ADVANCED FOUNDATION ENGINEERING

Subject Code: **A57011**
Regulations: R15 - JNTUH
Class : IV Year B.Tech CE I Semester

Department of Civil Engineering

BHARAT INSTITUTE OF ENGINEERING AND TECHNOLOGY

Ibrahimpatnam - 501 510, Hyderabad

ADVANCED FOUNDATION ENGINEERING (57011)
COURSE PLANNER

I. COURSE OVERVIEW:

Focuses on geotechnical design of deep foundation, including driven piles, drilled piers, under-reamed piles, cantilever sheet piles, anchored bulk heads. Additional topics include

settlement of footings embedded in sands and clays of infinite thickness, settlement of pile groups resting in sands and clays, stability of cantilever, counterfort retaining walls and foundation on expansive soils.

II. PREREQUISITE(S):

Level	Credits	Periods	Prerequisite
UG	4	5	Geotechnical Engineering, Foundation Engineering

III. COURSE OBJECTIVES:

The objectives of this course are to impart knowledge and abilities the students to:

a. Design a shallow foundation subjected to eccentric & inclined loads.
b. Design of deep foundation i.e., piles based on settlement & bearing capacity criteria.
c. Impart knowledge on earth pressure theories in design of gravity and cantilever retaining wall.
d. Narrate the importance of apparent earth pressure diagrams in design of sheet piles & braced cuts.
e. Design of foundations in Expansive soils.

IV. COURSE OUTCOMES:

1. Analyze the elastic settlement of footings in sands and clays of infinite thickness
2. Ability to learn the settlement of footings in soils of finite thickness
3. Apply knowledge of lateral stability of wells though Terzaghi's analysis.
4. Students should be able to understand earth pressure theories
5. Students should be able to understand the stability of retaining walls
6. Ability to learn stabilization of expansive soils
7. Students should be able to understand the concept of foundations in expansive soils
8. Ability to understand the concept of pile foundation, well foundation, sheet piles and bulk heads.
9. Develop confidence for self education and ability for life-long learning.
10. Can participate and succeed in competitive examinations like GATE, PSU

V. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Exams
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments, Exams
PO3	**Design/development of solutions**: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and	H	Assignments, Exams

	environmental considerations.		
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Discussion
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations .	-	------
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	H	Exams, Assignment, Discussions
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutionsin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	S	Discussions
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe engineering practice.	S	Discussions
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings.	S	Assignment, Discussions
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineeringcommunity and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Discussions
PO11	**Project management and finance**: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary	-	-----
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.	S	Discussions

S – Supportive **H - Highly Related**

VI. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program outcomes		Level	Proficiency assessed by
PSO 1	**ENGINEERING KNOWLEDGE:** Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	H	Lectures, Assignments, Exams
PSO 2	**BROADNESS AND DIVERSITY:** Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	H	Lectures, Assignments, Exams
PSO 3	**SELF-LEARNING AND SERVICE:** Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly.	S	Lectures, Guest Lectures, Discussions, Industrial visits

VII. SYLLABUS:

UNIT – I

Introduction- Bearing capacity of Footing subjected to Eccentric and inclined loading – Meyerthoff's, Hansen's vasic theories- Foundations on layered soils. Elastic settlement of Footings embedded in sands and clays of infinite thickness – Footings on soils of Finite thickness- Schmertamaunn's method, Janbu method.

UNIT – II

Pile foundations – piles groups – settlement of pile groups resting in sands and clays -negative skin friction – under reamed piles. Laterally loaded piles – ultimate capacity of laterally loaded pile Brom's method – Reese and Matlock approach

UNIT – III

Lateral Earth pressure- Rankine- Coloumb's and graphical methods Culmans method – stability of cantilever and counterfort retaining walls.

UNIT-1V

Cantilever and anchored sheet piles, Earth pressure diagram – Determination of Depth of embedment in sand and clays – braced cuts- Earth pressure diagrams – Forces in struts..

UNIT-V

Foundations in Expansive soils – problems in Expansive soils – Mechanism of swelling –swell pressure and swelling potential – Heave – foundation practices – Sand cushion – CNS technique- under–reamed pile Foundations – Granular pile – anchor technique, stabilization of expansive soils..

