

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 $\phi = 35^\circ$. The water table is at a depth of $5m$ below G.L. The moist wt. of soil above the water table is $17.25kN/m^2$.

Determine —

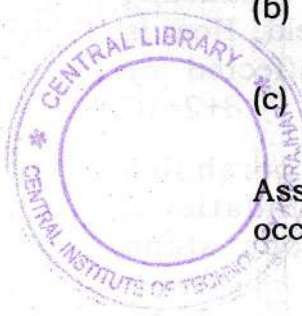
(a) the ultimate bearing capacity of the soil

(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.

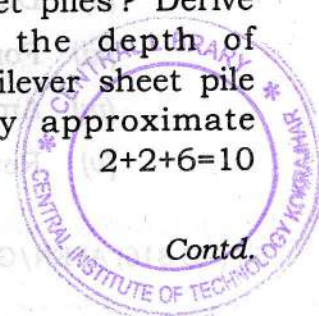
6+2+2=10



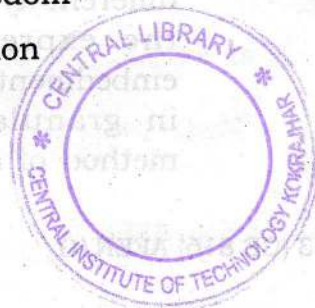
(b) Design a combined trapezoidal footing for two columns $400\text{mm} \times 400\text{mm}$ and $300\text{mm} \times 300\text{mm}$ in section carrying loads of 750kN and 450kN respectively spaced at 3.5m c/c. There is a restriction on extending the footing on the heavier column side by a distance not more than 100mm . Adopt allowable soil pressure of 130kN/m^2 for design purposes. 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 the maximum moment occurs. Take constant of subgrade reaction $= 5.24 \times 10^4\text{kN/m}^3$ and $E = 2.24 \times 10^7\text{kN/m}^2$. 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 $3.5m$ 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 : $2 \times 5 = 10$
- (i) Damping
 - (ii) Degree of freedom
 - (iii) Forced vibration
 - (iv) Amplitude
 - (v) Resonance.



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

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

