

BACHELOR OF SCIENCE IN CIVIL AND STRUCTURAL ENGINEERING DEGREE  
SECOND SEMESTER EXAMINATIONS 2013/2014 ACADEMIC YEAR

**COURSE CODE: CSE 422**

**COURSE TITLE: FOUNDATION ENGINEERING**

**Instructions to Candidates**

- 1. Answer Question 1 and any other three questions**
- 2. Duration:** Time: 3hrs

**Question 1 (40 marks)**

1(a).A strip footing of width 3m is founded at a depth of 2m below ground surface in soil strata having cohesion  $c=30\text{KN/m}^2$  and angle of shearing resistance  $\phi=30$  degrees. The Water table is at a depth 4m below ground level. The moist weight of soil above water table is  $18\text{KN/m}^3$ . Determine:

- The ultimate bearing capacity of soil (7 marks)
- The net ultimate bearing capacity (6 marks)
- The safe bearing capacity for a factor of safety of 2 (7marks)

(b) If the soil above fails by local shear failure criteria determine the safe net bearing capacity. All other data remains the same (10 marks)

(c) If the water table in (a) occupies a position 1.25m below ground level (assume  $\gamma_{\text{sat}}=19\text{KN/m}^3$ ) what will be the net safe bearing pressure. All other data remains the same. Assume  $R_{w1}=0.81$  and  $R_{w2}=0.5$  (10 marks)

**Question 2 (20 marks)**

- (a).(i) What are piles?(3marks) (ii)Discuss the classification of piles (4marks) and (iii) types of piles according to their composition and method of installation (3marks)
- (b) (i) Explain the three types of Bearing Capacity Failures (3marks). (ii) With the help of diagrams explain Shallow and Deep Foundations (4marks). (iii) How would you determine the type of foundation to be used. (3marks)

**Question No.3 (20 marks)**

A rectangular footing of size 3x6m is founded at a depth of 2m below the ground surface in a homogeneous cohesionless soil having an angle of shearing resistance  $\phi=35$  degrees. The water table is at a great depth. The unit weight of soil is  $\gamma=18\text{KN/m}^3$ . Determine

- (a) (i) Net ultimate bearing capacity (3marks) (ii) Net allowable bearing capacity for a factor of safety  $F_s=3$  (3marks) (iii) The safe load the footing can carry (4marks). Use Terzaghi's Theory
- b) If the soil for the above problem is cohesionless and fails in local shear, determine (i) The ultimate bearing capacity (ii) the net bearing capacity and (iii) net allowable bearing pressure (10 Marks)

**Question 4 (20 marks)**

- What is a foundation?(3marks)
- Explain its function (3marks).

- c) Describe and discuss the procedure for choosing a foundation . (4 marks)
- d) A footing of 2m diameter carries a safe load (including self weight) of 800kN in cohesionless soil. The soil has an angle of shearing resistance  $\phi=36$  degrees and an effective unit weight of  $10\text{kN/m}^3$ . Determine the depth of foundation for  $F_s=2.5$ . Use Terzaghi's general failure criteria (10 marks)

**Question 5 (20 marks)**

- a) ; What are retaining walls?(3marks)
- b) Explain the factors to be taken into account when designing retaining walls (3marks).
- c) With the help of diagrams discuss the different types of retaining walls.(4marks)
- d) What do understand by the term grouting?(3marks)
- e) Discuss the reasons for injecting grout and mention cases where grouting is effective. (4 marks)
- f) Also discuss the different methods of grouting.(3 marks)

**ANNEXE 1**

TERZAGHI'S BEARING CAPACITY FACTORS							
$\phi$	$N_c$	$N_q$	$N_\gamma$	$\phi$	$N_c$	$N_q$	$N_\gamma$
0.0	5.7	1.0	0.0	21.0	18.9	8.3	5.1
1.0	6.0	1.1	0.1	22.0	20.3	9.2	5.9
2.0	6.3	1.2	0.1	23.0	21.7	10.2	6.8
3.0	6.6	1.3	0.2	24.0	23.4	11.4	7.9
4.0	7.0	1.5	0.3	25.0	25.1	12.7	9.2
5.0	7.3	1.6	0.4	26.0	27.1	14.2	10.7
6.0	7.7	1.8	0.5	27.0	29.2	15.9	12.5
7.0	8.2	2.0	0.6	28.0	31.6	17.8	14.6
8.0	8.6	2.2	0.7	29.0	34.2	20.0	17.1
9.0	9.1	2.4	0.9	30.0	37.2	22.5	20.1
10.0	9.6	2.7	1.0	31.0	40.4	25.3	23.7
11.0	10.2	3.0	1.2	32.0	44.0	28.5	28.0
12.0	10.8	3.3	1.4	33.0	48.1	32.2	33.3
13.0	11.4	3.6	1.6	34.0	52.6	36.5	39.6
14.0	12.1	4.0	1.9	35.0	57.8	41.4	47.3
15.0	12.9	4.4	2.2	36.0	63.5	47.2	56.7
16.0	13.7	4.9	2.5	37.0	70.1	53.8	68.1
17.0	14.6	5.5	2.9	38.0	77.5	61.5	82.3
18.0	15.5	6.0	3.3	39.0	86.0	70.6	99.8
19.0	16.6	6.7	3.8	40.0	95.7	81.3	121.5
20.0	17.7	7.4	4.4	41.0	106.8	93.8	148.5