Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCEC502	Mechanics of Geomaterials	3	1	0	4

Course Objective

The course aims to develop thorough understanding on fundamentals of soil as a particulate system, particle and particulate properties, steady and transient flow through porous media including seepage and consolidation, strength characteristics of geomaterials and focus on the conceptual models that represent the mechanical behaviour of soils based on critical state concepts.

Learning Outcomes

Upon successful completion of this course, the students should be able to understand:

- Behaviour of soil as a particulate system; particle and particulate properties of soil, soil classification system.
- Steady and transient flow through the porous media for design of geotechnical structures
- Elastic and plastic analysis and design of geotechnical systems with emphasis on critical state soil mechanics

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1	**Soil formation, composition and engineering properties** Particle and particulate properties, standard classification of soil	**3L+1T**	Understand the soil mineralogy/structure and engineering properties.
2	**Conduction phenomena through porous media** Steady state flow: Flow laws and interrelationships, hydraulic, electrical, thermal and diffusion. Flow through unsaturated and saturated soil. **Transient flow: Consolidation Theory** One, two, three dimensional and radial consolidation, numerical solution for consolidation theories.	**9L+3T**	Understand electrical, thermal, and flow of water through soil media, mechanism of seepage, consolidation, and settlement parameters.
3	**Geomechanics: Elasticity** Boussinesq solution, Mindlin solution, plane strain problem.	**6L+2T**	Understand the stresses in the soil by elasticity theory.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
4	**Geomechanics: Plasticity** Principal stress space, Yield surfaces for metals, The Coulomb yield criterion, flow rule.	**6L+2T**	Understand the plasticity theory in soil mechanics.
5	**Strength Characteristics of Geomaterials** Shear strength of cohesive and cohesionless soils, drained and undrained conditions, pore pressure parameters, determination of shear strength, stress path, soil modulus.	**6L+2T**	Understand the importance of soil shear strength for the analysis of geotechnical problems.
6.	**Critical State Soil Mechanics** Introduction to critical state soil mechanics, Critical state parameters, Critical state for normally consolidated and over consolidated soil, Roscoe and Hvorslev state boundary surface, Cam clay soil model.	**10L+3T**	Use of critical state framework to understand the soil response, constitutive models, and soil behaviour under different boundary conditions.
7	**Recent Advances on Geomechanics**	**2L+1T**	Exposure for recent developments.
	Total Contact hours	**42L+14T**	

Text Books:

1. James K. Mitchell, Kenichi Soga (2005). Fundamentals of Soil Behavior, Third edition, Wiley India Pvt Ltd;
2. Davis, R. O., and Selvaduari, A. P. S. (1996). Elasticity and Geomechanics, Cambridge University Press.
3. Budhu, M. (2011) Soil Mechanics and Foundations, John Wiley & Sons Inc, USA.

Reference Books:

1. Atkinson, J. H., and Bransby, P. L. (2013). The Mechanics of Soils: An Introduction to Critical State Soil Mechanics, McGraw-Hill Book publications.
2. Das, B.M. (2013). Advanced Soil Mechanics, 4th Edition, CRC Press.
3. Lambe, T. W., and Whitman, R. V. (2008). Soil Mechanics, Wiley India Pvt Ltd publications.
4. Poulos, H. G., and Davis, E. H. (1974). Elastic Solutions for Soil and Rock Mechanics, John Wiley & Sons Inc, USA.
5. SP 36 (Part 1) Compendium of Indian Standards on Soil Engineering- Laboratory testing of soils for Civil Engineering Purposes, Bureau of Indian Standards , New Delhi