

Course Content:

Nature and genesis of unsaturated soils: Introduction to phase properties and relations, air-water-solid interface, in-situ stress state component profiles, suction and potential of soil-water system, transient suction and moisture profiles, compaction; Soil suction: Suction component, principle and measurement of total suction, matric suction, osmotic suction, capillarity; State of stress and shear strength: Stress state variables, material variables, effective stress concepts for unsaturated soils, representation of net normal stress, matric suction and suction stress tensor, stress control by axis translation. Shear strength of unsaturated soil, extended Mohr-Coulomb criterion, shear strength and pore pressure parameters, measurements of shear strength parameters; Flow of water in unsaturated soils: Soil-water characteristic curve (SWCC), hysteresis in SWCC, permeability and hydraulic conductivity function, direct and indirect measurements of SWCC and hydraulic conductivity function. One-dimensional consolidation and swelling for unsaturated soils; Applications: Applications of unsaturated material properties in geotechnical and geo-environmental structures.