Fundamentals of Geotechnical Engineering – III CEng3143 Tentative Lecture Plan 2012EC Semester I (Winter 2019)				
Week (2019GC)	**Session**	**Delivery**	**Subject**	**Learning Outcome (Competence)** **Students will be able to**
39 [SEP. 23 - 29]	1	Discussion	Starting Session	Introduction & Formalities
	2	Lecture / Exercise	1. Soil Compressibility & Settlement Analysis 1.1 Introduction	✓ Calculate stresses in soils (assuming elastic behavior) from external loads and describe the concept of contact pressure ✓ Articulate stress states and stress paths. ✓ Describe the compressibility characteristics of soil ✓ Differentiate between the different components of soil settlement
	3	Lecture / Exercise	1.2 Immediate Settlement	✓ Describe and compute elastic settlement for different soils and contact ✓ Elastic Compression for Cohesive Soils / Cohesionless Soils
40 [SEP. 30 – OCT. 6]	1	Lecture / Exercise	1.3 Primary Consolidation	✓ Have a basic understanding of soil consolidation under vertical loads. ✓ Articulate the mechanism of primary consolidation
	2	Lecture / Exercise		✓ Understand and appreciate the effect of stress history on consolidation ✓ Differentiate between normal & over-consolidation phenomena.
	3	Lecture / Exercise		✓ Know and determine primary consolidation parameters ✓ Compute primary consolidation
41 [OCT. 7 - 13]	1	Lecture / Exercise	1.4 Secondary Compression	✓ Describe and compute secondary consolidation ✓ Differentiate between the two creep hypotheses
	2	Lecture / Exercise	1.5 Rate of Consolidation	✓ Articulate the fundamentals of rate of consolidation ✓ Be able to derive the fundamental governing equation
	3	Lecture / Exercise		✓ Compute rate of consolidation parameters ✓ Interpret the field implications of rate of settlement
42 [OCT. 14 - 20]	1	Lecture / Exercise	1.6 Oedometer Testing and Result Interpretation	✓ Grasp holistic knowledge of the working mechanism and procedure of oedometer testing; identify data collected, quantities calculated for plotting and parameters up for interpretation.
	2	Lecture / Exercise		✓ Perform settlement computation using oedometer test data
	3	Lab. practice		▪ Perform Oedometer testing and produce a lab report on it
	Assignment 1		Computation of amount and rate of settlement for the Leaning Tower Pisa using Settle3D	
	Mini project		Production of physical model for the Spring-Mass analogy developed by Karl von Terzaghi	
Test 1				

43 [OCT. 21 - 27]	1	Lecture / Exercise	2. Shear Strength of Soils 2.1 Introduction	✓ Articulate the basics of shearing resistance ✓ Revise fundamentals of principal stresses & principal planes ✓ Understand typical responses of soils to shearing forces
	2	Lecture / Exercise	2.2 Failure Criteria	✓ Describe the essence of failure criterion, genesis and its uses ✓ Describe the different temporal loading conditions on soil mass
	3	Lecture / Exercise		✓ Differentiate between Tresca & Mohr-Coulomb failure criteria ✓ Differentiate among other failure criteria
44 [OCT. 28 – NOV. 3]	1	Lecture / Exercise	2.3 Laboratory Tests	✓ Grasp the working mechanism and procedure of direct shear test / unconfined compression / triaxial test; identify data collected, quantities calculated for plotting and parameters up for interpretation.
	2	Exercise		
	3	Exercise		
45 [NOV. 4 - 10]	1	Lecture / Exercise	2.4 Field Tests	✓ Describe the working principles of the different types of field tests available for shear strength determination ✓ Be able to interpret results of vane shear test and CPT test
	2	Lecture / Exercise	2.6 Sensitivity & Thixotropy	✓ Describe and compute sensitivity parameter ✓ Articulate thixotropy phenomena
	3	Lab. practice	➢ Perform direct shear tests and produce a lab report of acceptable standard ➢ Perform unconfined compression & triaxial testing and produce a lab report of acceptable standard	
	Assignment 2		Produce a poster presentation of the various shear strength tests	
46 [NOV. 11 - 17]	1	Lecture / Exercise	3. Lateral Earth Pressure 3.1 Introduction	✓ Describe the purpose, types etc of retaining walls ✓ Differentiate between at rest, active & passive earth pressure
	2	Lecture / Exercise	3.2 Earth pressure theories	✓ Articulate Rankine's theory and learn the expressions for granular & cohesive materials
	3	Lecture / Exercise		✓ Describe the genesis of tension cracks and their implications ✓ Be able to determine critical depth of unsupported cuts in cohesive materials
47 [NOV. 18 - 24]	1	Lecture / Exercise		✓ Describe EP coefficients and their relationship with oedometer testing ✓ Articulate Coulomb's theory
	2	Lecture / Exercise	3.3 More on calculation of EP	✓ Learn the effects of the presence of inclined backfill, uniform surcharge, submergence, soil layering, etc on the computation of EP
	3	Lecture / Exercise	3.4 Graphical methods	✓ Describe and calculate EP using Rebhann's and Culmann's methods
	Assignment 3		Write code for computation of lateral earth pressure under various conditions	
Test 2				

