

**Course Name** : Civil Engineering Group. **Course Code** : CE/CS/CR/CV

**Semester** : Fourth

**Subject Title** : Geo-Technical Engineering **Subject Code**: 9047

**Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
TH	TU	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
03	--	02	03	80	20	--	--	25@	125

**Rationale:**

Every engineering structure such as building, bridges, dams, towers, monuments etc are supported by soil and rock. The stability of these structures depends upon behaviors of soil and capacity of soil to carry loads under different environmental conditions.

The soil & rock is also used as construction materials for embankments, roads, dams, mud walls etc.

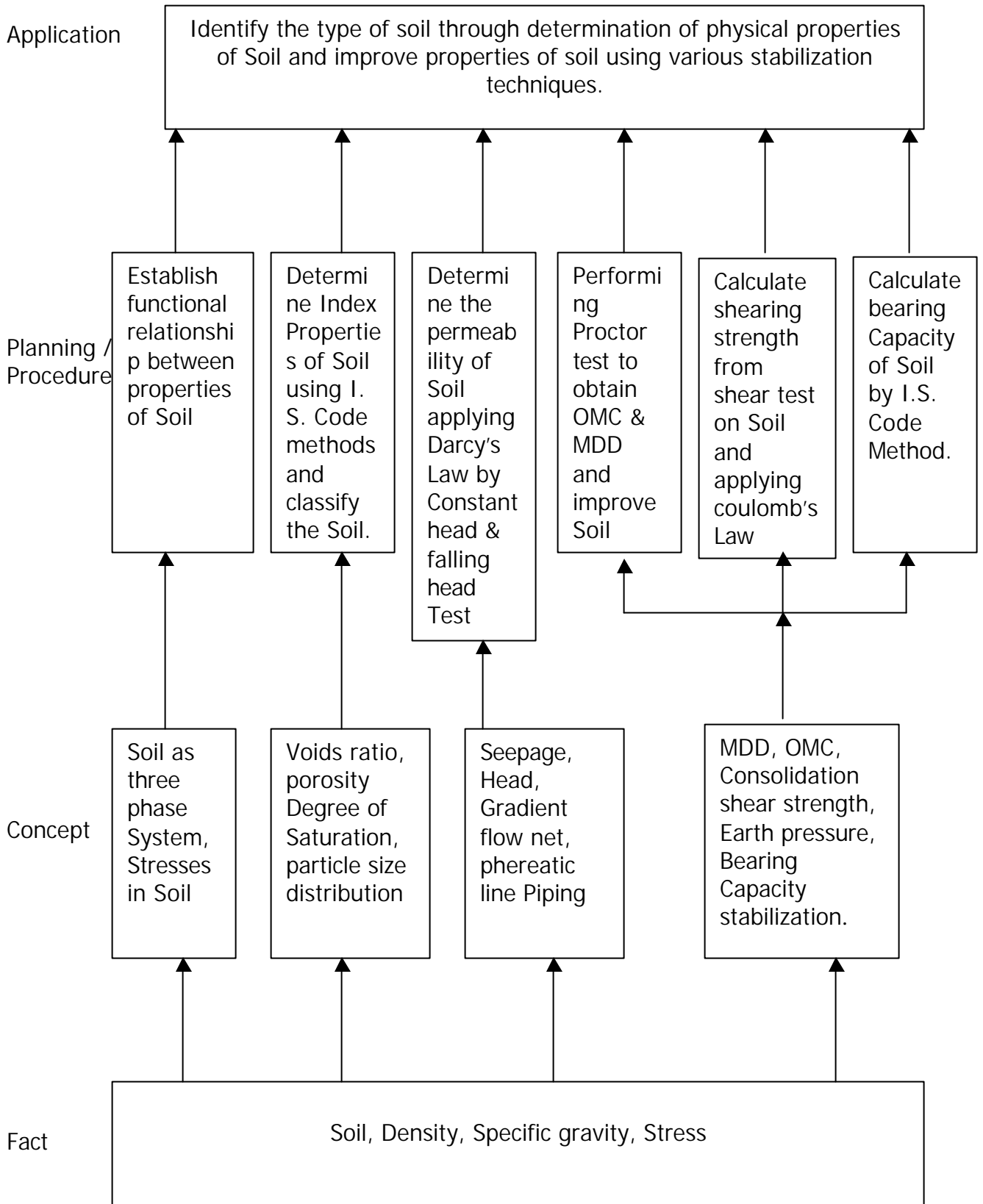
Thus it becomes mandatory to learn this subject which includes knowledge of physical properties, classification of soil, its behaviors and various techniques to improve soil properties.

**Objectives:**

Students will be able to:

- 1) Explain soil as three phase system and establish relationship between properties of soil.
- 2) Determine properties of soil by following standard test., procedure and plot particle size distribution curve.
- 3) Determine permeability by constant head and falling head test using Darcy's Law
- 4) Obtained OMC & MDD for any soil sample by performing Proctor Compaction test.
- 5) calculate shearing strength of soil, using Coulomb's law

