Geotechnical Engineering (66445)

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AIMS:

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

- To understand of the origin, composition, classification and properties of soil.
- To assist in understanding the plasticity characteristics and hydraulic properties of soil.
- To assist in understanding the consolidation characteristics of soil.
- To assist in understanding the lateral earth pressure of soil.
- To provide understanding of the site investigation and method of sample collection.
- To provide basic field skill for collection of soil sample.
- To provide basic laboratory skill required to determine soil properties and to perform the relevant calculations.

SHORT DESCRIPTION:

Introduction to geotechnical engineering; Preliminary definition and simple tests; Particle size of soil; Plasticity characteristic of soil; Hydraulic properties of soil; Consolidation characteristics of soil; Subsurface investigation; Lateral earth pressure; Bearing capacity of soil.

DETAIL DESCRIPTION:

Theory: 1. Understand the basic concept of geotechnical engineering.

1.1 Define rock, soil and soil engineering.

1.2 Describe origin and formation of soil.

1.3 Describe major soil deposits in Bangladesh.

1.4 Explain limitation of soil engineering.

1.5 Mention the soil classification system.

1.6 State textural, AASHO and unified ASTM system.

1.7 State field identification test such as; dilatancy, toughness, dry strength test & shaking test.

1.8 List general properties of soil.

2. Understand preliminary soil tests.

2.1 Define the following terms: void ratio, porosity, degree of saturation, percentage of air voids, air content, water content, bulk unit weight, dry unit weight, saturated unit weight, submerged unit weight, unit weight of solids, specific gravity of solids, density index.

2.2 Explain three-phase diagram in terms of void ratio.

2.3 Explain three-phase diagram in terms of porosity.

2.4 Solve problems on soil properties.

2.5 Explain oven drying method of water content determination.

2.6 Explain specific gravity determination by pycnometer method.

3. Understand the particle size of soil.

3.1 Define index properties of soil.

3.2 State mechanical analysis of soil.

3.3 Describe sieve analysis.

3.4 Mention and interpret stokes law.

3.5 Describe particles size analysis by hydrometer.

4. Understand the plasticity characteristics of soil.

4.1 Define: plasticity of soil, Atterberg limit, liquid limit, plastic limit, shrinkage limit,

4.2 Explain plasticity index, liquidity index, consistency index, flow index and toughness index.

4.3 State the method of measurement of consistency.

4.4 Define the terms: sensitivity and thixotropy.

4.5 List the uses of consistency (Atterberg) limits.

5. Understand the hydraulic properties of soil.

5.1 Define the following: Permeability of soil, hydraulic head, piezometric head, position head.

5.2 State & Explain Darcy's law.

5.3 State the constant head and variable head permeability test for determination of co-efficient of permeability.

5.4 Describe the pumping out tests for determination of coefficient of permeability.

5.5 Compute effective pressure and pore water pressure.

5.6 List the factors affecting permeability of soil.

5.7 Define seepage pressure, seepage velocity, equipotential line and flow net.

6. Understand the consolidation characteristics of soil.

6.1 Define consolidation

6.2 Classify & explain consolidation.

6.3 State behavior of saturated soil under pressure.

6.4 Identify triaxial compression test apparatus.

6.5 Differentiate between consolidation and compaction of soil.

6.6 State standard proctor test of compaction.

6.7 Explain optimum moisture content & percent compaction.

6.8 State unconfined test.

6.9 State confined compression test.

7. Understand the purpose of subsurface investigation.

7.1 State subsurface investigation of soil.

7.2 Mention the stages in subsurface explorations.

7.3 Mention the purposes of subsurface investigation of soil.

7.4 Compute the depth and lateral extent of explorations.

7.5 Describe the open excavation (Test Pit) methods of explorations.

7.6 Describe auger boring, wash boring, and rotary drilling.

7.7 Identify various types of soil samples.

7.8 Identify split barrel sampler, spring core catches, scraper bucket and piston sampler for collecting samples.

7.9 Describe the method of standard penetration test (SPT).

7.10 State the procedure of writing subsoil investigation report.

8. Understand the aspect of lateral earth pressure.

8.1 State the meaning of at-rest pressure, active earth pressure and passive earth pressure.

8.2 explain active and passive earth pressure of Rankine's theory with non-surcharge.

8.3 State the formula of active earth pressure of Rankine's theory with surcharge.

8.4 State the fundamental assumptions of Coulomb's wedge theory.

8.5 State the formula of active earth pressure of Coulomb's theory with surcharge.

9. Understand the bearing capacity of soil.

9.1 Define bearing capacity of soil.

9.2 Correlate between penetration resistance and unconfined compressive strength for cohesive soil.
9.3 Correlate between penetration resistance and angle of shearing resistance for cohesion less soil.

9.4 Explain the bearing capacity from Standard Penetration Test (SPT).

9.5 List the causes of foundation settlement

PRACTICAL:

1. Determine the water content of soil by oven drying method.
2. Determine the specific gravity of soil by pycnometer method.
3. Determine bulk unit weight & dry unit weight of soil.
4. Determine the particle size of soil by sieve analysis.
5. Determine the particle size of soil by hydrometer analysis.
6. Determine the liquid limit of soil by casagrand’s apparatus.
7. Determine the plastic limit of soil.
8. Determine the co-efficient of permeability of soil by constant head test.
9. Determine the shear strength of soil using vane shear test.
10. Determine the bearing capacity of soil from Standard Penetration Test (SPT).
11. Determine the amount of compaction and the water content by standard proctor test.
12. Determine the shear characteristics of soil by unconfined compression test.

REFERENCE BOOKS:

1 Foundation Engineering - Ralph B Peck, Walter, E Hanson
2 Soli Mechanics and Foundation Engineering - Dr. K. R.Arora.
3 3 Soil Mechanics and Foundation - Dr. B. C.Punmia.
4 Foundation Analysis and Design - Josef and Vawels.