SUGGESTED BOOKS:

TEXTBOOKS:

1. C. Venkaramaiah Geotechnical Engineering , New Age International Pvt. Ltd , New Delhi, India
2. B. C. Punmia, Ashok Kumar Jain, Arun Kumar Jain (2005), Soil Mechanics and Foundations, Laxmi publications Pvt. Ltd., New Delhi, India.
3. K. R. Arora (2011), Soil Mechanics and Foundation Engineering, Standard Publishers, New Delhi, India.
4. B.M. Das (2007) , Principles of Foundation Engineering , CengageLearningIndiapvt ltd..

REFERENCEBOOKS:

1. Swami Saran (2011) Analysis and design of sub structures, Oxford & IBH publishing co,pvt,ltd, New Delhi.
2. GopalRanjan, A. S. R. Rao (2004), Basic and Applied Soil Mechanics, New Age International Pvt. Ltd. , New Delhi, India.
3. V. N. S. Murthy (2010), Geotechnical Engineering, Marcel Dekkar Inc., New Delhi, India.

NPTEL WEB COURSE:

http://nptel.ac.in/downloads/105108069/

NPTEL VIDEO COURSE:

http://nptel.ac.in/downloads/105108069/#

GATE SYLLABUS:

- **Soil Mechanics:**
  Origin of soils, soil classification, three-phase system, fundamental definitions, relationship and interrelationships, permeability &seepage, effective stress principle, consolidation, compaction, shear strength.
- **Foundation Engineering:**
  Sub-surface investigations- scope, drilling bore holes, sampling, penetration tests, plate load test. Earth pressure theories, effect of water table, layered soils. Stability of slopes-infinite slopes, finite slopes. Foundation types-foundation design requirements. Shallow foundations-bearing capacity, effect of shape, water table and other factors, stress distribution, settlement analysis in sands & clays. Deep foundations–pile types, dynamic &static formulae, load capacity of piles in sands &clays, negative skin friction.

IES SYLLABUS:

- **Soil Mechanics:**
  Properties of soils, classification and interrelationship; Compaction behavior, methods of compaction and their choice; Permeability and seepage, flow nets, Inverted filters; Compressibility and consolidation; Shearing resistance, stresses and failure; soil testing in laboratory and in-situ; Stress path and applications; Earth pressure theories, stress distribution in soil; soil exploration, samplers, load tests, penetration tests.
- **Foundation Engineering:**
  Types of foundations, Selection criteria, bearing capacity, settlement, laboratory and field tests; Types of piles and their design and layout, Foundations on expansive soils, swelling and its prevention, foundation on swelling soils.

VIII. COURSE PLAN:

Lecture No.	Week	Unit	Topics to be covered	Learning Objective	References
1.	1	1	To know the bearing capacity of footings subjected Eccentric and inclined loads	Bearing capacity of footings- Meyerhofs, Hansen and velsic theories	**T2:24.6 T2:24.7 T2:24.8**
2.	1	1			
3.	1	1			
4.	1	1			
5.	2	1			
6.	2	1	Able to understand the foundation an layered soils	Foundations on layered soils.	**T7:12.14**
7.	2	1			
8.	2	1			
9.	3	1			
10.	3	1	To understand the elastic settlement of footings embedded in sands and clays of infinite thickness	Elastic settlement of footing embedded in sands and clays of infinite thickness	**T4:3.10**
11.	3	1			
12.	3	1	Able to understand settlement of footings an soils of finite thickness.	Settlement of footings an soils of finite thickness by schmertmann's and Janbu method.	**T4:3.11 T4:3.12**
13.	4	1			
14.	4	1			
15.	4	1			
16.	4	2	To study the types of pile foundations	Pile foundations	**T1:16.2**
17.	5	2	To understand the load carrying capacity of piles based on static and dynamic pile formulae	Static and dynamic methods	**T1:16.5**
18.	5	2			
19.	5	2			
20.	5	2	To know the load carrying capacity of pile groups in sands and clays	Piles groups	**T1:16.6.2**
21.	6	2			
22.	6	2	To understand negative skin fiction	Negative skin fiction	**T2:26.9**
23.	6	2	To understand under-reamed piles	Under- reamed piles	**T2:26.11**
24.	6	2	Able to analysis settlement of pile groups in sands and clays	Settlement of pile groups	**T1:16.7**
25.	7	2			
26.	7	2			
27.	7	2	Able to analysis ultimate capacity of laterally loaded piles	Laterally loaded piles	**T2:26**
28.	7	2			
29.	8	2			
30.	8	3	Able to understand the Rankine's Theory of earth pressure	Rankine's theory of earth pressure	**T2:20.4**
31.	8	3	Able to understand the coulomb's earth pressure theory.	Coulomb's theory of earth pressure	**T2:23.4**
32.	8	3	Able to understand graphical methods for active earth pressure	Rebhann's&Culmann's methods.	**T2:20.9 T2:20.10**
33.	9	3			
34.	9	3			

