INTENDED AUDIENCE: Undergraduate students in Civil Engineering, Postgraduate and Ph. D. students in geotechnical engineering

PREREQUISITES: Nil for PG. For UG, geotechnical engineering basic courses need to be done before this course.

INDUSTRIES SUPPORT: Basic civil engineering infrastructural companies.

COURSE OUTLINE:
This course intends to bridge the basic soil mechanics concepts with the advanced topics related to stresses and soil strength. In the process, it will help to reinforce the understanding gained during the undergraduate learning and would help to alleviate any misconceptions related to the stress-strain response and strength behaviour of soils. Not all the concepts explained in this course are advanced, but attempts to add clarity to the knowledge gained at undergraduate level. This course is ideal for the orientation of geotechnical engineering post-graduate students and final year undergraduate students to the higher realms of geomechanical characteristics of soils.

ABOUT INSTRUCTOR:
Dr. Sreedeep S is a Professor in the Geotechnical Engineering Division, Department of Civil Engineering, Indian Institute of Technology Guwahati since 2006. Since then he has taught the course Advanced Soil Mechanics multiple times till date. He obtained his Ph.D. and M.Tech. degrees from IIT Bombay and B. Tech. degree from Calicut University. His research interests include behavioural studies of unsaturated geomaterials, hazardous waste management, utilization of waste materials and bio-geotechnology. He has published around 100 peer reviewed journals and several conference/seminar proceedings. He was a recipient of the Shamsher Prakash Research Award for Geotechnical Engineering in 2014. He is a member of ASCE, ASTM, IACMAG, IGS and TC 106 of ISSMGE. He is a reviewer for several national and international journals.

COURSE PLAN:

Week 1: Introduction to course contents Module • 1 Introduction to continuum mechanics • 1.1a Stress at a point-Cauchy stress • 1.1b Stress at a point-Stress tensor • 1.2 Stress acting on a plane • 1.2a Stress acting on a plane example • 1.3 Transformation of stress tensor

Week 2: 1.4 Stress invariants • 1.4a Relationship between stress invariants • 1.4b Principal stresses and Eigen vectors • 1.5 Strain in soil • 1.6 Cause-effect relationship

Week 3: 1.7 Important constitutive relationship • 1.8 3D to 2D idealization • 1.9 Mathematical formulation of plane stress, plane strain • 1.10 Mathematical formulation of axisymmetric conditions • 1.11 Summary of Module 1

Week 4: Module 2 Shear strength of cohesionless and cohesive soil • 2.1a Basics of shear strength • 2.1b Stress representation • 2.2a Shear strength granular soil • 2.2b Shear strength granular soil • 2.3a Shear strength cohesive soil • 2.3b Shear strength cohesive soil - Stress strain

Week 5: 2.4a Pore water pressure and Skempton’s equation • 2.4b Overall pore water pressure parameter • 2.4c Pore water pressure -plane strain-effect of sampling • 2.4d Pore water pressure estimation

Week 6: 2.5a Triaxial test • 2.5b Interpretation triaxial test-UU UCS • 2.5c Interpretation triaxial test-CU • 2.5d Interpretation triaxial test-CD

Week 7: 2.6 Some additional aspects of shear strength • 2.7 Summary of Module 2

Week 8: Module 3 Stress path • 3.1 Importance and representation of stress path • 3.2 Stress path for different cases of loading

Week 9: 3.3 Stress path for different field conditions • 3.4 Summary of Module 3 • Module 4 Critical state soil mechanics • 4.1 Critical state concept and its importance • 4.2 Parameters relevant to critical state

Week 10: 4.3 2 D analysis of critical state • 4.4 Soil yielding-I • 4.4 Soil yielding-II

Week 11: 4.4 Soil yielding-III • 4.5 Prediction of NC and LOC behavior • 4.6 Prediction of OC behavior

Week 12: 4.7 Elements of CS model, cam clay, modified cam clay • 4.8 State boundary surface, drained and undrained plane • 4.9 Summary of Module 4