Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH (GET)/SEM-1/GTE-103/2012-13

2012

ADVANCED FOUNDATION ENGINEERING-I

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.

[Use of I.S. Codes 2950 & 2911 is permitted]

Answer any *five* questions : 5 × 14 = 70

1. Determine the ultimate and the net safe bearing capacity of the rectangular footing using I.S. Code method. The length of footing is 3 m and the breadth is 2 m. The depth of foundation is 1 m. The average density of the cohesionless soil near the surface is 1·6 T/m^3 and the average density below the base of the footing is 1·9 T/m^3. The *N* values obtained at different depth in the field are given in the following table :

Depth (m) :	0·75	1·5	2·25	3·0	3·75	4·50	5·25	6·0
N Value :	8	10	13	16	15	17	20	23

Given for N = 14, φ = 31° and for φ = 31°, N_q = 14·5 and N_γ = 17.

2. A rectangular footing has a size of 1·8 m × 3 m has to transmit the load of a column at a depth of 1·5 m. Calculate the safe load which the footing can carry at a factor of safety of 3 against shear failure. Use IS code method. The soil has following properties : n = 40%, G = 2·67, w = 15%, c = 8 kN/m^2, φ = 32°. For φ = 32°, N_c = 35·49, N_q = 23·18 and N_γ = 30·22.

   What will be the per cent reduction in the load capacity of the footing, if the water table rises upto (a) base of footing, (b) 1 m below the base of the footing ? Assume that saturated unit weight of soil is 19·5 kN/m^2.

3. a) Discuss the different causes for differential settlement.

   b) What are the corrections made on settlement due to consolidation ?

   c) Discuss the methods that can be used to reduce settlement in buildings.

4. a) A load of 4000 kN is being taken by a square column footing. Side of the column is 3 m, footing rests on a silty soil with a Poisson's ratio = 0·25. Modulus of elasticity of the soil was determined by stressing a sample to 300 kPa. The strain noted is 0·6%. Find the settlement at the centre and at edge of the footing. Assume influence factor for centre = 1·12 and at edge = 0·56.

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

5. a) Discuss the relation between SPT values and φ with compactness and relative density of sand.

   b) Discuss standard penetration test. What are the various corrections ? What is the importance of the test in geotechnical engineering ?

6. a) Determine the net ultimate bearing capacity of a mat foundation measuring 15 m × 10 m on a saturted clay with c_u = 95 kN/m^2, φ = 0, and D_f = 2m.

   b) Estimate the consolidation settlement at the centre of a raft foundation of 30 m × 40 m plan having total dead load + live load = 200 MN. Consider the data given :

   Depth of foundation = 2 m

   Ground w.T. = 4 m from G.L.

   1st layer (sand) (G.L. — 4 m) : γ = 15·7 kN/m^3

   2nd layer (sand) (4 m — 17 m) : γ_{sat} = 19·1 kN/m^3

   3rd layer (Normaly Consolidated Clay) (17 m — 23 m) : γ_{sat} = 18·6 kN/m^3, C_c = 0·28, e_o = 0·9.

4 + 10

7. a) Estimate the consolidation settlement of a 1 m × 2 m foundation with the help of data given :

Depth of foundtion = 1 m

Ground W.T. = 2·5 m from G.L.

q_0 = 150 kN/m^2

1st layer (sand) (G.L. — 2·5 m) : γ = 16 kN/m^3

2nd layer (sand) (2·5 m — 3 m) : γ_{sat} = 17·5 kN/m^3

3rd layer (Normaly Consolidated Clay) (3 m — 5·5 m) : γ = 16 kN/m^3, e_a = 0·8, E_s = 6000 kN/m^2,

C_c = 0·32, μ_s = 0·5, C_c = 0·09.

b) Combined footing 5·7 m long and 2·4 m broad, has two columns at 5 m spacing. If the depth of the footing is 750 mm, examine that we can adopt rigid beam analysis. Assume the modulus of subgrade reaction is 2·5 kg/cm^3. 6 + 8