Course Type	Course Code	Name of Course	L	T	P	Credit
DC	NCEC540	Computational Geomechanics	3	1	0	4

Course Objective
The course provides a detail understanding of computational modeling and solution of various geotechnical problems encountered in practice
Learning Outcomes
The student will acquire knowledge constitutive relationships of various geomaterials, and solution of geotechnical problems through numerical techniques and thereby enabling them to apply the knowledge in real time problems.

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
1.	**Introduction and basic review:** Theoretical considerations; Geometric idealization; Simple methods; Numerical techniques	3L+1T	Understand basics of geotechnical analysis
2.	**Limit analysis:** Lower and upper bound theorem of plastic collapse; Lower and upper bound analysis using linear programming; Application to different geotechnical systems such as shallow foundation, retaining wall and slope stability, etc.	6L+2T	Concepts of limit analyses and their application
3.	**Finite difference method:** Formulation and solution; Solution for axially loaded pile; Terzaghi's one-dimensional consolidation; Seepage analysis	3L+1T	Application of finite difference method for solving geotechnical problems
4.	**Finite element theory for linear materials:** Introduction to FEM; Element discretization; Displacement approximation; Isoparametric finite elements; Numerical integration; Solution; Calculation of stresses and strains	9L+3T	Knowledge on finite element method
5.	**Geotechnical considerations:** Total stress analysis; pore pressure calculation; FEM for structural components; Interface modelling; Boundary conditions; Nonlinear finite element analyis	6L+2T	Specific considerations for geotechnical problems

Unit No.	Topics to be Covered	Contact Hours	Learning Outcome
6.	**Theory of elasticity and plasticity:** Isotropic elasticity and nonlinear elasticity; Yield criterion, Plastic potential and plastic flow rule; Strain hardening: Isotropic and Kinematic hardening; Perfect plastic models for geotechnical materials.	9L+3T	Key concepts of plasticity theory and perfect plastic models
7.	**Elasto-plastic constitutive models:** Tresca model; Von-Mises model; Mohr-Coulomb model; Drucker-Prager model; Cam-clay model; Multi-surface plasticity model; Bounding surface plasticity model.	6L+2T	Understand and apply advanced constitutive models to predict soil behavior under various loading conditions.
	Total Contact Hours	**42L+14T**	

Text Books:

1. Potts, D.M. and Zdravkovic, L. (2004) Finite Element Analysis in Geotechnical Engineering: Theory, Thomas Telford
2. Wood, D.M. (2017). Geotechnical Modelling, CRC Press.
3. Srinath, L.S. (2010). Advanced Mechanics of Solids, 3rd Edition, McGraw Hill publications.

Reference Books:

1. Chen, W.F. (1975). Limit Analysis and Soil Plasticity, 1st Edition, Elsevier.
2. Desai, C.S. and Abel. J.F. (2005). Introduction to the Finite Element Method: A Numerical Method for Engineering Analysis, 1st Edition, CBS Publisher.
3. Krishnamoorthy, C.S. (1994). Finite Element Analysis: Theory and Programming, Tata McGraw-Hill.