35.	9	3			
36.	9	3			
37.	10	3	Able to understand stability of cantilever and gravity retaining wall	Stability of cantilever and gravity retaining wall	**T4:5.13 T2:34.2**
38.	10	3			
39.	10	3			
40.	10	4	To study the cantilever sheet piles and anchored bulk heads	Cantilever sheet piles and anchored bulk head	**T2:21.1-21.2**
41.	11	4	Able to determine the depth of embankment of sheet pile wall in sands and clays	Depth of embankment is sands and clays	**T:21.3-T:21.4**
42.	11	4			
43.	11	4			
44.	11	4			
45.	12	4	Able to design the anchored bulk head by free and fixed earth support method	Design of anchored bulk head by free and fixed earth support methods.	**T2:21.5-21.6**
46.	12	4			
47.	12	4			
48.	12	4			
49.	13	4	To understand the lateral earth pressure in braced cuts and forces in struts	Timbering of trenches earth pressure diagrams and forces in struts	**T4:7.1-7.3**
50.	13	4			
51.	13	4			
52.	13	5	To study foundations on expensive soils and problems	foundations on expensive soils and problems	**T4:10.7**
53.	14	5			
54.	14	5			
55.	14	5	To understand mechanism of swelling swell pressure, swelling potential and swell pressure test	mechanism of swelling swell pressure, swelling potential and swell pressure test	**T4:10.8 T4:10.9**
56.	14	5			
57.	15	5			
58.	15	5	To know the foundation practices	foundation practices	**T4:10.10**
59.	15	5			
60.	15	5	To understand replacement of soils and CNS concept	Replacement of soils and CNS concept	**T5:13.8**
61.	16	5			
62.	16	5	To study under-reamed file foundations	under-reamed file foundation Granular pile, anchor technique	**T5:13.9**
63.	16	5	To study under-reamed file foundations	under-reamed file foundation Granular pile, anchor technique	**T5:13.9**
64.	16	5	To study under-reamed file foundations	under-reamed file foundation Granular pile, anchor technique	**T5:13.9**

IX. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO 1	PO2	PO3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
I	S	H											H		S
II	H	S											H	S	
III				H			S						H	S	
IV												S	S	H	
V			S	S						S			S	H	S

N=None **S=Supportive** **H=Highly related**

X. QUESTION BANK: (JNTUH)

DESCRIPTIVE QUESTIONS:

UNIT-I

SHORT ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Write Generalized Bearing Capacity Equation	Understand	1
2.	What is a shallow footing	Understand	1
3.	What are the modes of failure	Understand	4
4.	What are the various types of settlements of foundation	Understand	8
5.	What factors Hansen general bearing capacity equation take in to account	Understand	1
6.	Bearing capacity, settlement of footing depends on which factors	Understand	1
7.	With what factors bearing capacity increases.	Understand	2
8.	Write mayerhafs bearing capacity equation	Understand	3
9.	What is differential settlement and where it is noticed?	Understand	1
10.	What are the various components of total settlement of a footing	Understand	1

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Determine the maximum & minimum soil pressure under one-way eccentricity? Write Meyerhof's bearing capacity equation of the footing subjected to one-way eccentricity	Remember& Understand	3
2.	Explain the influence of two-way eccentricity on soil pressures & bearing capacity of the footing?	Remember& Understand	4
3.	What is the bearing capacity of the footing resting on layered soils?	Understand	1
4.	Explain eccentric loading on the footing and its effect	Understand	3
5.	Bearing capacity of the footing resting on stronger layer overlying a weaker layer, explain each & every term with suitable figure?	Remember& Understand	2
6.	Bearing capacity of the footing resting on dense sand overlaid by a saturated soft clay?	Remember& Understand	2
7.	What is Hansen bearing capacity analysis	Understand	1
8.	Explain Elastic settlement of footing & explain each term	Remember	2
9.	What is total settlements of foundation and what are its components	Remember	1
10.	Explain consolidation settlement of footing & its importance in various soils?	Remember	5

