Advanced Geotechnical Engineering - Video course

COURSE OUTLINE

The first course in soil mechanics generally introduces the fundamental concepts, principles to the undergraduate students of civil engineering.

This course "Advanced Geotechnical Engineering" goes deeper into the various aspects of soil mechanics along with bringing out the advanced theories and practical knowledge of geotechnical engineering.

Each topic will be developed in logical progression with up-to-date information with reference to recent developments.

The topics cover Soil formation; Soil structure; Clay mineralogy; Soil compaction, Consolidation, Shear strength, stability of slopes, loads on pipes.

Other topics which will be covered are Geotechnical Physical modeling methods; Application of centrifuge modeling and its relevance to geotechnical engineering; Centrifuge modeling of geotechnical structures.

The advanced course material on advanced geotechnical engineering will be very useful to undergraduate students, post-graduate students, researchers, teachers and practitioners.

A number of chosen problems will be solved to illustrate the concepts clearly.

Contents:

Soil formation; Soil structure; Clay mineralogy; Soil compaction; Effective stress; Flow of water through soils; Stresses in soil from surface loads;

Consolidation theories; 1-D and 3-D consolidation; Settlement of compressible soil layers; Methods for accelerating consolidation settlements;

Shear strength; Stress paths in p-q space; Triaxial behaviour, stress state and analysis of UC, UU, CU, CD, and other special tests, tress paths in triaxial and octahedral plane;

Short-term and Long-term stability analysis of slopes; Methods for stability analysis of slopes; Methods for enhancing stability of unstable slopes;

Loads on pipes; Marston's load theory for rigid and flexible pipes; Pipe floatation and Liquefaction;

Geotechnical Physical modeling methods; Application of centrifuge modeling and its relevance to geotechnical engineering; Centrifuge modeling of geotechnical structures.

COURSE DETAIL

Sl. No.	Topic	No. of Hours
1	**Soil composition and soil structure:** • Soil formation; Types of soils and their characteristics; Particle sizes and shapes; their	5

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Civil Engineering

Pre-requisites:

1. Basic courses in soil mechanics.

Additional Reading:

1. Literature on geotechnical engineering in relevant journals and handbooks.

Coordinators:

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	impact on engineering properties; • Soil structure; Clay mineralogy; Soil-air-water interaction; Consistency; Soil compaction; Concept of effective stress.	
2	**Permeability and Seepage:** • Permeability; Seepage force and effective stress during seepage. • Laplace equations of fluid flow for 1-D, 2-D and 3D seepage, Flow nets, Anisotropic and non-homogeneous medium, Confined and Unconfined seepage.	7
3	**Compressibility and Consolidation:** • Stresses in soil from surface loads; Terzagahi's 1-D consolidation theory; Application in different boundary conditions; Ramp loading. • Determination of Coefficient of consolidation cv; Normally and Overconsolidated soils; Compression curves; Secondary consolidation. • Radial consolidation; Settlement of compressible soil layers and Methods for accelerating consolidation settlements.	10
4	**Stress-strain relationship and Shear strength of soils:** • Stress state, Mohr's circle analysis and Pole, Principal stress space, Stress paths in p-q space; • Mohr-coulomb failure criteria and its limitations, correlation with p-q space; • Stress-strain behaviour: Isotropic compression and pressure dependency, confined compression, large stress compression, Definition of failure, Interlocking concept and its interpretations, Drainage conditions; • Triaxial behaviour, stress state and analysis of UC, UU, CU, CD, and other special tests, Stress paths in triaxial and octahedral plane; Elastic modulus from triaxial tests.	10
5	**Stability of Slopes:** • Stability analysis of a slope and finding critical slip surface; Sudden Draw down condition, effective stress and total stress analysis; • Seismic displacements in marginally stable slopes; • Reliability based design of slopes, Methods for enhancing stability of unstable slopes.	8
6	**Buried Structures:** • Load on Pipes, Marston's load theory for rigid and flexible pipes, Trench and Projection conditions, minimum cover, Pipe floatation and Liquefaction.	3

7	**Geotechnical Physical Modeling**: • Physical modeling methods; Application of centrifuge modeling and its relevance to geotechnical engineering; • Centrifuge modeling of geotechnical structures.	4

References:

1. Das, B.M. (2008). Advanced Soil Mechanics. Taylor and Fracis Group, London, Second edition.
2. Helwany, S. (2007). Applied Soil Mechanics with ABAQUS Applications, John Wiley & Sons, INC, New Jersey, USA.
3. Wood, D.W. (2004). Geotechnial Modelling. Spon Press, Taylor and Francis Group, London, First edition.
4. Powrie, W. (2002). Soil Mechanics concepts and applications. Spon Press, Taylor and Fracis Group, London, Second edition.
5. Terzaghi, K., Peck, R.B. and Mesri, G. (1996). Soil Mechanics in Engineering Practice.