MOHAMED SATHAK A J COLLEGE OF ENGINEERING
Siruseri IT park, OMR, Chennai - 603103

LESSON PLAN
Department of Civil Engineering

Name of the Subject	FOUNDATION ENGINEERING	Name of the handling Faculty	Mr. Rakhesh Ramarajan
Subject Code	CE8591	**Year / Sem**	III / V
Academic Year	2022-2023	**Batch**	2020-2024

Course Objective

To impart knowledge on common method of sub soil investigation and design of foundation. At the end of this course student acquires the capacity to investigate the soil condition and to select and design a suitable foundation.

Course Outcome

1. Describe various methods involved in sub soil exploration, Sampler and Sampling Techniques

2. Design the foundation based on the bearing capacity of soil

3. Analyze to Carry out various test involved in settlement of foundation

4. Apply the suitable type of footing for different loading conditions.

5. Analyze various pressure acting on retaining walls

Lesson Plan

Sl. No.	Topic(s)	T / R* Book	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc.)	Blooms Level (L1-L6)	CO	PO
UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION							
1	Scope and objectives, Methods of exploration	T3	1	PPT	L1	CO1	PO1
2	Auguring and boring, Wash boring and rotary drilling	T3	1	BB, PPT	L2	CO1	PO1
3	Depth of boring, spacing of bore hole	T3	1	BB, PPT	L2	CO1	PO2
4	Sampling techniques, Representative and undisturbed sampling, Methods	R3	1	BB, PPT	L3	CO1	PO3
5	Split spoon sampler, thin wall sampler, Stationery piston sampler	R3	2	BB, PPT	L3	CO1	PO3
6	Penetration tests (SPT and SCPT), Bore log report	T3	1	BB, PPT	L1	CO1	PO2
7	Data interpretation, strength parameters and Liquefaction potential	T3	1	BB, PPT	L2	CO1	PO2
8	Selection of foundation based on soil condition.	T3	1	BB, PPT	L1	CO1	PO1
Suggested Activity: Quiz							
Evaluation method: 10 Questions, each carry 1 mark							
UNIT II SHALLOW FOUNDATION							
9	Introduction, Location and depth of foundation Codal provisions	R3	1	PPT	L1	CO2	PO1
10	bearing capacity of shallow foundation on homogeneous deposits	R3	1	BB, PPT	L1	CO2	PO2
11	Terzaghi's formula and BIS formula, factors affecting bearing capacity, problems	R3	1	BB, PPT	L3	CO2	PO2

12	Bearing capacity from in-situ tests (SPT, SCPT and plate load) Allowable bearing pressure	R3	1	BB, PPT	L2	CO2	PO3
13	Seismic considerations in bearing capacity evaluation	R3	2	BB, PPT	L3	CO2	PO2
14	Determination of Settlement of foundations on granular and clay deposits	R3	1	BB, PPT	L2	CO2	PO3
15	Total and differential settlement, Allowable settlements	R3	1	BB, PPT	L2	CO2	PO1
16	Codal provision, Methods of minimizing total and differential settlements.	R3	1	BB, PPT	L1	CO2	PO1

Suggested Activity: Assignment (Bearing capacity Problem)

Evaluation method: Paper Based

UNIT III FOOTINGS AND RAFTS

17	Types of footings	R3	1	BB	L1	CO4	PO1
18	Distinction between Igneous, Sedimentary and Metamorphic rocks.	R3	1	BB	L4	CO3	PO1
19	Contact pressure distribution: Isolated footing	R3	1	BB	L3	CO3	PO3
20	Combined footings	R3	1	BB	L2	CO3	PO2
21	Types and proportioning	R3	1	BB	L1	CO3	PO3
22	Mat foundation, Types and applications	R3	2	BB	L1	CO3	PO2
23	Proportioning, Floating foundation	R3	1	BB	L2	CO3	PO2
24	Seismic force consideration, Codal Provision	R3	1	BB	L2	CO3	PO1

Suggested Activity: Assignment (Design of foundation)

