

Subject Code: 1ET4010405	Subject Title: Geotechnical Engineering
Pre-Requisite	----

RATIONALE:

Geotechnical Engineering is a very fundamental subject consisting of determination of various soil parameters theoretically and experimentally based on laws of mechanics. Any civil engineering structure needs strong and stable foundation which depends on proper understanding of soil behavior, determination and interpretation of soil parameters, determination of stresses in soil. The design of any foundation system is based on understanding of soil parameters and its implication based on thorough interaction with type of structure. The course of Geotechnical Engineering provides basic knowledge on soil properties, testing procedures, suitability of test and analytical solutions necessary for design and behavior of soil.

COURSE OBJECTIVE:

Following are the objectives of this course:

- To understand and determine physical and index properties and classification of soil.
- To estimate permeability and shear strength of soil.
- To know the load bearing capacity of soil.
- To learn various soil stabilization and compaction methods.

TEACHING AND EVALUATION SCHEME:

Teaching Scheme (Hours per week)				Evaluation Scheme (Marks)			
Lecture	Tutorial	Practical	Credit	Theory		Practical	
				University Assessment	Continuous Assessment	University Assessment	Continuous assessment
3	-	2	4	60	40	20	30

DETAILS OF COURSE CONTENTS:

S. NO.	TOPIC	Total Hrs.	WEIGHTAGE
1	Introduction of Geotechnical Engineering 1.1 Structure and composition of earth 1.2 Importance of soil in Civil engineering structures and foundation 1.3 State the types of failures due to soil 1.4 General characteristics of different types of soils	02	4%
2	Physical and Index Properties of Soil 2.1 Two phase diagram, Three phase diagram 2.2 Properties of soil like Density, Field density, Dry density, Saturated density, Void ratio, Porosity,	07	16%

	Specific Gravity , Degree of saturation, Moisture content , Density Index 2.3 Derive the following relations for a soil sample from fundamentals 2.3.1 $e = n/n-1$, $n = e/1+e$ 2.3.2 $w \times G = e \times s_r$ 2.3.3 $\gamma_d = \gamma_b / 1+w$ 2.3.4 $\gamma_b = (G + e.s_r) \gamma_w / (1+e)$ 2.3.5 $\gamma_{sat} = (G + e) \gamma_w / (1+e)$		
3	Soil Classification 3.1 Classification of soil (Grain size) as per Indian Standard, Basis /criteria of classification of soils three main categories of soils. 3.2 Mechanical Analysis of soil 3.3 Difference between coarse grained and fine grained Soil on the basis of range of grain size and engineering properties 3.4 Sieves designation as per I.S. code 3.5 Coarse & Fine Sieve analysis, sedimentation analysis 3.6 Grading Curves and different coefficients i.e. CU and CC 3.7 Consistency Limits like Liquid limit, Plastic limit, Shrinkage Limit and Plasticity Index	07	16%
4	Compaction 4.1 Compaction and its Application 4.2 Effects of compaction on different soil properties like permeability, shear strength, soil settlements-stability of embankments. 4.3 Maximum dry density and O.M.C. 4.4 Proctor test 4.5 Factors affecting compaction like water content, nature of soil grading of soil, compaction energy, thickness of layer 4.6 Compaction and Consolidation 4.7 Methods of Field Compaction & various Equipment for compaction	06	15%
5	Permeability & Seepage: 5.1 Permeability & Factors affecting the permeability 5.2 Methods to find Coefficient of Permeability 5.3 Quick sand condition 5.4 Flow net, Its characteristics and application	06	15%

6	Shear Strength 6.1 Shear strength of soil 6.2 Different shear tests used to determine shear strength of soil in laboratory 6.3 Types of soil C-soil, ϕ -soil, C- ϕ soil	05	12%
7	Bearing Capacity of soil 7.1 Different Bearing capacity of soil 7.2 Methods – Plate Load Test, Penetration Test & using C – Φ parameters for determining bearing capacity of soil and to improve bearing capacity of soil 7.3 Foundation on soils of various bearing Capacity 7.4 Liquefaction & Effects of Liquefaction Remedial for Liquefaction	05	12%
8	Soil Investigation & Exploration 8.1 Purposes of exploration of soil 8.2 Program Planning of exploration 8.3 Soil samples and collection. 8.4 Field penetration Test:SPT	04	10%

COURSE OUTCOME:

After completing this course, student will be able to

1. Identify types of sub soil strata of earth.
2. Interpret the physical properties of soil related to given construction activities.
3. Use the results of permeability and shear strength test for foundation analysis.
4. Interpret the soil bearing capacity results.
5. Compute optimum moisture content values for maximum dry density of soil through various tests.

LIST OF PRACTICAL:

SR. No.	Experiment
1	Determine water content of given soil sample by oven drying method.
2	Determine specific gravity of soil by pycnometer method.
3	Determine dry unit weight of soil in field by core cutter method.
4	Determine dry unit weight of soil in field by sand replacement method.
5	Determine Plastic and Liquid Limit along with Plasticity Index of given soil sample
6	Determine grain size distribution of given soil sample by mechanical sieve analysis.
7	Determine coefficient of permeability by constant head test and falling head test.

8	Determine shear strength of soil by direct shear test.
9	Determine MDD and OMC by standard proctor test of given soil sample.

LIST OF REFERENCES:

Sr.no.	Title	Author
1	Soil Mechanics and Foundation Engineering	B.C. Punmia
2	Soil Mechanics and Foundation Engineering	K R Arora
3	Geotechnical Engineering	Kasamalkar, B. J.
4	Soil Mechanics and Foundation Engineering	Murthy, V.N.S
5	Soil Mechanics and Foundation Engineering	Raj, P. Purushothama
6	Geotechnical Engineering	Ramamurthy, T.N. &Sitharam,T.G