Semester	**:**	**III**		
Course No.	**:**	**SWCE-232**	**Credit Hrs.**	**: 2(1+1)**
Course Title	**:**	**Soil Mechanics**		

SYLLABUS

Objectives : To make the students acquainted with the Principles of Soil Mechanics and the calculation of different stresses in soil, which will be helpful in designing the retaining walls and other engineering structures.

THEORY

Introduction to Soil Mechanics, Field and scope of Soil Mechanics; Phase diagram, Physical and index properties of soil, Particle size distribution, Grain size distribution curve, Soil indices; Plastic limit, liquid limit, shrinkage limit; Classification of soils, Effective and neutral stress, Boussinesq and Wester-guard's analysis, New-mark's influence chart, Stress distribution and diagrams; Shear stress, Mohr's circle, Direct shear stress, Triaxial test and Vane shear test; Mohr coulomb failure theory, Effective stress principle, Determination of shear parameters by direct shear test, Triangle test and vane shear test. Numerical Exercise based on various types of tests Compaction of soils, Standard and modified protector test, Abbot's compaction and Jodhpur mini compaction test, Field compaction method and Control; Consolidation of soils, Terzaghi's theory of one-dimensional consolidation, Spring analogy, Laboratory consolidation test, Calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method. Earth pressure: Plastic equilibrium in soils, Active and passive states, Rankine's theory of earth pressure, Active and passive earth pressure for cohesive soils, Simple numerical exercises; Stability of slopes: Introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number, Friction circle method.

PRACTICAL

Determination of moisture content of soil sample; Determination of specific gravity of soil sample; Study of field density by core cutter; Study of bulk density, dry density by sand replacement method; Determination of grain size distribution of coarse grained soil by sieving; Determination of grain size by hydrometer method; Determination of liquid limit by Casagrande apparatus; Determination of liquid limit by cone penetrometer; Determination of plastic limit of soil specimen; Determination of shrinkage limit of soil; Determination of optimum moisture content of saturated soil by Abbot's compaction test; Determination of optimum moisture content of saturated soil by Proctor's mould; Consolidation characteristics of soil; Shear strength of soil by direct shear test; Shear strength of soil by tri-axial shear test.

TEACHING SCHEDULE

THEORY [SWCE-232]

Lecture No.	Topic	Sub-topics/ Key Points	Weightage (%)
1	Soil Mechanics	Introduction to Soil Mechanics, Field and Scope of Soil Mechanics	5
2	Soil Properties	Soil as a three-phase system or diagram, Physical properties of soil (void ratio, porosity and degree of saturation, functional relationships and numerical)	5
3		Index properties of soil: Water content, Specific gravity, Particle size distribution, Consistency limits, *In-situ* density and Density index.	5
4		Particle size distribution, Grain size distribution curve, soil indices; Plastic limit, Liquid limit, Shrinkage limit	5
5		Classification of soils: Particle size classification, Textural classification Highway Research Board classification and Unified Classification	5
6	Soil Stresses	Effective and natural stress: Modes of water, capillarity and stress condition in soil	5
7		Boussinesq and Wester-guard's analysis, New-mark's influence chart	5
8 - 9		Mohr's circle, direct shear stress, triaxial test and vane shear test; Mohr coulomb failure theory, Effective stress principle, Determination of shear parameters by direct shear test, triangle test and vane shear test	10
10 - 11	Compaction of Soils	Standard Proctor Test, Modified Proctor Test, Abbot Compaction Test, Jodhpur Mini Compaction test, Field compaction methods and Field compaction control	15
12 - 13	Consolidation of Soil	One-dimensional consolidation, Spring analogy, Tergazi's theory of one-dimensional consolidation, Laboratory consolidation test, Calculation of voids ratio and coefficient of volume change, Taylor's and Casagrande's method.	15
14 - 15	Earth Pressure	Plastic equilibrium in soils, Active and passive states, Rankine's theory of earth pressure, Active earth pressure for cohesive soils, Passive earth pressure for cohesive soils. Simple Numerical Exercises.	15
16	Stability of Slopes	Introduction to Stability analysis of infinite slopes, Finite slope. Friction circle methos, Taylor's stability number, Friction circle method.	10
		Total =	**100**

TEACHING SCHEDULE

PRACTICAL [SWCE-232]

Exercise No.	Exercise Title
1	Determination of moisture content of soil sample.
2	Determination of specific gravity of soil sample.
3	Study of field density by core cutter.
4	Study of bulk density, dry density by sand replacement method.
5	Determination of grain size distribution of coarse-grained soil by sieving.
6	Determination of grain size by hydrometer method.
7	Determination of liquid limit by Cassagrande apparatus.
8	Determination of liquid limit by cone penetrometer.
9	Determination of plastic limit of soil specimen.
10	Determination of shrinkage limit of soil.
11	Determination of optimum moisture content of saturated soil by Abbot's compaction test.
12	Determination of optimum moisture content of saturated soil by Proctor's mould.
13	To study the Consolidation characteristics of soil.
14	Determination of hydraulic conductivity of soil by constant head methods.
15	Shear strength of soil by direct shear test.
16	Shear strength of soil by tri-axial shear test.

Suggested Readings [SWCE-232]:

1. Punmia B.C., Jain A.K. and Jain A.K. 2005. Soil Mechanics and Foundations. Laxmi Publications (P) Ltd., New Delhi.
2. Ranjan G. and Rao A. S. R. 1993. Basic and Applied Soil Mechanics. Welley Easters Ltd., New Delhi.
3. Singh A. 1994. Soil Engineering. Vol. I. CBS Publishers and Distributions, New Delhi.