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CS/B.Tech(CE)/SEM-7/CE-703/2009-10

2009

FOUNDATION ENGINEERING

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

GROUP – A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) In sand having relative density of 50%, the type of bearing capacity failure will be

a) general shear failure

b) local shear failure

c) punching shear failure

d) unpredictable.

ii) The standard penetration resistance value N (blows / 30 cm) for general shear failure of bearing capacity is

a) between 10 and 20

b) between 20 and 25

c) greater than / equal to 30

d) less than 30.

iii) The net ultimate bearing capacity on fairly saturated homogeneous cohesive soils is equal to (as per IS code)

a) $c.N_C'.S_C.d_C.i_C$

b) $c.N_C'.S_C.d_C.i_C + \bar{\sigma}\left(N'_q - 1\right).S_q.d_q.i_q$

c) $c.N_C'.S_C.d_C.i_C + \bar{\sigma}\left(N'_q - 1\right).S_q.d_q.i_q + 0{\cdot}5\,\gamma B.N'_\gamma.S_\gamma.d_\gamma.i_\gamma$

d) $5{\cdot}14c.S_C.d_C.i_C$.

iv) Shape factors as per IS 6403-1981 for square footing S_C , S_q , S_γ are respectively

a) 1·3, 1·2, 0·8 b) 1·2, 1·2, 0·8

c) 1·3, 1·2, 0·6 d) 1·3, 1·2, 0·6.

v) According to IS 6403-1981 a shallow foundation is one,

a) whose width is greater than its depth

b) whose depth is greater than its width

c) whose depth is equal to its width

d) none of these.

vi) A shallow foundation is 2 m deep having water table at a depth of 1 m from ground surface. Unit weights of soil above and below the water table are 16 and 18 kN/m^3 and that of water is 9·81 kN/m^3. The effective surcharge at the base level of foundation is

a) 24·19 kN/m^2 b) 24 kN/m^2

c) 25·5 kN/m^2 d) none of these.

vii) The SPT-N value is the no. of blows required to drive the sampler through the last

a) 15 cm b) 30 cm

c) 45 cm d) 50 cm.

viii) The type of sampler used in standard penetration test is

a) Shelby tube sampler b) Piston sampler

c) Split spoon sampler d) any of these.

ix) A pile driven through a fairly compacted and hard stratum and extended a few metres into the hard stratum will behave as a

a) friction pile

b) bearing pile

c) friction cum bearing pile

d) pile of unknown behaviour.

x) The depth of well foundation from the high flood level is at least

a) 1·33 times the deepest scour depth

b) 1·20 times the deepest scour depth

c) 1·25 times the deepest scour depth

d) 1·30 times the deepest scour depth.

xi) The safe load Q_{st} on pile should not exceed

a) $Q_{st} = (0{\cdot}25 f_{CK}) \cdot A_C$

b) $Q_{st} = (0{\cdot}33 f_{CK}) \cdot A_C$

c) $Q_{st} = (0{\cdot}40 f_{CK}) \cdot A_C$

d) $Q_{st} = (0{\cdot}50 f_{CK}) \cdot A_C$.

where, f_{CK} is characteristic strength of concrete and A_C is area of cross-section of concrete pile.

xii) Rise of water table in cohesionless soil up to ground surface reduces the net ultimate bearing capacity by

a) 25% b) 50%

c) 75% d) 90%.

GROUP – B
(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Briefly make a note on selection of depth and bearing capacity determination of well foundations. 5

3. A square pile group passes through a recently constructed fill. The depth of the fill is 3 m. The diameters of the piles are 30 cm and the piles are spaced 90 cm centre to centre. If the soil is cohesive with q_u = 60 kN/m^2 and γ = 15 kN/m^3, compute the total negative frictional load.

4. Explain the effect on bearing capacity of the underlying soil layer which is (i) weaker & (ii) firmer than the contact layer.

5. A reinforced concrete pile with dolly and hammer weighs 30 kN. It is being driven by a drop hammer weighing 40 kN and having an effective fall of 0·8 m. Set per blow is measured as 1·4 cm. Taking total elastic compression as 1·8 cm, e = 0·25 and F_s = 2, determine Q_f and allowable pile load.

6. a) What are the factors that influence the depth and number of exploratory holes ?

   b) What are the different methods of stabilizing bore holes ? 3 + 2

7. Discuss with suitable illustrations the field situations where use of geotextile may be beneficial as a method of ground improvement.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. Calculate the net ultimate bearing capacity of a rectangular footing 2 m ∞ 4 m in plan founded at a depth of 1·5 m below the ground surface. The load on the footing is at an angle of 15° to the vertical and is eccentric in the direction of width by 15 cm. The saturated unit weight of soil is 18 kN/m^3. The soil parameters are : C = 15 kN/m^2 and Φ = 25°. Natural water table is at a depth of 2 m below the ground surface. Corresponding to Φ = 25°, N_C, N_q and N_γ from IS code respectively 20·72, 10·66 and 10·88.

9. A square footing located at a depth of 1·5 m below the ground surface has to carry a safe load of 1000 kN. Find the size of the footing, if the desired factor of safety is 3. The soil has the following property :

   Void ratio = 0·55, degree of saturation = 50%, specific gravity = 2·67, c = 8 kN/m^2 and Φ = 30°, Terzaghi's bearing capacity factors are :

   N_C = 37·16, N_q = 22·46 and N_γ = 19·13.

10. a) The external diameter of a sampling tube is 75 mm. What should be the preferable thickness of tube for sampling in stiff to very stiff clay ?

    b) The observed standard penetration test value in a deposit of fully submerged fine silty sand was 45 at a depth of 6·5 m. The average saturated unit weight of soil is 19·5 kN/m^3. Find the corrected SPT value for dilatancy effect.

    c) Discuss the relation between SPT values and Φ with compactness and relative density of sand. 5 + 5 + 5

11. A 12 m long, 300 mm diameter pile is to be driven in a uniform deposit of sand (Φ = 40°). The water table is at great depth and not likely to rise. The average dry unit weight of sand is 18 kN/m^3. Using N_q value from Berezantav, calculate the safe load capacity of the pile with a factor of safety 2·5. N_q may be taken as equal to 137.

12. a) What is a caisson ? How many types of caisson are there ?

    b) Give neat sketch of a well foundation showing the various components.

    c) Give IRC recommendations for determining thickness of straining of wells. Give the various steps of sinking wells. 4 + 5 + 2 + 4

13. a) Determine the consolidation settlement of the soil foundation system under the action of load intensity of 40 kN/m^2 .

    b) What are the different causes of settlement ? What are the different types of settlement that a shallow foundation can undergo ? 8 + 7