48 [NOV. 25 – DEC. 1]	1	Lecture / Exercise	4. Bearing Capacity of Soils 4.1 Introduction 4.2 Bearing capacity theories	✓ Describe foundation systems in general and shallow foundations in particular. ✓ Articulate plastic failure theory ✓ Articulate Rankine's and Prandtl's bearing capacity theories
	2	Lecture	4.3 Bearing capacity equations	✓ Articulate the general form of bearing capacity equation and the developments in terms of shape & depth factors, inclined loading, ground & base factors
	3	Lecture / Exercise		
49 [DEC. 2 - 8]	1	Lecture		✓ Describe the additional considerations in computation of bearing capacity in terms of choice of soil parameters, effect of ground water table, eccentric loading condition, presence of uplift forces
	2	Exercise		
	3	Exercise		
50 [DEC. 9 - 15]	1	Lecture / Exercise	4.4 BC based on serviceability	✓ Be able to determine bearing capacity from settlement (serviceability) requirement
	2	Lecture / Exercise	4.5 Bearing capacity from in-situ tests	✓ Be able to determine bearing capacity from standard penetration test and plate loading test
	3	Lecture / Exercise	4.7 Introduction to Eurocode	✓ Describe the provisions in the current Eurocode for bearing capacity of soils
	Assignment 4		Develop MS Excel sheet for determination of bearing capacity under different conditions	
51 [DEC. 16 - 22]	1	Lecture / Exercise	5. Soil Slope Stability 5.1 Introduction	✓ Describe the different types of slope failures & their respective causes ✓ Differentiate between finite and infinite soil slopes ✓ Differentiate between long- and short-term stability analyses ✓ Be able to describe the different pore pressure conditions in soil slopes and compute seepage forces
	2	Lecture / Exercise	5.2 Planar failures	✓ Articulate planar translational slips and stability analysis Perform stability analysis based on total and effective stress basis ✓ Articulate the effect of tension cracks in stability of slopes
	3	Lecture / Exercise	5.3 Rotational failures	✓ Perform stability analysis using the Swedish method of slices & its variations
52 [DEC. 23 - 29]	1	Lecture / Exercise	5.4 Slope stability design charts	✓ Be able to perform slope stability analysis using Taylor's charts, Bishop & Morgenstern's charts, etc
	2	Lecture	5.5 Wedge failure	✓ Articulate wedge failure and corresponding stability analysis
	3	Lecture	5.6 Eurocode	✓ Articulate the requirements of Eurocode concerning slope stability
	Assignment 5		Perform soil slope stability analysis using GeoStudio/SLIDE and FLAC-3D/PLAXIS	
Test 3				

[DEC. 30, 2019 - JAN. 10, 2020]	1	Lecture / Exercise	1.3 Janbu's Modulus Concept & Settlement Analysis	Stress-dependent modulus Settlement calculation
	2	Lecture / Exercise		Rate of consolidation
	3	Lecture / Exercise		Oedometer testing & result interpretation
	1	Lecture / Exercise	2.5 Stress-strain paths	
	2	Lecture / Exercise		More on triaxial testing Modulus from triax Triaxial data interpretation
	3	Lecture	2.7 Dilatancy & Liquefaction	
	1	Lecture / Exercise	3.5 NTNU method of calculating earth pressure	Stress fields Su analysis a-ϕ analysis
	2	Lecture / Exercise	4.6 Bearing capacity from stress fields	Su analysis a-ϕ analysis
	3	Lecture / Exercise	5.4 Slope stability design charts	NTNU charts
	1	Lecture / Exercise	6. Fundamentals of Unsaturated Soil Mechanics	6.1 Peculiar Phenomena in the Framework of Unsaturated Conditions 6.2 Stress Variables for Unsaturated Soils 6.3 Conduction Phenomena in Unsaturated Media
	2	Lecture / Exercise		6.4 Macroscopic Physical Behavior of Unsaturated Soil Mass 6.5 Earth Pressure for Partially Saturated Soils 6.6 Bearing Capacity of Partially Saturated Soils
	3	Lecture / Exercise		6.7 Stability Issues in Unsaturated Soil Slopes
JAN. 11		**Submission and defense of semester-based mini-project**		
JAN. 13 - 27		**Final Examination**		