

B.E. Semester: VI
Department of Civil Engineering
Subject Name: Geotechnical Engineering – II (CV604-N)
Course Category: Program Course Core (PCC)

A. Objectives of the Course:

- To understand purposes and different phases of a soil investigation, soil exploration program, soil exploration methods and soil identification in the field.
- Discuss the concept of effective stress and determine stress distribution within a soil mass.
- To be aware of various reinforced techniques to enhance soil bearing Capacity of poor soils.
- To understand the soil behaviours before and after application of loads.
- Learn about types and purposes of different foundation systems and structures.
- Be able evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.

B. Teaching & Evaluation Scheme:

Teaching Scheme				Credit	Evaluation Scheme					Total Marks
L	T	P	Total		Theory		IE	CIA	Pra/Viva	
hrs	hrs	hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	
3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus:

1. Basics of foundation:

Types of Foundation, Factors Affecting the Selection of Type of Foundations, Steps in Choosing Types of Foundation

2. Stress Distribution of Soils:

Causes of Stress in Soil, Geostatic Stress, Boussinesque's Equation, Stress Distribution Diagrams, Stresses Due to Circular and Other Loadings, New-Mark's Influence Chart Westergard's Equation, Contact Pressure

3. Soil Exploration:

Objectives of Exploration, Planning of Exploration Program, Soil Samples and Soil Samples, Field Penetration Tests: SPT, SCPT, and DCPT. Introduction to Geophysical Methods, Bore Log and Report Writing

4. Consolidation of Soil:

Introduction, Comparison between Compaction and Consolidation, Initial, Primary & Secondary Consolidation, Spring Analogy for Primary Consolidation, Interpretation of Consolidation Test Results, Terzaghi's Theory of Consolidation, Final Settlement of Soil Deposits, Computation of Consolidation Settlement and Secondary Consolidation

5. Stability of Slopes:

Introduction, Types of Slopes and their Failure Mechanisms, Factor of Safety, Analysis of Finite and Infinite Slopes, Wedge Failure Swedish Circle Method, Friction Circle Method, Stability Numbers and Charts

6. Earth Pressure:

Types of Lateral Earth Pressure, Rankine's and Coulomb's Earth Pressure, Theory and their Application for Determination of Lateral Earth Pressure under Different Conditions, Rebhann's and Culminnn's Graphical Methods of Determination of Lateral Earth Pressures

7. Bearing Capacity of Shallow Foundation:

Introduction, Significant Depth, Design Criteria, Modes of Shear Failures, Detail Study of Bearing Capacity Theories (Rankine, Terzaghi,), Bearing Capacity Determination Using IS Code, Settlement, Components of Settlement & Its Estimation, Permissible Settlement, Allowable Bearing Pressure, Bearing Capacity by Use of Penetration Test Data and by Plate Load Test, Factors Affecting Bearing Capacity Including Water-Table

8. Pile foundations:

Introduction, Load Transfer Mechanism, Types of Piles According to their Composition, Method of Installation and Load Carrying Characteristics of Piles, Piles Subjected to Vertical Loads - Pile Load Carrying Capacity from Static Formula, Dynamic Formulae (ENR And Hiley), Penetration Test Data & Pile Load Test Pile

Group: Carrying Capacity, Efficiency and Settlement. Negative Skin Friction, Under Reamed Pile Foundation

D. Lesson Planning:

Unit No	Title of the Unit	Minimum Hours	Weightage (%)
1	Basics of foundation	02	07
2	Stress Distribution of Soils	05	13
3	Soil Exploration	04	13
4	Consolidation of Soil	06	12
5	Stability of Slopes	06	13
6	Earth Pressure	06	13
7	Bearing Capacity of Shallow Foundation	08	15
8	Pile Foundations	08	15
Total:		45	100

E. List of Practical/Assignments:

Unit No.	Title of the Unit
1	Model pile driving method
2	SPT test
3	Free swell Index
4	Swelling pressure test
5	Tri axial model test

F. Instructional method and pedagogy (Continuous Internal Assessment Scheme CIA):

- At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
- Lecture may be conducted with the aid of multi-media projector, black board, OHP etc.
- Attendance is compulsory in lectures, practical and tutorial which carry 05 marks.

- At regular intervals assignments is given. In all, a student should submit all assignments of 05 marks each.
- Classroom participation and involvement in solving the problems in tutorial rooms carries 05 marks.
- Viva voce will be conducted at the end of the semester of 05 marks.
- One internal exam of 30 marks is conducted as a part of mid semester evaluation.

G. Students Learning Outcomes:

On the successful completion of this course

- The students will gain an experience in the implementation of Geotechnical Engineering on engineering concepts which are applied in field Geotechnical Engineering.
- The students will get a diverse knowledge of geotechnical engineering practices applied to real life problems of designing of structures.
- The students will learn to understand the theoretical and practical aspects of geotechnical engineering along with the design and management applications.
- The students will learn to design the type of foundation based on type of soil and type of loading

H. Recommended Study Materials:

a. Text book & Reference Books:

1. Arora K. R., Soil Mechanics & Foundation Engineering, Standard Publications.
2. Punamia B. C., Soil Mechanics & Foundations, Laxmi Publications,
3. Taylor, John Wiley & Sons, Fundamentals of Soil Engineering
4. Murthy V. N. S., Soil Mechanics & Foundation Engineering, Dhanpat Rai, Engineering
5. Alamsingh; Soil Mechanics & Foundation Engineering; CBS Publishers & Distributors, Delhi
6. Gopal Ranjan & Rao A. S. R., Basic & Applied Soil Mechanics, New Age International Publishers
7. Das Braja M; Principles of Geotechnical Engineering; Thomson Asia Pvt. Ltd.
8. G. H. Davis, Stephen J. Reynolds and Charles F. Kluth, Structural Geology of Rocks and Regions 3rd Edition, Wiley 2012.

9. S. K. Ghosh, Structural Geology: Fundamentals and Modern Developments, Elsevier Ltd, 2013.
10. F. G. Bell, Engineering Geology Second Edition, Elsevier Ltd, 2007.
11. Parbin Singh, Engineering and General Geology, S. K. Kataria & Sons 2010.
12. Shroff A. V., Shah D. L., "Soil Mechanics & Geotechnical Engineering", Oxford-IBH New Delhi.
13. Craig R.F., Chapman & Hall Soil Mechanics

b. Indian Standards:

1. IS 2911-1-4 2010 Code of practice for design and construction of pile foundations, Part 1: Concrete piles, Section 4: Bored precast concrete piles
2. IS 2911-2 1980 Code of practice for design and construction of pile foundations, Part 2: Timber piles
3. IS 2911-3 1980 Code of practice for design and construction of pile foundations, Part 3: Under-reamed piles
4. IS 2911-4 1985 Code of practice for design and construction of pile foundations, Part 4: Load test on piles
5. IS 2950-1 1981 Code of practice for design and construction of raft foundations, Part 1: Design
6. IS 6403 1981 Code of practice for determination of bearing capacity of shallow foundations
7. IS 9640 1980 split spoon sampler
8. IS 10108 1982 Code of practice for sampling of soils by thin wall sampler with stationary piston

c. Web Materials:

1. <http://edudel.nic.in>
2. <http://bis.org.in/other/quake.htm>
3. <https://www.sitegeo.com.au/>
4. <https://www.geotechnicalinfo.com/>
5. <https://www.geoengineer.org/online-library>