27.1.09

Ex/BESUS/CE-702/09

B.E. (CE) Part-IV 7th Semester Examination, 2009

Foundation Engineering

(CE-702)

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

Use separate answerscript for each half.

FIRST HALF

(Answer Q.No. 1 and any TWO from the rest.)

1. Answer any five of the following:

(a) State three important assumptions of Terzaghi's analysis.

(b) How can you take into account the effect of one-way eccentricity on the bearing capacity of a footing?

(d) What are the causes of settlement of shallow foundations?

(e) What are the components of total settlement of a shallow foundation? Which component is significant under what field condition?

(f) Illustrate with a neat sketch (i) uniform settlement (ii) differential settlement (iii) angular distortion and (iv) tilt.

(g) Is there any correlation between 'total settlement' and 'differential settlement'? How was the limiting 'total settlement' specified in the codes arrived at? 3x5=15

2. (a) What corrections are to be applied to the calculated values of settlement and why?

(b) Describe the plate load test method of determination of safe bearing pressure of a shallow foundation.

(c) Discuss how would you calculate the consolidation settlement of a footing on overconsolidated clay. 4+3+4=11

3. (a) State Skempton's bearing capacity equation for a shallow footing. Explain the notations used in the equation.

(b) A square footing of width 2.5 m is to be constructed at a depth of 1.5 m below GL. The subsoil consists of a deep stratum of loose sand, which is overlain by a 1 m thick layer of fill material having γ=16 kN/m^3. The properties of sand are as follows:

c=0, φ=25°, γ=17.5 kN/m^3, γ_{sat}=18 kN/m^3

The water table is located at a depth of 2 m below GL. Use Terzaghi's equation to determine the ultimate and safe bearing capacities of the footing. Use a factor of safety of 3. The values of bearing capacity factors for φ=25° are given below:

N_c= 25.1, N_q= 12.7, N_γ = 9.7, N_c'= 14.8, N_q'= 5.6, N_γ'= 3.2 4+7=11

4 (a) Distinguish between general and local shear failures of shallow foundations with the help of sketches of typical load-settlement curve for each case.

(b) Two identical columns of a building, each having a cross-section of 250 mm x 250 mm are spaced at a centre-to-centre distance of 4.5 m from each other. The gross loads on the columns (inclusive of self-weights) are 525 and 750 kN. Due to space restrictions, the footing can not be projected beyond a distance of 0.6 m from the outer edge of the column carrying the greater load. Proportion a suitable trapezoidal combined footing to support the columns. The net allowable bearing pressure may be taken as 60 kN/m^2. 11

5 (a) State the important design requirements for a machine foundation.

(b) Enumerate different types of machine foundations from the structural point of view. Draw typical sketch of each.

(c) Derive the equation of motion of a spring-mass system undergoing free vibration without damping.

(d) Draw typical displacement-vs-time curves for (i) overdamped (ii) underdamped vibrating systems.

3+3+3+2=11

SECOND HALF

(Answer any THREE questions. Two marks are reserved for neatness.)

6. (a) Classify deep foundations.

(b) State the various methods of classification of piles. Which method of classification is rated as the best and why? Give one example for each of the 'large displacement', 'small displacement' and 'non-displacement' piles.

(c) Enumerate the advantages and disadvantages of (i) precast driven piles and (ii) bored and cast-in-situ piles.

(d) Under what circumstances would you recommend the use of under-reamed piles?

[2+4+4+1]

7. (a) Name the various methods of estimating the ultimate bearing capacity of an individual pile.

(b) Discuss the usefulness and limitations of the dynamic pile formulae.

(c) What is negative skin friction? Explain with neat sketch.

(d) A 14.0 m long 400 mm diameter pile is driven in a uniform deposit of sand ($\phi = 36°$). The average dry unit weight of sand is 18 kN/m^3. Using Berezantsev's N_q value of 70, calculate the safe load on the pile. **[1+3+3+4]**

8. (a) How you will estimate the capacity of a group of piles in clay based on 'block failure'.

(b) Explain the procedure for calculating the settlement of a pile group in clay.

(c) A nine pile group arranged in a square pattern is used as a foundation for a column. Piles are, 200 mm diameter and 8.0 m long, embedded in a uniform deposit of medium clay ($q_u = 110$ kN/m^2).
Assuming spacing of piles 500 mm c/c, calculate the safe load on the group. **[4+3+4]**

9. (a) Define 'initial test' and 'routine test'. Also mention the IS code criteria of assessment of safe load from initial load test data.

(b) Explain how cyclic load test data can be utilised to separate skin friction load and end bearing load. **[4+7]**

10. (a) What are the various types of caisson foundations?

(b) Explain with a neat sketch the various components of a typical well foundation.

(c) What are the different shapes of well commonly used? What is the principle followed?

(d) Discuss design criteria as per IS:3955 for fixing the depth of a well foundation.

[2+4+3+2]

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