UNIT-II

SHORT ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	How piles are classified	Understand	4
2.	What is efficiency of pile group	Understand	2
3.	What are various approaches available to estimate the load carrying capacity of pile?	Remember	3
4.	What is under reamed pilesandwhere were they used?	Understand	4
5.	What are the failure pattern of group piles in cohesion soils	Understand& Remember	3
6.	Explain the settlement of piles and pile groups in sands and gravels	Understand& Remember	2
7.	When would you prefer pile foundations?	Understand	5
8.	What is negative skin friction, when does it occur?	Remember	1
9.	Write the classification of piles based on load transfer mechanism ?	Remember	5
10.	What is the relation between settlement of pile group &single pile?	Understand& Remember	5

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	What do you understand by the term efficiency of a pile group? Derive the expression of spacing between friction piles for 100% efficiency of pile group?	Understand	4
2.	Give the methods for determining the settlement of pile group in (i) cohesion less soil and (ii) cohesive soils	Understand	4
3.	Explain the significance of under reams on bearing capacity	Understand	2
4.	Explain the group action of pile in detail	Remember& Understand	3
5.	Discuss the effect of fixity of pile head on deflection and bending moment of lateral loaded piles?	Remember& Understand	8
6.	Discuss the Brom's method for calculating the lateral load capacity of single pile in cohesive and cohesion less soils	Remember& Understand	1
7.	How do you classify pile foundations on the basis of (a) material, (b) influence of pile installation, (c) load transfer and (d) method of installation.	understand& Remember	5
8.	What is 'negative skin friction '? How is it calculated for a single pile and a group of piles in clay?	understand& Remember	3
9.	Explain group action of piles in details	Understand	1
10.	Explain the phenomenon of settlement of pile group in clay	Understand	3

UNIT-III

SHORT ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	What is lateral earth pressure at rest	Understand	4
2.	What is coefficient earth pressure	Understand	3
3.	Name two or three cases where lateral earth pressure is significant in design of structures?	Understand	2
4.	What is active earth pressure	Understand	1
5.	What is passive earth pressure	Understand	2
6.	What are the factors affect lateral earth pressure	Remember	10
7.	What is a sliding wedge	Understand	3
8.	What is critical height	Understand	4
9.	What is basic purpose of graphical methods	Understand	5
10.	What is the range of wall friction	Understand	6

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	What are the assumptions made by Rankine in active earth pressure theory and write the expression for earth pressure coefficients as per rankine?	Understand	1
2.	Clearly explain the difference between the active earth pressure and the passive earth pressure. Give two examples of each kind.	Understand	2
3.	What are the assumptions of Coulombs wedge theory and what is the advantage of Coulombs theory over Rankine's theory	Understand	3
4.	What are the forces acting on a wedge of a soil	Understand	2
5.	Explain the step by step procedure to determine the active earth pressure by culmann's graphical method	Understand	1
6.	What is the basic difference between gravity retaining wall, cantilever and counterfort retaining wall	Understand	4
7.	Explain with neat sketches the situations where retaining walls are provided. List the various types of retaining wall giving the limitations of each with respect to height of backfill?	Understand	5
8.	What are the main advantages of Rebhann and Culmann graphical methods	Understand	4
9.	Derive the expression for active earth pressure coefficients using coulombs theory in cohesion less soil.	Understand	3

UNIT-IV

SHORT ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	What is sheet pile and what is its purpose	Remember	6
2.	What is cantilever sheet pile	Remember	2
3.	What is anchor sheet pile	Remember	4
4.	What are the various types anchored sheet piles	Remember	2
5.	Define Excavation?	Remember	3
6.	The stability of cantilever sheet piles depends on what	Understand& Remember	1
7.	The stability of anchored sheet piles depends on what	Understand& Remember	4
8.	What is the minimum stability number required as factor of safety for anchored sheet pile with free earth support	Understand & Remember	5
9.	Where anchored sheet piles are mostly used	Remember	2
10.	What is the function of struts in braced cut?	Understand & Remember	3

LONG ANSWER QUESTIONS:

S. No	Question	Blooms Taxonomy Level	Course Outcome
1.	Draw the earth pressure diagram for the cantilever sheet pile	Understand	4
2.	Derive the expression for depth of embedment of cantilever sheet pile incohesive soils?	Understand	6
3.	Derive the expression for minimum depth of embedment and maximum bending moment for anchored sheet piles in granular soils using free earth support method?	Understand	3
4.	What is active earth pressure on cantilever walls embedded on cohesive soils	Understand	5
5.	What is braced cuts and why they are provided? what are the advantages & disadvantages of braced cuts	Understand	6
6.	What are the important cases to be considered in stability of braced cuts in saturated clay	Understand	4
7.	Explain lateral earth pressure distribution on braced cuts, draw the apparent pressure diagram for clay & sandy soil	Understand	2
8.	What are the main criteria involves in design of sheet pile wall.	Understand	1
9.	A cut 4.0 m wide 7.0 m deep is proposed in cohesionless soil with φ=370. Sketch the suitable scheme of sheeting and bracing and also determine the maximum strut load. Assume the density of soil as 19kN/m3.	Understand	3
10.	A strutted excavation,2.0 m wide, is made in normally loaded clay of unit weight 18 kN/m3. If the undrained shear strength of clay is 24 kN/m2 and the cut is made up to a depth of 6.0m, check the safety against base failure. Also shown the pressure distribution and scheme of strutting. If the cut is made in stiff fissured clay, what will be the change in the strut load.	Understand	3

