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53 (CE 816) AFEN

2017

ADVANCED FOUNDATION ENGINEERING

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

Answer **any five** questions.

“Assumptions made should be clearly stated”.

“Use of IS Code is permitted”.

“Illustrate answers with neat sketches whenever required”.

1. (a) Why soil exploration program is necessary? How the depth of boreholes are determined for,

(i) Footings placed far apart

(ii) Footings placed closely

(iii) Raft foundation

(iv) Pile and well foundation?

2+8=10

Contd.

(b) State with diagram how the depth of boreholes for pier foundation is determined. Discuss about the various steps involved in SPT.

4+6=10

2. (a) What are flexible footing and rigid footing? Explain the variation of contact pressure and settlement at the base of flexible and rigid footings.

4+6=10

(b) A strip footing of size $2m \times 2m$ has a tilted base inclined at 10° to the horizontal. Estimate its ultimate bearing capacity assuming unit weight of soil as $18kN/m^3$. Cohesion and internal friction angle is $25kN/m^2$ and 25° respectively. Assume $H=200kN$, $V=600kN$ and the average depth of footing is $0.3m$.

10

3. (a) Design a combined trapezoidal footing for two columns $400mm \times 400mm$ and $300mm \times 300mm$ in section carrying loads of $750kN$ and $450kN$ respectively spaced at $3.5m$ c/c. There is a restriction of extending the footing on the heavier column side by a distance not more than $100mm$. Adopt allowable soil pressure of $130kN/m^2$ for design purposes.

10

(b) A reinforced concrete pile of size $(30 \times 30cm)$ and $10m$ long driven into coarse sand extending to a great depth. The average total unit weight of soil is $18kN/m^3$ and the average N -value is 15. Determine the allowable load on the pile by static formula. Use factor of safety 2.5. The water table is close to ground surface.

10

4. (a) A $8.0m$ long precast driven pile in cohesionless soil is subjected to a vertical load of $800kN$ and a lateral load of $160kN$ at the top of the pile which is $0.2m$ above the ground surface. Determine the maximum moment as well as the depth at which maximum moment occurs. Take, constant of subgrade reaction = $5.24 \times 10^4 kN/m^3$ and $E = 2.24 \times 10^7 kN/m^2$.

10

(b) What is Sheet Pile? What are the different types of sheet piles? Derive the expression for the depth of embedment of a cantilever sheet-pile in granular soils by approximate method of analysis.

2+2+6=10

5. (a) Proportion a strap footing for two columns (400×400) mm and (300×300) mm, carrying loads of 750kN and 450kN respectively spaced at 3.5m c/c. There is a restriction on extending the footing on the heavier column side by a distance not more than 100mm. Assume soil pressure as 130 kN/m^2 . 10

(b) 200mm diameter, 8m long piles are used on foundations for a column in a uniform deposit of medium clay ($q_u = 100 \text{ kN/m}^2$). The spacing between the piles is 500mm. There are 9 piles in the ground arranged in a square pattern. Calculate the ultimate pile load capacity of the group. Assume adhesion factor = 0.9. 10

6. (a) Define the following terms with respect to machine foundations : . $2 \times 5 = 10$

(i) Damping

(ii) Degree of freedom

(iii) Forced vibration

(iv) Amplitude

(v) Resonance.

(b) What are the basic criteria to be satisfied for machine foundations? 4

(c) What are the tests adopted for determination of dynamic properties of soil? Discuss briefly. 6