COURSE TITLE : GEOTECHNICAL ENGINEERING
COURSE CODE : 5013
COURSE CATEGORY : A
PERIODS/WEEK : 3
PERIODS/SEMESTER: 39
CREDITS : 2

TIME SCHEDULE

Module	Topics	Period
1	Properties of soil	10
2	Permeability and compaction of soil	10
3	Soil exploration	9
4	Foundation engineering	10
TOTAL		**39**

COURSE OUTCOME

Sl.	Sub	Student will be able to
1	1	Know the importance of soil mechanics and three phase system of soil
	2	Understand the Index properties of soil and it's determination by lab test and field test
	3	**C**omprehend the consistency of soil
2	1	Describe the permeability of soil
	2	Discuss about the compaction of soil
	3	Discuss about the soil exploration
3	1	Explain the concept of bearing capacity of soil
	2	Discuss about the foundation

SPECIFIC OUTCOME

Upon completion of the study, the student should be able to:

MODULE - I

1.1.0 Understand origin of soil and importance of geotechnical engineering

1.1.1 Define the term soil.
1.1.2 Explain origin of soil.
1.1.3 Explain the importance of soil Engineering.
1.1.4 List the applications of soil mechanics.
1.1.5 Identify the types of residual and transported soils.
1.1.6 State the three phase system of soil
1.1.7 Illustrate three phase system of soil mass
1.1.8 Define the terms: water content, bulk unit weights, dry unit weight unit weight of solids, saturated unit weight, submerged unit weight, sp:gravity of soil, void ratio, porosity, degree of saturation, percentage of air voids, air content, and density index.
1.1.9 Derive the functional relationships between various properties.
1.1.10 Solve problems using functional relationships.

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1.2.0 Understand the index properties of soil

1.2.1 Describe the determination of water content of soil by oven drying
1.2.2 Describe the determination of specific gravity of soil
1.2.3 Describe the methods of particle size analysis
1.2.4 Describe the procedure of sieve analysis for fine and coarse fractions (wet and dry sieve analysis)
1.2.5 Describe procedure of hydrometer method
1.2.6 Describe the procedure of calibration of hydrometer
1.2.7 Describe the corrections to the hydrometer readings
1.2.8 Describe the particle size distribution curves
1.2.9 Identify well graded, uniform graded and poorly graded soil samples.
1.2.10Estimate uniformity co-efficient and effective size
1.2.11 Define the engineering properties of soil
1.2.12 Define field density of soil.
1.2.13 Describe the procedure of sand replacement method
1.2.14 Describe the procedure of core cutter method
1.2.15 Give the necessity of classification of soils
1.2.16 Give the IS classification of soils

1.3.0 Understand Consistency of soils

1.3.1 State Atterberg's limits of soil.
1.3.2 Describe the procedure for determination of liquid limits, plastic limits, shrinkage limits
1.3.3 Define the terms shrinkage ratio, plasticity index.

MODULE - II

2.1.0 Understand Soil water.

2.1.1 Define the terms free water, held water/adsorbed water and capillary water
2.1.2 Explain effective pressure, pore pressure and neutral pressure

2.2.0 Understand Permeability of soil

2.2.1 Define permeability
2.2.2 State Darcy's law
2.2.3 Define discharge and seepage velocity
2.2.4 List the factors affecting permeability
2.2.5 Describe constant and varying head methods for finding coefficient of permeability
2.2.6 Determine of coefficient of permeability by constant and varying head test method

2.3.0 Understand the compaction of soil

2.3.1 List the objectives of compaction of soil
2.3.2 Describe the procedure of Standard and Modified Proctor test.
2.3.3 Plot the compaction curve and explain the features (OMC, maximum dry density)
2.3.4 Describe the various field compaction methods
2.3.5 Explain the factors affecting compaction.

MODULE - III

3.1.0 Understand the basic concept of soil exploration

3.1.1 List objectives of site explorations
3.1.2 Need of site reconnaissance
3.1.3 Identify the depth of exploration
3.1.4 Identify the number and position of pits and boring
3.1.5 Need of general and detailed exploration
3.1.6 Describe the various methods of the explorations
3.1.7 List the soil samplers
3.1.8 Define undisturbed and disturbed samples
3.1.9 Describe the method of Standard Penetration test
3.1.10 Describe geophysical methods.

