T 8098

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2006.

Fifth Semester

Civil Engineering

CE 1305 — FOUNDATION ENGINEERING

(Common to B.E. (Part - Time) Fourth Semester R 2005)

(Regulation 2004)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

Use of BIS 6403 and 2911 (Part I) is permitted.

PART A — (10 × 2 = 20 marks)

1. What are the functions of drilling mud?

2. Can you perform unconfined compressive strength test on the sample collected in the standard split spoon sampler? Justify your answer.

3. A strip footing, 0.8 m wide carries a load of 80 kN/m and is founded on a clayey soil of unconfined compressive strength of 100 kPa. Find the factor of safety against shear failure as per BIS 6403, ignoring the depth factor.

4. The settlement of plate of size 300 mm on sand for a particular loading intensity is 12.8 mm. Find the settlement of foundation of size 1.5 m on the same sand for the same loading intensity.

5. State the assumptions made in the conventional structural design of footings.

6. State the situations under which mat foundation is adopted.

7. What are the advantages of bored precast pile over a driven cast in-situ pile?

8. A pile group consisting of four piles is in a square pattern with equal spacing in both the directions. Find the c/c spacing in terms of the diameter of the piles, if efficiency of the group is 75% as per Converse-Labarre formula.

9. Say true or false and justify your answer. Greater the depth of tension cracks, greater is the cohesion of the soil.

10. Draw the lateral earth pressure diagram of clay depend for active condition.

PART B — (5 × 16 = 80 marks)

11. (a) (i) Explain the terms inside clearance and outside clearance for a sampler. (6)

(ii) In an infinite sand deposit, standard penetration test was done and the following results were obtained.

Depth from ground level, m	2	4	6	8	10	12
N-value	35	38	42	45	46	49

The water table is at a depth of 2 m below ground level. The specific gravity of solids and void ratio of the sand are 2.7 and 0.7 respectively. Assume the soil above the water table to be dry. If it is proposed to found a continuous footing of width 2 m at a depth of 2 m below the ground level, find the design corrected N-value. (10)

Or

(b) (i) In a clay deposit, the water table is at a depth of 2 m below ground level. It is proposed to adopt a raft foundation of a diameter 5 m for an oil tank at a depth of 1 m below ground level. If the foundation is subjected to a loading intensity of 50 kPa, find the depth of borehole to be made. Unit weight of the soil above and below water table respectively is 18 kN/m^3 and 21 kN/m^3. (11)

(ii) Discuss the advantages and disadvantages of Static Cone Penetration Test over 'Standard Penetration Test'. (5)

12. (a) (i) Find the dimensions of a rectangular footing to carry a design load of 1000 kN with a factor of safety of 3. The foundation is at a depth of 1.2 m below ground level in a clayey soil of unconfined compressive strength of 120 kPa extending for a large depth. The width/length ratio of the footing can be taken as 0.8. Adopt BIS 6403 recommendations. (10)

(ii) What are the different components of settlement? Distinguish between them. (6)

Or

(b) (i) A footing 1.5 m × 1.5 m is placed at a depth of 1.8 m in stratum of saturated clay extending upto a depth of 5 m from the ground level. The unconfined compressive strength, submerged unit weight, liquid limit, and specific gravity of solids of the clay are 110 kPa, 9 kN/m^3 , 40% and 2.65 respectively. Determine the allowable

bearing capacity for the footing if the factor of safety against shear failure is not to be less than 3 and consolidation settlement is not to be more than 75 mm. The ground water table is quite close to the ground level. (10)

(ii) Discuss the limitations of plate load test. (6)

13. (a) (i) Find the plan dimensions of a combined footing to support two columns 250 mm × 250 mm and 300 mm × 300 mm carrying loads of 300 kN and 450 kN respectively. The columns are spaced at 4 m c/c. The first column is on the boundary line. The allowable bearing capacity of the soil is 150 kPa. If the second column is also on the boundary line, find the plan dimensions of another combined footing. (10)

(ii) Draw the contact pressure distribution diagram for flexible and rigid footings resting on sand and clay respectively. (6)

Or

(b) (i) Proportion a strap footing carry loads of 750 kN and 400 kN through columns of sizes 400 mm × 400 mm and 250 mm × 250 mm respectively. The columns are spaced at 5 m c/c and the second column is on the boundary line. The width of the footing could be assumed as 2.2 m. The allowable bearing capacity of the soil is 250 kPa. (6)

(ii) What is meant by floating foundation? Where is it adopted? Find the factor of safety for such a foundation against shear failure. Also find the theoretical settlement of the foundation. (10)

14. (a) (i) A 300 mm diameter and 10 m long concrete pile is designed to carry a safe load of 280 kN with a factor of safety of 2.5 against shear failure. When the pile is driven by a steam hammer of mass 2.2 t with short dolly and cushion and with a height of fall of 750 mm, the penetration in the last 5 blows is observed as 12.5 mm. Verify whether the pile will be able to carry the design load safely using modified Hiley's equation if the efficiency of hammer and coefficient of restitution are 90% and 0.5 respectively. (10)

(ii) Explain the classification of piles based on their function. (6)

Or

(b) (i) A 4-pile group arranged in a square pattern with c/c spacing of 1.0 m is used as a foundation for a column carrying a load of 800 kN. The piles of length 15 m and diameter 300 mm are driven

in sandy soil of unit weight of 19.81 kN/m^3 and angle of internal friction of 36°. The ground water table is at the ground surface. The earth pressure coefficient and angle of wall friction can be taken as 1.5 and 27° respectively. Take N_q = 58 for φ = 36°. Find the available factor of safety against shear failure. Also, find the settlement of the pile group, if the results of pile load test conducted on a single pile are given below.

Load, kN	0	100	200	300	400	500	600
Settlement, mm	0	1.0	2.5	6.0	8.0	15.0	35.0

(12)

(ii) What is meant by negative skin friction? Where does it occur? (4)

15. (a) (i) State the assumptions made in Rankine's earth pressure theory and hence discuss its limitations. (8)

(ii) A 4.5 m high gravity retaining wall that is restrained from yielding, retains sand of angle of internal friction of 30°. The water table is at a depth of 3 m from the top of the backfill. The unit weight of sand above and below water table is 16 kN/m^3 and 19.81 kN/m^3 respectively. Find the total force on the wall per unit length. (8)

Or

(b) A retaining wall 6 m high with a vertical back retains a cohesionless backfill of unit weight 19 kN/m^3 and angle of internal friction 33°. By Culmann's graphical construction, find the total active thrust. The angle of wall friction may be taken as 22°. (16)