UNIT-V

SHORT ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	What are the basic characteristic of expansive soils	Remember	3
2.	What is swelling potential	Remember	4
3.	What is swelling pressure	Understand	2
4.	Define free swell	Understand	3
5.	Write the equation for predicting swelling pressure	Understand& Remember	4
6.	What is swell index	Understand	5
7.	What is expansion index	Remember& Understand	5
8.	How the clays are divided on the basis of crystalline arrangement	Remember& Understand	2

9.	Name various stabilization techniques of expansive soils?	Remember& Understand	3
10.	What is the benefit of using under-reamed piles in expansive soils?	Remember& Understand	4

LONG ANSWER QUESTIONS:

S.No	Question	Blooms Taxonomy Level	Course Outcome
1.	Explain general characteristics of expansive soils in detail	Understand	2
2.	Explain swelling mechanism of expansive soils	Understand	4
3.	Explain the foundation practices in expansive soils	Understand	7
4.	Name different techniques used in identification of expansive soils, explain all the techniques in detail?	Understand	3
5.	What are the various stabilization methods of expansion soils, explain in detail	Understand	2
6.	How the under reamed pile foundation are suitable in expansive spoils, explain in detail.	Understand	4
7.	What is heave? What are the factors that contribute for heaving	Understand	2
8.	What are the three general types of foundations in expansive soils	Understand	5
9.	Explain the equation for predicting swelling pressure& describe the methods for obtaining swelling pressure?	Understand	1
10.	Explain in detail Granular pile Anchor technique	Understand	8

XI. OBJECTIVE QUESTIONS: JNTUH

UNIT-I

1. The minimum depth for all foundations below the natural ground level is [ ]
   A) 500 mm B) 1200mm C) 250mm D) 100mm
2. Net allowable bearing pressure is [ ]
   A) Net safe bearing capacity B) net safe settlement pressure
   C) smaller of A and B D)none of the above
3. The Bearing capacity of a soil depends upon [ ]
   A) Grain of the soil B) size of the footing shape of the footing D) all of these
4. As per IS code maximum permissible differential settlement on clay soil is [ ]
   A) 25mm B) 40mm C) 65mm D) 100mm
5. When the water table is close to the ground surface the bearing capacity of a soil is reduced to
   A) One-fourth B) one-half C) two-third D) three-fourth
6. A square footing of size B, with eccentricity 'e' and load Q acting eccentrically, then 'qmax is given by [ ]
   A) 4Q/3L(B-2e) B) (Q/BL) + 6e/B2L C) Q/BL D) 4Q/3Q(B-2e)
7. The factor of safety for eccentric loading footings an be evaluate by the following Formula [ ]
   A) Skempton B) Hansen's C) Meyerhoff's D) Terzaghi's
8. Skempton's Method is used to find the bearing capacity of footings on the following soils [
   A) Sand Soils B) Pure Cohesive Soils C) Cohesionless soils D) Rocks

9. Bearing capacity of a footing on clay is practically independent of [ ]
   A) Size of Footing B) Properties of Soils C) Ground water table D) Soil Density
10. Eccentrically loaded footings subjected to moments are designed based on Concept [ ]
   A) Useful Width B) Diagonal Length C) Useful Depth D) None

UNIT-II

1. The load carrying capacity of a foundation if it is not back filled is [ ]
   a. Increased B) decreased C) no effect D) zero
2. The failure of a pile foundation is due to [ ]
   a. General shear B) local shear C) mixed shear D) punching shear
3. The diameter of the under reamed bulb is generally_____times the stem diameter. Choose the correct range [ ]
   A) 2 to 3 B) 1.25 to 1.50 C) 1 to 2 D) 3 to 4
4. When the number of bulbs is increased from one to two the capacity of the pile increased by about [ ]
   A)100% B) 75% C)50% D) 25%
5. Which one of the following statements is true?
   A Clays are more porous than sands
   B Pressure of organic matter in a soil decreases the bearing capacity of the soil
   C Aluminous cement is used for foundations in soils with chemical deposits
   D All the above
6. The crushing of wooden fibers caused by the impact of the hammer is referred to As _____
7. Negative friction occurs when a soil layer surrounding a portion of pile shaft_____
8. In a soft / very soft soils piles driving should be_____from Foundation
9. According to "Feld's rule" the value of each pile in pile group is reduced by__
10. Most of the theoretical solutions for laterally loaded piles involve the concept of _____

