Bengal Engineering and Science University, Shibpur
B.E. 7th Semester Final Examinations, 2012
Foundation Engineering (CE-702)

Full Marks: 70 **Time: 3 hours**

Use Separate Answer script for each half

FIRST HALF
Answer Q No. 5 and any two from the rest

1.(a) What are the criteria of foundation design?
(b) Is there any guidelines available regarding the mode of failure to be considered in the design of a shallow foundation?
(c) A rectangular footing with plan area of 1.4m x 2m is to be placed at a depth of 2m below the ground surface. The subsoil is clayey, sandy silt with saturated unit weight of 18 kN/m^3 , c′ = 10 kPa and ϕ' = 28°.Compute the magnitude of the load the footing can carry without any risk of shear failure, if the water table is located at the base of the footing. Use IS 6403 recommendations. Given, for for ϕ' = 28°, N'_c = 16.8, N'_q =7.5 and N'_γ=5.0.

(2+2+6)

2.(a) If in Q.1 above, the footing is eccentrically loaded with e_B = 0.2m, estimate the safe load on the footing.
(b) Also obtain and show the pressure distribution underneath the foundation? (5+5)

3.(a) Enumerate the methods of estimation of settlements of footings on cohesionless soils.
(b) Describe the method based on the static cone penetration test
(c) Proportion a combined footing for two columns of (400 x 400) and (300x300) square cross-sections carrying loads of 750 kN and 450 kN respectively. Spaced at 3.5m centres. The heavier column is the exterior column for which the projection beyond the centre line of column is to be restricted to 300mm due to the position of the property line. Proportion a combined footing if it is desired to have uniform pressure distribution under this footing. For the initial design the allowable bearing pressure can be taken as 130 kPa.

(2+4+4)

4.(a) A square footing (6m x 6m), carrying a gross loading intensity of 160 kPa, is located at a depth of 2m in a deposit of medium sand 4 m thick. A soft clay layer 1m thick lies immediately below the sand layer which, in turn, is underlain by a deep layer of silty sand. From oedometer tests on specimens of the clay, the value of $C_c/1+e_0$ is found to be 0.06. The undrained elastic modulus for the clay is estimated to be 55 MN/m^2. Determine the total settlement under the centre of the footing.
(b) For the above problem, if, instead of the upper sand layer, the clay layer extended upto the ground surface, how will the estimated value of the settlement would change?
(c) What other corrections are to be applied to the calculated values of settlements?

(6+2+2)

5. Write short notes on the following (any three): (3x5)

i) Contact pressure below shallow foundations
ii) Usefulness and Limitations of plate load tests
iii) Modes of failure of shallow foundations
iv) Correlation between maximum total and maximum differential settlements
v) Advantages of Mat foundations
vi) Floating foundations
vii) Effect of water table location on bearing capacity
viii) Use of elastic formula for estimation of settlements of footings on cohesionless soils.

SECOND HALF

Answer Q No. 10 and any two from the rest

6.(a) What are the methods of determination of bearing capacity of a single pile?

(b) State the static formula to determine the bearing capacity of a pile in clay soil.

(c) What is group effect and how will you estimate the bearing capacity of a pile group in clay?

(d) A square group of 9 piles was driven into soft clay extending to a large depth. The diameter and length of the piles were 300 mm and 9 m respectively. If the unconfined compression strength of the clay is 90 kN/m^2, and the pile spacing is 900 mm centre to centre, what is the capacity of the group? Assume a factor of safety of 2.5 and adhesion factor of 0.75.

(1+2+3+4)

7.(a) Write a brief note on the Pile driving formula.

(b) A reinforced concrete pile weighing 30 kN (including helmet and dolly) is driven by a drop hammer weighing 30 kN with an effective fall of 0.9 m. The average penetration per blow is 15 mm. The total temporary elastic compression of the pile, pile cap and soil may be taken as 18 mm. Coefficient of restitution is 0.36. What is the safe load on the pile with a factor of safety of 2? Use the Modified Hiley formula.

(4+6)

8.(a) With a neat sketch, describe Well Foundation showing all the component parts.

(b) Enumerate the forces likely to act on a well foundation.

(c) What is 'Grip Length' of well? What are the considerations in the determination of the depth of a well foundation?

(4+2+4)

9(a) (i) Define 'test pile' and 'working pile'

(ii) What are the purposes of 'Initial tests' and 'Routine tests'?

(iii) Describe the 'maintained load method' of load test for a vertical compressive load

(b) The following data were obtained in an initial vertical pile load test on a 300 mm diameter pile:

Load (kN)	5.0	10.0	20.0	30.0	40.0	50.0	60.0
Settlement (mm)	2.5	4.0	9.5	16.5	27.0	40.5	61.0

Plot the load-settlement curve and determine the safe load as per IS: 2911

(6+5)

10. Write short notes on the following (any three): (3x5)

i) Methods of classification of piles.

ii) Cyclic pile load test to separate skin friction, and end bearing.

iii) Different types of caissons.

iv) Undamped natural frequency of a single degree of freedom system.

v) Advantages and disadvantages of bored and cast-in-situ piles.

vi) Negative skin friction.