**Learning Structure:**



## Contents: Theory

Chapter	Name of the Topic	Hours	Marks
01	<b>Overview Geotechnical Engineering</b> 1.1 IS definition of soil 1.2 Importance of soil in Civil Engineering as construction material in Civil Engineering Structures, as foundation bed for structures 1.3 Field application of geotechnical engineering foundation design, pavement design, design of earth retaining structures, design of earthen dams (brief ideas only)	02	02
02	<b>Physical Properties of Soil</b> 2.1 Soil as a three phase system 2.2 Water content, Determination of water content by oven drying method as per IS code 2.3 Void ratio, porosity and degree of saturation, density index 2.4 Unit weight of soil mass – bulk unit weight, dry unit weight, unit weight of solids, saturated unit weight, submerged unit weight 2.5 Determination of bulk unit weight and dry unit weight by core cutter method and sand replacement method as per IS code 2.6 Specific gravity, determination of specific gravity by pycnometer. 2.7 Consistency of soil, stages of consistency, Atterberg's limits of consistency viz. Liquid limit, plastic limit and shrinkage limit, plasticity index. 2.8 Determination of liquid limit, plastic limit and shrinkage limit as per IS code. 2.9 Particle size distribution, mechanical sieve analysis as per IS code particle size distribution curve, effective diameter of soil, Uniformity coefficient and coefficient of curvature, well graded and uniformly graded soils. 2.10 Particle size classification of soils & IS classification of soil	12	20
03	<b>Permeability of Soil &amp; Seepage Analysis</b> 3.1 Definition of permeability 3.2 Darcy's law of permeability, coefficient of permeability, typical values of coefficient of permeability for different soil 3.3 Factors affecting permeability 3.4 Determination of coefficient of permeability by constant head and falling head permeability tests, simple problems to determine coefficient of	06	12

	<p>permeability.</p> <p>3.5 Seepage through earthen structures, seepage velocity, seepage pressure, phreatic line, flow lines and equipotential lines.</p> <p>3.6 Flow net, characteristics of flow net, application of flow net (no numerical problems)</p>		
04	<p><b>Shear Strength of Soil</b></p> <p>4.1 Shear failure of soil, field situation of shear failure</p> <p>4.2 Concept of shear strength of soil</p> <p>4.3 Components of shearing resistance of soil – cohesion, internal friction</p> <p>4.4 Mohr-coulomb failure theory, Strength envelope, strength equation</p> <p>4.5 Purely cohesive and cohesionless soils</p> <p>4.6 Laboratory determination of shear strength of soil – Direct shear test, Unconfined compression test &amp; vane shear test, plotting strength envelope, determining shear strength parameters of soil</p>	06	10
05	<p><b>Bearing Capacity of Soils</b></p> <p>5.1 Concept of bearing capacity, ultimate bearing capacity, safe bearing capacity and allowable bearing pressure</p> <p>5.2 Terzaghi's analysis and assumptions made.</p> <p>5.3 Effect of water table on bearing capacity</p> <p>5.4 Field methods for determination of bearing capacity – Plate load test and standard penetration test. Test procedures as Per IS:1888 &amp; IS:2131</p> <p>5.5 Typical values of bearing capacity from building code IS:1904</p> <p>5.6 Definition of active earth pressure and passive earth pressure, structures subjected to earth pressure in the field</p>	06	10
06	<p><b>Compaction of Soil &amp; Stabilization</b></p> <p>6.1 Concept of compaction, purpose of compaction field situations where compaction is required.</p> <p>6.2 Standard proctor test – test procedure as per IS code, Compaction curve, optimum moisture content, maximum dry density, Zero air voids line.</p> <p>6.3 Modified proctor test</p> <p>6.4 Factors affecting compaction</p> <p>6.5 Field methods of compaction – rolling, ramming &amp; vibration and Suitability of various compaction equipments.</p> <p>6.6 California bearing ratio, CBR test, significance of CBR value</p> <p>6.7 Difference between compaction and consolidation</p>	10	16

	6.8 Concept of soil stabilization, necessity of soil stabilization 6.9 Different methods of soil stabilization – Mechanical soil stabilization, lime stabilization, cement stabilization, bitumen stabilization, fly-ash stabilization		
07	<b>Site Investigation And Sub Soil Exploration</b> 7.1 Necessity of site investigation & sub-soil exploration. 7.2 Types of exploration – general , detailed. 7.3 Method of site exploration open excavation & boring 7.4 Criteria for deciding the location and number of test pits and bores 7.5 Disturbed & undisturbed soil samples for lab testing. 7.6 Field identification of soil – dry strength test, dillitancy test & toughness test 7.7 Empirical correlation between soil properties and SPT values.	06	10
	Total	48	80

### Practical-

Skills to be developed:

Intellectual Skills:

- a. Identify properties of soil.
- b. Interpret test results
- c. Follow IS procedure of testing

Motor Skills :

- a. Measure the quantities accurately
- b. Handle the instruments carefully

### List of Practical (Any ten)

1. Determination of water content of given soil sample by oven drying method as per IS Code.
2. Determination of bulk unit weight dry unit weight of soil in field by core cutter method as per IS Code.
3. Determination of bulk unit weight dry unit weight of soil in field by sand replacement method as per IS Code.

5. Determination of Liquid limit & Plastic limit of given soil sample as per IS Code.
6. Determination of grain size distribution of given soil sample by mechanical sieve analysis as per IS Code.
7. Determination of coefficient of permeability by constant head test
8. Determination of coefficient of permeability by falling head test  
Practical (Live demo or Prerecorded demo)
9. Determination of shear strength of soil using direct shear test.
10. Determination of shear strength of soil using Laboratory Vane shear test
11. Determination of MDD & OMC by standard proctor test on given soil sample as per IS Code.
12. Determination of CBR value of given soil sample.
13. Determination of shear strength of soil using unconfined compressive strength.
14. Determination of shear strength of soil using tri-axial shear test.

**Learning Resources:**

**Books:**

Sr. No.	Author	Title	Publisher
01	Dr. B. C. Punmia	Soil Mechanics & Foundation Engineering	Standard Book house, New Delhi
02	Murthi	Soil Mechanics & Foundation Engineering	Tata McGraw Hill , New Delhi
03	B. J. Kasmalkar	Soil Mechanics	Pune Vidhyarti Griha, Pune
04	Gulhati & Dutta	Geo-technical Engineering	Tata McGraw Hill , New Delhi