Total number of printed pages–5

53 (CE 816) AFEN

2021

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 is the depth of borehole affected by significant depth of soil? 8+2=10

   (b) How are the depth of boreholes determined for raft foundation? Discuss about the various steps involved in SPT. 4+6=10

Contd.

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) 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

3. *(a)* 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 wt. of soil above the water table is $17{\cdot}25kN/m^2$.

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 occurred in the soil mass.

6+2+2=10

(b) 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

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 the 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 cantilever sheet pile in granular soils by approximate method of analysis. 2+2+6=10

5. *(a)* Proportion a strap footing for two columns $(400 \times 400)mm$ 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) $200mm$ diameter, $8m$ long piles are used as foundations for a column in a uniform deposit of medium clay ($q_u = 100kN/m^2$). The spacing between the piles is $500mm$. There are new piles in the ground arranged in a square pattern. Calculate the ultimate pile and capacity of the group. Assume cohesion factor = 0·9. 10

6. *(a)* Define the following terms with respect to machine foundations : 2×5=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 foundation? 4

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