.in/courses/105105104/