3.2.0 Understand the basic concept of bearing capacity of a soil

3.2.1 Define ultimate bearing capacity, safe bearing capacity and allowable bearing pressure.
3.2.2 Explain the types of failure analysis – general and local shear failure
3.2.3 State Terzaghi's theory of bearing capacity
3.2.4 Identify effect of water table on bearing capacity.
3.2.5 Describe the plate load test.
3.2.6 List the limitations of plate load test.

MODULE - IV

4.1.0 Comprehend the type of foundation to be adopted for a particular soil condition

4.1.1 Define the term foundation
4.1.2 Identify the objectives of foundation
4.1.3 Distinguish shallow and deep foundation
4.1.4 Identify different types of shallow foundations with sketches
4.1.5 Describe the proportioning of rectangular footing.
4.1.6 State Rankine's theory for foundation design.

4.1.7 Design of strip or continuous footing based on Rankine's theory.
4.1.8 Identify various classifications of pile foundation
4.1.9 Describe pile erection methods.
4.1.10 Draw the shapes and component parts of well foundation.
4.1.11 Describe the method of well sinking and correcting tilting
4.1.12 Identify the causes of failure of foundation and rectifying methods.

CONTENT DETAILS

MODULE – I

Introduction of Soil mechanics: – soil Engineering – Scope of soil Engineering – History of development of soil mechanics –Soil types – residual and transported – Soil as a three phase system – water content. Unit weight of soil – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weights – specific gravity –void ratio – porosity – degree of saturation – percentage air voids –Air content -density index - functional relationships –Estimation and relationship between properties.
Determination of index properties: - water content by oven drying method – specific gravity using Pycnometer and specific gravity bottle – particle size distribution – sieve analysis, hydrometer method – particle size distribution curve – consistency of soils - liquid limit, plastic limit, shrinkage limit, plasticity index, consistency index –determination of liquid limits, plastic limit & shrinkage limit - shrinkage ratio. Field
density by sand replacement method and the core cutter method. Classification of soils, Engineering properties of soil-Shear strength-permeability- compressibility. Necessity – I.S. classification.

MODULE – II

Soil water – classification – absorbed water – capillary water - stress condition in soil
Effective and neutral pressures - Permeability of soil – Darcy's law – discharge velocity and seepage velocity – factors affecting permeability - Determination of coefficient of permeability – constant head permeability test – falling head permeability test- coefficient of permeability estimation problems.
Compaction of soil- Definition and objectives of compaction – Standard Proctor test and modified proctor test – concept of O.M.C and maximum dry density – Zero air voids line – field compaction methods – factors affecting compaction.

MODULE – III

Site Investigation and sub-soil exploration – Objectives – site reconnaissance – site exploration – depth of exploration – number and disposition of pits and boring – general exploration – detailed exploration - methods of site exploration – open excavations – boring methods - auger boring – auger and shell boring - wash boring – percussion boring – rotary boring – soil samples and samplers – disturbed sampling – undisturbed sampling–Standard Penetration Test – Geophysical methods (Seismic refraction and Electrical resistivity method.)
Bearing capacity: – ultimate bearing capacity, safe bearing capacity and allowable bearing pressure – general and local shear failure – Terzaghi's theory of bearing capacity – effect of water table - plate load test – limitations.

MODULE – IV

Foundation engineering–different types of foundations – proportioning of foundations – rectangular footing. Design of strip footing using Rankine's equation.
Deep foundations: - Pile foundation – necessity of pile foundation – classification of piles according to materials, mode of transfer of loads, method of installation, use and displacement of soil. Well foundations/caissons – shapes of wells and component parts – well sinking – tilts and shifts – measures for rectification of tilts and shifts.

REFERENCE BOOKS

1. Gopal Ranjan & A.S.R.Rao : Basic and applied soil mechanics ; New Age International
2. Shashi K Gulhati & Manoj Datta : Geotechnical Engineering ; Tata McGraw Hill publishing company Ltd
3. P. Purushothama Raj : Soil Mechanics & foundation Engineering ; Pearson Education
4. Dr.B.C. PUnmia : Soil Mechanics and Foundation Engineereing ; A.Saurabh&Co(P) Ltd
5. Dr.Arora.K.R : Soil Mechanics and Foundation Engineering ; Standard publishers
6. A.Khan : Text book of Geotechnical Engineering ; Prentice Hall of India
7. Dr. J.Sha & S.K.sinha : Construction and Foundation Engineering ; KhannaPublishers Delhi.
8. C.Venkatramaiah : Geotechnical Engineering ; New age International