



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani
Pilani Campus
Instruction Division

FIRST SEMESTER 2015-2016

Course Handout (Part II)

Date: 12/01/2016

In addition to part I (General Handout for the course appends to the time table) this portion gives further specific details regarding course.

Course No. : CE F243

Course Title : Soil Mechanics

Instructor In-Charge : Ravi Kant Mittal

Instructor : Kamlesh Kumar, Shibani K Jha, R. Srinivas, Manpreet Singh, Gauravdeep Singh Gill

❖ **Scope & Objective of the Course:**

Soil Mechanics deals with the study of soil as foundation/ construction material, its behavior and engineering properties under stresses. Without the knowledge of soils properties, behaviour and its use as a foundation/ construction material, it is very difficult to plan, estimate, or start any civil construction work. The present course is intended to cover the most essential aspects of soil as an engineering material, and the application of principles derived to the basic civil engineering design. Techniques to evaluate soil properties are introduced by the experimental work in the form of laboratory and field work.

❖ **Text Books:**

- T1.** Gopal Ranjan, and A. S. R. Rao, "Basic and Applied Soil Mechanics", New Age International Publishers, 3rd edition, 2015
T2. Bowles, J.E. "Engg. Properties of Soils & Their Measurement", McGrawHill, 4th ed., 1992.

❖ **Reference Books**

- R1.** Holtz, R.D., Kovacs, W.D. and Sheahan, T.C.(2013) "Geotechnical Engineering" Pearson, Second edition
R2. Knappett, J. , Craig, R.F. Craig's Soil Mechanics, Eighth Edition, CRC Press, 2012.

❖ **Course Plan**

Lec. No.	Learning Objectives	Topic to be covered	Ref.
2	Soil Terminology	Preview of Geotechnical Problems in Civil Engineering and Infrastructure development, Geological origin & soil formation, soil deposits of India	T1:Ch1
4	Index Properties	Phase diagram, Index properties of soils and interpretation.	T1:Ch2
2	Soil Classification	IS Classification of soils, field identification and its applications.	T1:Ch3,
2	Clay mineral & Soil Structure	Soil structure and fabric, Clay mineral and behavior of clay, adsorbed water, diffuse double layer, Soil Structure and fabric	T1: Ch4
4	Compaction of soil	Compaction characteristics, water content - dry unit weight relationships, compaction theory, factors affecting compaction, comparison of dry of optimum and wet of optimum compaction and selection, relative compaction, field compaction, specification and control. Different techniques for compaction of existing deeper soil layers such as dynamic compaction, vibro-compaction, vibroflotation etc.	T1:Ch5, R1: Ch5
3	Effective Stress & Permeability of Soil	Effective stress principle, Darcy's law, permeability of soil and its measurement, factors affecting permeability	T1:Ch6
3	Seepage Through Soil	Seepage forces, quick sand condition, Flow net, flow through dams, Filter design, design of geosynthetics filter and applications.	T1:Ch7
4	Stress Within Soil due to Applied Loads	Stresses due to different type of applied loading, Boussinesq equations, Newmark chart, & Westergaard's equation.	T1:Ch8
5	Consolidation	Compressibility and consolidation characteristics, maximum past stress, OCR, determination of coefficients of consolidation and secondary compression (creep), consolidation under construction loading, 3-D consolidation theory, sand drains, PVD.	T1:Ch9
4	Shear Strength of Soil	Mohr Coulomb theory, Shear strength and its measurement by direct shear, triaxial, UCS, vane shear tests, & Shear strength parameters, UU, CU, CD,	T1:Ch10 R1:Ch12



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		behaviour of loose and dense sands, NC and OC soils, stress path, Skempton's pore pressure parameters, selection of shear strength parameters	
4	Soil Exploration and field testing	Site investigation methods, guidelines for number of boreholes and depth of exploration, Drilling techniques, Sampling techniques, <i>In-situ</i> field testing such as SPT, DCPT, SCPT, PMT, PLT, VST, geophysical explorations techniques and dynamic tests. Interpretation of field test results.	T1:Ch19, R1: Ch11,13
5	Settlement Analysis	Component of settlement, Immediate settlement, elastic theories, Consolidation & creep settlements, computation of horizontal displacement, tilt and rotation of foundations, methods based on in-situ tests using.	T1:Ch15.7, Ch8:R2, Ch13,14

Total Lectures = 42

❖ **Laboratory Components:**

<i>Sl. No.</i>	<i>Name of Experiment</i>	<i>Ref. to Ch. of T2</i>
1.	Field Density of soil by sand replacement & core cutter methods	10
2.	Specific Gravity & Relative Density	7, IS2720-Part14
3.	Grain Size Distribution by Sieve analysis and soil classification	5
4.	Hydrometer	6
5.	Atterberg Limits	3
6.	Compaction Properties of Soil	9
7.	Permeability of Soil	12
8.	Un-confined compression strength test	14
9.	Direct Shear Test	17
10.	C. B. R. test	19
11.	Standard Penetration Test (SPT)	IS2131
12.	Dynamic Cone Penetration Test (DCPT)	IS4968

Note: Experiment 10 (SPT) and 11 (DCPT) will be performed on Sunday's/ holidays.

❖ **Evaluation Scheme:**

<i>Evaluation Component</i>	<i>Duration</i>	<i>Weightage (%)</i>	<i>Date & Time</i>	<i>Nature of Component</i>
Mid semester Test	90 min.	25	16/3 2:00 -3:30 PM	OB
Laboratory/field Work	-	20	Continuous	OB/CB
Tutorials	-	20	Continuous	CB
Comprehensive Examination	3 hours	35	9/5 FN	CB

- ❖ **Chamber Consultation Hour:** To be announced in the class.
- ❖ **Make-up Policy:** Make-up would be granted only for genuine cases with **prior permission**.
- ❖ Reading assignments will be given whenever necessary.
- ❖ **Notices:** All concerning notices will be displayed on Civil Engineering Notice Board only.

Instructor In-Charge



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