UNIT-III

1. The minimum number of piles needed in a group of piles to support a column is [ ]
   A) One B) two C) three D) four
2. The lateral earth pressure on a retaining wall
   A is equal to mass of the soil retained B proportional to the depth of the soil C proportional to the square of the depth of the soil D proportional to the internal friction of the soil
   E none of these
3. Rankine's theory of active earth pressure assumes
   A soil mass is homogeneous, dry and cohesionless
   B ground surface is a plane which may be horizontal or inclined
   C back of the wall is vertical and smooth D wall yields about the base E all the above
4. According to Coulomb's wedge theory, the active earth pressure slides the wedge
   A down and outwards on a slip surface B up and inwards on a slip surface
   C horizontal upward and parallel to base D horizontal inward and parallel to base
5. Net allowable bearing pressure is
   A) Net safe bearing capacity B) net safe settlement pressure
   C) smaller of A and B D)none of the above
6. The minimum number of piles needed in a group of piles to support a column is
   A One B two C three D four
7. The ratio of horizontal stress to the vertical stress is called

A. Coefficient of earth pressure B. coefficient of active state C. Coefficient of backfill

8. The state of shear failure accompanying a minimum earth pressure is called the

A. At rest state B. Active state C. Passive state D. None

9. Toe settlements are produced by

A. Loads B. surcharge C. lateral earth pressure D. none

10. When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as

(A) Passive earth pressure (B) Swelling pressure (C) Pore pressure (D) Active earth pressure

UNIT-IV

1. The maximum value of effective stress in the past divided by the present value, is defined as over consolidation ratio (OCR) The OCR of an over consolidated clay is

A less than 1 B 1 C more than 1 DNone of these

2. Pick up the correct statement from the following:

A Sandy clayloam contains highest percentage of sand
B Silty clayloam contains highest percentage of silt
C Stiff boulder clay offers maximum shear strength
D Soft chalk carries least safe load E All the above

3. The clay soil mainly consists of

A Kaolinites B Montomorillonite C Illites DVermiculite EAll the above

4. Pick up the clay soil group which does not swell when wet from the following :

A Kaolinite group B Mite group C Vermiculite group D Montrorillonite group

5. In well foundation the longitudinal forces occur due to forces

A. Tractive forces B. braking forces C. Tractive & braking forces

6. In cantilever sheet piling for cohesive soils the factor of safety is taken between =

A. 1.0 to 2.0 B. 1.0 to 1.5 C. 1.5 to 1.7

7. Width of base slab of cantilever retaining wall approximately is

A. 0.5H-0.7H B. 0.3H – 1.0H C. 0.7H – 1.0H

8. Under-reamed piles are generally

A driven piles B bored piles C precast piles Dall the above

9. Pick up the correct statement from the following:

A. When water table is above the base of a footing, the dry weight m should be used for soil below water table
B. When water table is located somewhat below the base of a footing, the elastic wedge is partly of moist soil and partly of submerged soil, and a suitable reduction factor is used
C. When water table is just at the base of the footing, no reduction factor is used
D. None of these.

10. Pick up the correct statement from the following:

A. Sandy clayloam contains highest percentage of sand
B. Silty clayloam contains highest percentage of silt
C. Stiff boulder clay offers maximum shear strength
D. Soft chalk carries least safe load E. All the above.