Evaluation method: Paper Based

UNIT IV PILE FOUNDATION

25	Types of piles and their function, Factors influencing the selection of pile	R3	1	BB, PPT	L1	CO4	PO1
26	Carrying capacity of single pile in granular and cohesive soil, static formula	R3	1	BB	L1	CO4	PO1
27	dynamic formulae (Engineering news and Hileys), Capacity from in-situ tests (SPT and SCPT)	R3	2	BB	L2	CO4	PO2
28	Negative skin friction, uplift capacity, Group capacity by different methods (Feld's rule, Converse, Labarra formula and block failure criterion)	R3	2	BB	L3	CO4	PO3
29	Settlement of pile groups, Interpretation of pile load test (routine test only), Under reamed piles	R3	2	BB	L2	CO4	PO2
30	Capacity under compression and uplift.	R3	1	BB	L1	CO4	PO1

Suggested Activity: Quiz

Evaluation method: 10 Questions, each carry 1 mark

UNIT V RETAINING WALLS

31	Plastic equilibrium in soils, active and passive states	R3	2	BB	L1	CO5	PO1
32	Rankine's theory, cohesionless and cohesive soil	R3	1	BB	L1	CO5	PO2
33	Coulomb's wedge theory	R3	1	BB	L1	CO5	PO2

34	Condition for critical failure plane, Earth pressure on retaining walls of simple configurations	R3	2	BB	L2	CO5	PO3
35	Culmann Graphical method	R3	1	BB	L2	CO5	PO1
36	pressure on the wall due to line load, Stability analysis of retaining walls.	R3	2	BB	L3	CO5	PO1

Suggested Activity: Case Studies

Evaluation method: Slope Stability

Content Beyond the Syllabus Planned

1	Tools used to design Dam
2	Tools used in Remote sensing

Text Books

1	Murthy, V.N.S., "Soil Mechanics and Foundation Engineering", CBS Publishers and Distributers Ltd., New Delhi, 2007.
2	Gopal Ranjan and Rao A.S.R. "Basic and Applied soil mechanics", New Age International Pvt. Ltd, New Delhi, 2005
3	Purushothama Raj. P., "Soil Mechanics and Foundation Engineering", 2nd Edition, Pearson Education, 2013
4	Varghese, P.C.," Foundation Engineering", Prentice Hall of India Private Limited, New Delhi, 2005.

Reference Books

1	Das, B.M. "Principles of Foundation Engineering" 5th edition, Thompson Asia Pvt. Ltd., Singapore, 2003.
2	Kaniraj, S.R. "Design aids in Soil Mechanics and Foundation Engineering", Tata Mc Graw Hill Publishing company Ltd., New Delhi, 2002.
3	Punmia, B.C. "Soil Mechanics and Foundations", Laxmi Publications Pvt. Ltd., New Delhi,2005
4	Venkatramaiah, C. "Geotechnical Engineering", New Age International Publishers, NewDelhi, 2007 (Reprint)
5	Arora K.R. "Soil Mechanics and Foundation Engineering", Standard Publishers and Distributors, New Delhi, 2005.
6	IS 6403: 1981 (Reaffirmed 1997) "Breaking capacity of shallow foundation", Bureau of Indian Standards, New Delhi, 1998
7	IS8009 (Part1):1976 (Reaffirmed 1998) "Shallow foundations subjected to symmetrical static vertical loads", Bureau of Indian Standards, New Delhi, 1999
8	IS8009 (Part2):1980 (Reaffirmed 1995) "Deep foundations subjected to symmetrical static vertical loading", Bureau of Indian Standards, New Delhi, 1992
9	IS2911(Part1):1979 (Reaffirmed 1997) "Concrete Piles" Bureau of Indian Standards, New Delhi, 1994
10	IS2911(Part2):1979 (Reaffirmed 1997) "Timber Piles", Bureau of Indian Standards, New Delhi, 2007
11	IS2911(Part 3) :1979 (Reaffirmed 1997) "Under Reamed Piles", Bureau of Indian Standards, New Delhi, 1998
12	IS2911 (Part 4) :1979 (Reaffirmed 1997) "Load Test on Piles", Bureau of Indian Standards, New Delhi, 1997

Website / URL References

1	https://nptel.ac.in/courses/105/101/105101083/
	https://nptel.ac.in/courses/105/108/105108069/
2	https://easyenginering.net/ce6502-foundation-engineering-books/

