53 (CE 816) AFEN

2017

ADVANCED FOUNDATION ENGINEERING

Paper : CE 816

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 real sketches whenever required".

1. *(a)* Explain the procedure for conducting soil explorations in the field. How the depth of borehole is effected by significant depth of soil ? 10

(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 the guidelines to be followed while laying out foundation adjacent to the slopping ground ? What is floating raft ? 8+2=10

(b) A strip footing of width $3m$ is founded at a depth of $2m$ below the ground surface in a $(c-\phi)$ soil having a cohesion, $c = 30kN/m^2$ and angle of internal friction, $\phi = 35°$. The water table is at a depth of $5m$ below G.L. The moist at of soil above the water table is $17{\cdot}25\,kN/m^3$. Determine,

(a) The ultimate bearing capacity of the soil

(b) The net ultimate bearing capacity and

(c) The allowable bearing capacity for a factor of safety of 3.

Assume that general shear failure is to be occurred in the soil mass.

6+2+2=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 $3{\cdot}5m$ c/c. There is a restriction on 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) It is required to support a tower on bored piles on a site where stiff fissured clay is affected by seasonal swelling and shrinkage movements to a depth of $1{\cdot}0m$. The unconfined compressive strength of stiff clay increases linearly from $40kN/m^2$ at $1{\cdot}0m$ to $160kN/m^2$ at $8{\cdot}0m$. Design the pile group for a group efficiency of 100%. Assume a total load = $2500kN$ and a F.O.S. equal to 3. 10

4. *(a)* A $8{\cdot}0m$ 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 $0{\cdot}2m$ above the ground surface. Determine the maximum moment as well as the depth at which maximum moment occurs. Take, constant of subgrade reaction = $5{\cdot}24 \times 10^4 kN/m^3$ and $E = 2{\cdot}24 \times 10^7 kN/m^2$. 10

(b) What is sheet pile? What are the different types of sheet piles? Derive the expression for the depth of embedment of a canilever sheet-pile in granular soils by approximate method of analysis. 2+2+6=10

5. *(a)* Proportion a strap footing for two columns $(400 \times 400)mm$ and $(300 \times 300)mm$, carrying loads of $750kN$ and $450kN$ respectively spaced at $3{\cdot}5m$ c/c. There is a restriction on extending the footing on the heavier column side by a distance not more than $100m$. Assume soil pressure as $130kN/m^2$. 10

(b) 200*mm* diameter, 8*m* long piles are used on foundations for a column in a uniform deposit of medium clay $\left(q_u = 100 kN/m^2\right)$. The spacing between the piles is 500*mm*. 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) The successive peaks from a free vibration record obtained from initial displacement (sudden release) test on a block resting on soil are tabulated below :

Time(s)	0	0·02	0·4	0·06	0·08	0·10
Peak amplitude (*mm*)	16	−12	8	−6	4	−3
Time(s)	0·12	0·14	0·16	0·18	0·20	0·22
Peak amplitude (*mm*)	2	−1·5	1·0	−0·75	0·5	−0·38
	0·24	0·26	0·28	0·30		
	0·25	−0·19	0·13	−0·10		

Compute the natural frequency of vibrations of the block and also damping in the foundation. 10

(b) Define the following terms with respect to machine foundations : 2×5=10

(i) Damping

(ii) Degree of freedom

(iii) Amplitude

(iv) Forced Vibration

(v) Resonance.