UNIT-V

1. The internal molecular attraction of a soil, the cohesion

A decreases as the moisture content increases B)increases as the moisture content decreases
C is more in well compacted clays D)depends upon the external applied load

2. The quantity of seepage of water through soils is proportional to

A coefficient of permeability of soil B total head loss through the soil
C neither (a) nor (b) D both (a) and (b)

3. The ultimate Settlement of a soil is directly proportional to:
   A depth of the compressible soil strata B compressive index
   C void ratio D both (a) and (b) E none of these
4. The seepage force in a soil, is
   A perpendicular to the equipotential lines B proportional to the exit graident
   C proportional to the head loss D all the above
5. A soil has bulk density 230 g/cm^3 and water content 15 per cent, the dry density of the sample, is A 10 g/cm2 B 15 g/cm3 C 20 g/cm3 D 25 g/cm3
6. A compacted soil sample using 10% moisture content has a weight of 200 g and mass unit weight of 20 g/cm^3 If the specific gravity of soil particles and water are 27 and 10, the degree of saturation of the soil is
   A 111% B 556% C 696% D none of these
7. A partially saturated sample of soil has a unit weight of 20 g/cm3 and specific gravity of soil particles is 26 If the moisture content in the soil is 20%, the degree of saturation is
   A 20% B 77% C 93% D none of these
8. Fine grained soils of less than 0.002 mm particles size are classified as
   A. Clay B. Sand C. Silt D. Shale
9. The settlement of a group of friction piles as compared to that of a single pile is _____
10. The length of the pile may vary from m in deep deposit of block cotton soils.----------

XII. GATE QUESTIONS:

1. Explain the term "optimum moisture content". How is it affected by compacting effort?
2. State the factors affecting field compaction of soil?
3. A retaining wall 10m high is proposed to hold dry sand of void-ratio of 0.6. the void-ratio of 0.6. The value of angle of internal friction $\Phi = 30^0$ and specific-gravity of soil grain is 2.7. The back face of wall is vertical and smooth. Top surface of backfill is horizontal. Calculate the magnitude of the total active earth thrust against the wall assuming the wall is free to move. Also show the distribution of earth pressure and point of application of the resultant. Assume unit weight of water = 10 kN/m^3.
4. How many days would be required by a clay stratum 5 m thick, drained at both ends with coefficient of consolidation = 50×10^{-4} cm^2/sec to attain 50% of its ultimate settlement? Given: T50 = 0.197.
5. What is "negative skin friction" and its significance in the design of pile foundation?
6. Describe 'differential free swell' test of soil?
7. Estimate the value of coefficient of permeability for a uniform graded sand of size D_{10} = 0.15mm obtained from sieve analysis. G = 2.67.
8. Calculate active earth pressure at a depth of 3.6 m in a sandy soil with angle of internal friction as 30^0 and having a density of 1.9 gm/cc.?
9. Using Terzaghi theory find the ultimate bearing capacity for a square footing of 2.0 m x 2.0 m placed at depth of 1.2 m below the ground on a pure cohesive soil having density 18 kN/m^3. N_C = 5.7. Use local shear failure conditions. C = 40 kN/m^2.
10. What will be the gross and net safe bearing capacity of sand having $\Phi = 30^0$ and density 2.1 t/m^3 below
    1. 1.0 m wide strip footing

2. 1.0 m x 1.0 m square footing placed at a depth of 1.2 m below the ground. Take factor of safety as 2.5. Take $N_C = 30.14$, $N_q = 18.4$, $N_\gamma = 22.4$.

IES

1. A Clay Soil Sample Is Tested In A Triaxial Apparatus In Consolidated Drained Conditions at a Cell Pressure Of 100kn/M^2. What will be the pore water pressure at a deviator stress of 40 kN/m^2?
   (A) 0 kN/m^2 (B) 20 kN/m^2 (C) 40 kN/m^2 (D) 60 kN/m^2
2. The number of blows observed in a Standard Penetration Test (SPT) for different penetration depths are given as follows:

Penetration of sampler	Number of blows
0 – 150 mm	6
150 – 300mm	8
300 – 450 mm	10

