



Name :

Roll No. :

Invigilator's Signature :

**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 :

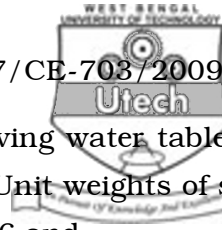
10 × 1 = 10

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
- between 10 and 20
 - between 20 and 25
 - greater than / equal to 30
 - less than 30.
- iii) The net ultimate bearing capacity on fairly saturated homogeneous cohesive soils is equal to (as per IS code)
- $c.N_C' .S_C .d_C .i_C$
 - $c.N_C' .S_C .d_C .i_C + \bar{\sigma} (N_q' - 1) . S_q .d_q .i_q$
 - $c.N_C' .S_C .d_C .i_C + \bar{\sigma} (N_q' - 1) . S_q .d_q .i_q + 0.5 \gamma B.N_\gamma' .S_\gamma .d_\gamma .i_\gamma$
 - $5.14c. S_C .d_C .i_C .$
- iv) Shape factors as per IS 6403-1981 for square footing S_C, S_q, S_γ are respectively
- 1.3, 1.2, 0.8
 - 1.2, 1.2, 0.8
 - 1.3, 1.2, 0.6
 - 1.3, 1.2, 0.6.
- v) According to IS 6403-1981 a shallow foundation is one,
- whose width is greater than its depth
 - whose depth is greater than its width
 - whose depth is equal to its width
 - 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/m³ and that of water is 9.81 kN/m³. The effective surcharge at the base level of foundation is
- a) 24.19 kN/m² b) 24 kN/m²
- c) 25.5 kN/m² 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
- 1.33 times the deepest scour depth
 - 1.20 times the deepest scour depth
 - 1.25 times the deepest scour depth
 - 1.30 times the deepest scour depth.
- xi) The safe load Q_{st} on pile should not exceed
- $Q_{st} = (0.25 f_{CK}) \cdot A_C$
 - $Q_{st} = (0.33 f_{CK}) \cdot A_C$
 - $Q_{st} = (0.40 f_{CK}) \cdot A_C$
 - $Q_{st} = (0.50 f_{CK}) \cdot A_C$
- 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
- 25% b) 50%
 - 75% d) 90%.

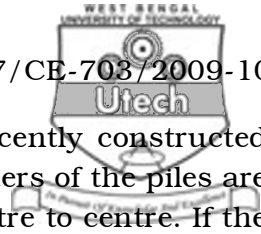
GROUP – B

(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 $q_u = 60 \text{ kN/m}^2$ and $\gamma = 15 \text{ kN/m}^3$, 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 ?
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. $3 \times 15 = 45$

8. Calculate the net ultimate bearing capacity of a rectangular footing $2 \text{ m} \times 4 \text{ m}$ 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 : $C = 15 \text{ kN/m}^2$ and $\Phi = 25^\circ$. Natural water table is at a depth of 2 m below the ground surface. Corresponding to $\Phi = 25^\circ$, 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, $c = 8 \text{ kN/m}^2$ and $\Phi = 30^\circ$, Terzaghi's bearing capacity factors are :

$$N_c = 37.16, N_q = 22.46 \text{ and } N_\gamma = 19.13.$$

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 ($\Phi = 40^\circ$). 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
