B. Tech. Civil Engineering				
Course code: Course Title	**Course Structure. Credit=4**			**Pre-Requisite**
CE 315: Advanced Mechanics of Soil	L	T	P	CE206: Soil Mechanics, CE 205 Fluid Mechanics
	3	1	0	

Course Objective: To understand the microscopic structure and mineralogical composition of clayey soils using advanced analysis techniques. To analyse effective stress, pore pressure, and permeability characteristics in soil. To conduct numerical analysis of seepage, flow nets, and filter design for hydraulic structures. To study consolidation theories, settlement behaviour, and the impact of sand drains. To evaluate shear strength parameters, stress-strain characteristics, and stability analysis of soils.

S. No	Course Outcomes (CO)
CO1	To evaluate the microscopic structure and clay mineralogy of the soil.
CO2	To assess the hydraulic conductivity of all types of soil by lab, field, and indirect methods, thereby using data for seepage discharge.
CO3	To evaluate seepage discharge, seepage pressure, and exit gradient through homogeneous and zoned dams.
CO4	To evaluate the settlement of the foundation due to one and 3D consolidation.
CO5	To evaluate shear parameters under different drainage conditions for the estimation of the bearing capacity of the foundation and stability of slopes.

S. No	Contents	Contact Hours
UNIT 1	Clay mineralogy, clay-water electrolyte system, Orientation of clay particles, soil structure analysis using X-ray diffraction, Scanning electron microscope, Optical microscope, differential thermal analysis, Pore Size distribution analysis method.	6
UNIT 2	Effective stress, pore pressure, hydraulic conductivity, and its directional variation, Direct and indirect methods for permeability analysis, and electroosmosis.	8
UNIT 3	Numerical Analysis of Seepage, Seepage behavior of soil flow net construction by various techniques, seepage in layered soil, filter design, seepage through dam body, safety of hydraulic structures against piping.	8

UNIT 4	Consolidation: one-dimensional and generalized consolidation theories, primary and secondary consolidation, Degree of consolidation under time-dependent loading, determination of Cv by various methods, Viscoelastic model, sand drains, effect of smear, numerical solution, consolidation settlement	8
UNIT 5	Shear behavior of soil, Mohr-Coulomb failure criteria, Curvature of Failure envelope, pore pressure parameters UU, CU & CD tests, stress path, methods for settlement analysis. Total and effective stress path, water content contours, stress history, anisotropy of strength, thixotropy creep, determination of in situ undrained shear strength, stress-strain characteristic of soil, determination of modulus of values.	10
	TOTAL	**40**

REFERENCES		
S. No.	**Name of Books/Authors/Publishers**	**Year of Publication / Reprint**
1	GE Barnes, 'Principle and Practice' (ISBN 9-03-088753-7)	2000
2	BM Das, 'Advance Soil Mechanics' (ISBN 0-77-04915-8)	1997
3	TW Lambe and RV Whitman, 'Soil Mechanics' (ISBN 0-71-6059714-1)	1987
4	James K. Mitchell, 'Fundamental of Soil Behavior' (ISBN 7-83-4697512-6)	1993
5	RF Scott, 'Principle of Soil Mechanics' (ISBN 9-54-3564799-8)	1963