   The observed N value is
   (A) 8 (B)14 (C) 18 (D) 24
3. The vertical stress at some depth below the corner of a 2mx3m rectangular footing due to a certain load intensity is 100 kN/m^2. What will be the vertical stress in kN/m^2 below the center of a 4mx6m rectangular footing at the same depth and same load intensity?
   (A) 25 (B)100 (C)200 (D)400
4. When a retaining wall moves away from the backfill, the pressure exerted on the wall is termed as
   (B) Passive earth pressure (B) Swelling pressure (C) Pore pressure (D) Active earth pressure
5. A footing 2m x 1m exerts a uniform pressure of 150 kN/m^2 on the soil. Assuming a load dispersion of 2 vertical to 1 horizontal, the average vertical stress (kN/m^2) at 1.0m below the footing is
   (A) 50 (B) 75 (C) 80 (D) 100
6. A direct shear stress was conducted on a cohesionless soil (c=0) specimen under a normal stress of 200 kN/m^2. The specimen failed at a shear stress of 100 kN/m^2. The angle of internal friction of the soil (degrees) is
   (A) 26.6 (B) 29.5 (C)30.0 (D)32.6
7. A pile of 0.5m diameter and of length 10m is embedded in a deposit of clay. The undrained strength parameters of the clay are cohesion = 60 kN/m^2 and the angle of internal friction = 0. The skin friction capacity (kN) of the pile for an adhesion factor of 0.6 is
   (A) 671 (B)565 (C) 283 (D)106
8. A saturated clay stratum draining both at the top and bottom undergoes 50 percent consolidation in 16 years under an applied load. If an additional drainage layer were present at the middle of the clay stratum, 50 percent consolidation would occur in
   (A) 2 years
   (B) 4 years
   (C) 8 years
   (D) 16 years
9. A test plate 30cm x 30cm resting on a sand deposit settles by 10mm under a certain loading intensity. A footing 150 cm x 200 cm resting on the same sand deposit and loaded to the same load intensity settles by
   (A) 2.0 mm (B) 27.8 mm (C) 30.2 mm (D) 50.0 mm
10. Consider the following statements:

1. A differential free swell value of 40% indicates a soil with a high degree of expansiveness.
2. A swelling pressure of less than 20 kN/m^2 is not of much consequence.
3. The swelling pressure is a unique parameter for a swelling soil and is not influenced by other factors.

Which of the above statements is/are correct?

(a) 1, 2 and 3 (b)1 and 2 only (c)2 and 3 only (d)1 only

XIII. WEBSITES:

- www.igs.org.in/
- nptel.iitm.ac.in/
- en.wikipedia.org/wiki/Geotechnical_engineering
- www.foundationengineering.com.au/
- www.cdeep.iitb.ac.in/.../Civil%20Engineering/Foundation_Engineering/
- www.geoengineer.org/
- www.issmge.org/
- www.geotechnicalinfo.com/
- www.ejge.com/GVL/
- http://www.asce.org
- http://www.icivilengineer.com
- http://www.construction-guide.in

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  Areas of Interest: Foundation Engineering, Blast Loading in Soil, Soil Plasticity and Constitutive Modeling, Soil-Structure Interaction and Underground Construction in Soil and Rock.

XV. JOURNALS:

	civil.iisc.ernet.in/~geotech/journals.htm	
	http://www.ejge.com/Index_ejge.htm	
	www.igs.org.in/	
	www.igi-global.com/journal/...journal-geotechnical...engineering/1145	
	ascelibrary.org/journal/jggefk	
0970-1141	Thesis Digest on civil Engineering	1987
0973-8061	International Engineering and Techn ology Journal of Civil and Structure	2007
0975-5314	International journal of civil engineering	2009
0975-6744	Journal of information knowledge and research in civil engineering	2009
0976-6308	International journal of civil engineering and technology	2010
2249-426X	International Journal of Civil Engineering and Applications	2011
2249-8753	Recent Trends in Civil Engineering and Technology	2011
2277-5986	World Research Journal of Civil Engineering	2011
2277-7032	International Journal of Structural and Civil Engineering	2012
2278-9987	International Journal of Civil Engineering (IJCE)	2012
2319-6009	International Journal of Structural and Civil Engineering Research	2012
2320-723X	International Journal of Advanced Research in Civil, Structural, Environmental and Infrastructure Engineering and Developing	2013

XVI. LIST OF TOPICS FOR STUDENT SEMINARS:

1. Behavior Of Lateral Resistance Of Flexible Piles In Layered Soils
2. Effect Of Blast Furnace Slag On Soil-Cement Stabilization
3. Effect Of Ph On Physical Properties Of Fine-Grained Soils
4. Engineering Aspects Of Reinforced Soil
5. Investigation Of Strength Properties Of Black Cotton Soil Stabilized With Fly Ash And Geo Reinforcement
6. Permanent & Temporary Soil Retaining Structures
7. Plastic As Soil Stabilizer

XVII. CASE STUDIES / SMALL PROJECTS:

1. Performance studies on California bearing ratio value using geofabrics
2. Strength characteristics of sub grade soils reinforced with geogrids
3. Improvement of cohesive strength of local clay using geotextile by sandwich technology
4. Investigation of strength properties of black cotton soil stabilized with fly ash and geo reinforcement

5. Stabilization of subgrade using geosynthetics
6. The use of geotextiles
7. Application of geotextile to improve the c b r value of subgrade in rural areas
8. Role of geo synthetic in the improvement of strength of soil
9. Failure of foundation due to earthquake