Blooms Level

Level 1 (L1) : Remembering		Lower Order Thinking	Fixed Hour Exams	Level 4 (L4) : Analyzing			Higher Order Thinking	Projects / Mini Projects
Level 2 (L2) : Understanding				Level 5 (L5) : Evaluating				
Level 3 (L3) : Applying				Level 6 (L6) : Creating				

Mapping syllabus with Bloom's Taxonomy LOT and HOT										
Unit No	Unit Name	L1	L2	L3	L4	L5	L6	LOT	HOT	Total
Unit 1	SITE INVESTIGATION AND SELECTION OF FOUNDATION	3	3	2				8	0	8
Unit 2	SHALLOW FOUNDATION	3	3	2				8	0	8

Unit 3	FOOTINGS AND RAFTS	3	3	1	1			7	1	8
Unit 4	PILE FOUNDATION	3	2	1				6	0	6
Unit 5	RETAINING WALLS	3	2	1				6	0	6
Total		15	13	7				35	1	36
Total Percentage		41.66667	36.11111	19.44444				97.22222	2.777778	100

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2										2	
CO2	3	2	1										2	
CO3	3	2	2										2	
CO4	3	2	2										2	
CO5	3	2	2										2	
Avg	3	2.2	1.8										2	

Justification for CO-PO mapping

CO1	PO1 :Engineering knowledge in Scope and objectives , Methods of exploration, Penetration tests (SPT and SCPT), Bore log report,Selection of foundation based on soil condition. PO2 : Problem analysis inDepth of boring , Spacing of bore hole,Penetration tests (SPT and SCPT), Bore log report,Data interpretation , strength parameters and Liquefaction potential PO3: Design/development of solutions in Sampling techniques , Representative and undisturbed sampling , Methods, PSO1: Sustainable solution for site investigation and selection of foundation.
CO2	PO1 :Engineering knowledge in Introduction ,Location and depth of foundation ,Codal provisions,Total and differential settlement ,Allowable settlements,Codal provision ,Methods of minimizing total and differential settlements. PO2 : Problem analysis inbearing capacity of shallow foundation on homogeneous deposits, Terzaghi's formula and BIS formula, factors affecting bearing capacity, problems,Seismic considerations in bearing capacity evaluation PO3: Design/development of solutions in Bearing capacity from in-situ tests (SPT, SCPT and plate load)Allowable bearing pressure, Determination of Settlement of foundations on granular and clay deposits. PSO1: Sustainable solution for Sallow foundation
CO3	PO1 : Engineering knowledge in Types of footings, Distinction between Igneous, Sedimentary and Metamorphic rocks, Seismic force consideration ,Codal Provision PO2 : Problem analysis in Combined footings, Mat foundation ,Types and applications,Proportioning , Floating foundation PO3:Design/development of solutions in Types and proportioning. PSO1: Sustainable solution for Footing and rafts
CO4	PO1 : Engineering knowledge in Types of piles and their function, Factors influencing the selection of pile, Carrying capacity of single pile in granular and cohesive soil ,static formula , Capacity under compression and uplift. PO2 : Problem analysis indynamic formulae (Engineering news and Hileys) ,Capacity from insitu tests (SPT and SCPT),Settlement of pile groups, Interpretation of pile load test (routine test only), Under reamed piles PO3:Design/development of solutions in Negative skin friction ,uplift capacity, Group capacity by different methods (Feld's rule, Converse , Labarra formula and block failure criterion), PSO1: Sustainable solution for pile foundation
CO5	PO1 : Engineering knowledge in Plastic equilibrium in soils, active and passive states, Culmann Graphical method,pressure on the wall due to line load ,Stability analysis of retaining walls. PO2 : Problem analysis in Rankine's theory, cohesionless and cohesive soil, Coulomb's wedge theory, PO3 :Design/development of solutions in Condition for critical failure plane, Earth pressure on retaining walls of simple configurations PSO1: Sustainable solution for Retaining Walls

3	High level	2	Moderate level	1	Low level

Name & Sign of Faculty Incharge :

Name & Sign of Subject Expert :

Head of the Department   :

Format No :231