

|                     |       |
|---------------------|-------|
| Question Paper Code | 13239 |
|---------------------|-------|

**B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2024**  
 Fifth Semester  
**Civil Engineering**  
**20CEPC501 - FOUNDATION ENGINEERING**  
 Regulations - 2020

Duration: 3 Hours

Max. Marks: 100

**PART - A (MCQ) (20 × 1 = 20 Marks)**  
 Answer ALL Questions

Marks *K-  
Level* CO

1. In site exploration, depth up to which the increase in pressure is likely to cause shear failure is known as \_\_\_\_\_ 1 K1 CO1  
 (a) Failure depth (b) Significant depth  
 (c) Pressure depth (d) Depth of exploration
2. Auger boring is most suitable for \_\_\_\_\_ type of work. 1 K1 CO1  
 (a) Air field pavement (b) Highway exploration  
 (c) Dam construction (d) Buildings
3. The seismic refraction method cannot be used 1 K2 CO1  
 (a) If the wave velocity of lower layer is greater than the upper layer  
 (b) if the wave velocity of lower layer is smaller than the upper layer  
 (c) if the wave velocity of lower layer is more than three times than the upper layer  
 (d) If the wave velocity of lower layer is more than four times than the upper layer
4. Terzaghi's bearing capacity factors  $N_c$ ,  $N_q$  and  $N_\gamma$  are functions of 1 K2 CO2  
 (a) Cohesion (b) Angle of internal friction  
 (c) Both cohesion and angle of internal friction (d) Unit weight
5. The net ultimate bearing capacity of 2 m wide strip footing resting on pure clayey soil with cohesion = 10 KN/m<sup>2</sup> using Terzaghi's theory is 1 K3 CO2  
 (a) 114 KN/m<sup>2</sup> (b) 57 KN/m<sup>2</sup> (c) 570 KN/m<sup>2</sup> (d) 5.7 KN/m<sup>2</sup>
6. The value of shape factor  $S_c$ ,  $S_q$  and  $S_\gamma$  for circular base is \_\_\_\_\_ 1 K2 CO2  
 (a) 1.3, 1.2, 0.8 (b) 1.3, 1.2, 0.6 (c) 1.0, 1.0, 1.0 (d) 1.2, 1.0 and 1.3
7. Shallow foundations in a very soft clay stratum are likely to fail in 1 K1 CO3  
 (a) Punching Shear Failure (b) Local Shear Failure  
 (c) General Shear Failure (d) Compression Failure
8. Two criteria considered for the determination of allowable soil pressure are 1 K1 CO3  
 (a) Tension and compression failure (b) Bond and Shear failure  
 (c) Settlement and Shear failure criteria (d) Tension and shear failure
9. The immediate settlement can be computed from the expression, based on 1 K1 CO3  
 (a) Theory of plasticity (b) Theory of elasticity  
 (c) Terzaghi's analysis (d) Pressure distribution
10. The contact pressure beneath rigid footing on cohesive soils is: 1 K1 CO4  
 (a) Uniform (b) More in the centre than at the edge  
 (c) Zero at the centre. (d) Less at the centre than at the edges.
11. Usually, rafts are designed as \_\_\_\_\_ 1 K1 CO4  
 (a) Reinforced slabs (b) Reinforced concrete flat slabs  
 (c) Ordinary concrete slab (d) Inverted flat slabs

12. A combined footing is commonly used 1 K1 CO4  
 (a) When two columns are spaced close to each other  
 (b) When two columns are spaced far apart  
 (c) Under a set of columns  
 (d) If there is only one column
13. For pile in cohesive soil \_\_\_\_\_ is neglected for individual pile action. 1 K2 CO5  
 (a) Frictional resistance (b) Surface area of pile  
 (c) Shear strength of soil (d) Area of the pile
14. The value of bearing capacity factor for cohesion,  $N_c$  for piles resting on clay is 1 K2 CO5  
 (a) 5.14 (b) 6.2 (c) 9 (d) 5.7
15. The negative skin friction on a pile develops when 1 K1 CO5  
 (a) The soil in which it is driven is sandy soil  
 (b) The soil surrounding it settles more than the pile  
 (c) The ground water table rises  
 (d) The soil near the tip is clay
16. Dynamic formulae are best suited for \_\_\_\_\_ type of soil. 1 K1 CO5  
 (a) Fine grained soil (b) Coarse grained soil  
 (c) Cohesive soil (d) None of the mentioned
17. If the failure occurs along a surface of sliding that intersect the slope at its toe, the slide is 1 K1 CO6  
 known as  
 (a) Base failure (b) Face failure (c) Slope failure (d) Crest failure
18. The depth of tension crack in a cohesive soil mass having cohesion  $C$  and unit weight  $\gamma$  is 1 K2 CO6  
 ----  
 (a)  $2C/\gamma$  (b)  $\gamma/4C$  (c)  $\gamma/2C$  (d)  $4C/\gamma$
19. The coefficient  $k_a$  of the active earth pressure, is given by 1 K2 CO6  
 (a)  $k_a = (1 - \tan \phi)/(1 + \tan \phi)$  (b)  $k_a = (1 + \tan \phi)/(1 - \tan \phi)$   
 (c)  $k_a = (1 + \sin \phi)/(1 - \sin \phi)$  (d)  $k_a = (1 - \sin \phi)/(1 + \sin \phi)$
20. Back fill with a sloping surface exerts a total active pressure  $P_a$  on the wall of 1 K2 CO6  
 height  $H$  and acts at  
 (a)  $H/4$  above the base parallel to base (b)  $H/2$  above the base parallel to base  
 (c)  $H/3$  above the base parallel to base (d)  $H/5$  above the base parallel to base

**PART - B (10 × 2 = 20 Marks)**

Answer ALL Questions

21. Differentiate Representative and Non Representative sample. 2 K2 CO1
22. How do you decide the depth of exploration? List the factors you will consider. 2 K2 CO1
23. Define Punching Shear failure. 2 K1 CO2
24. Write down the components of settlement. 2 K1 CO3
25. Draw the contact pressure distribution below rigid footing. 2 K2 CO4
26. Indicate the circumstances under which combined footings are adopted. 2 K2 CO4
27. Mention the methods available to determine the load carrying capacity of pile. 2 K1 CO5
28. What is negative skin friction? 2 K1 CO5
29. If the ratio between coefficient of passive earth pressure and that of active earth pressure 2 K3 CO6  
 is 9, find the angle of internal friction of the soil.
30. Write the assumptions in Rankine's theory. 2 K1 CO6

**PART - C (6 × 10 = 60 Marks)**

Answer ALL Questions

31. a) Explain in detail the standard penetration test. State the corrections to be applied on 10 K2 CO1  
 the observed SPT 'N' value.

**OR**

- b) i) Interpret the salient features of a good sub-soil investigation report. 5 K2 CO1  
 ii) Write short notes on Split spoon sampler. 5 K2 CO1

32. a) Calculate the net ultimate bearing capacity of a rectangular footing of size 1.8m×3.6m in plan founded at a depth of 1.6m below ground surface. The load on the footing acts at an angle of 16° to the vertical and is eccentric in the direction of width by 15cm. The unit weight of the soil is 18KN/m<sup>3</sup>. The rate of loading is slow and hence the effective shear strength can be used in the analysis, having C'=15KN/m<sup>2</sup> and φ'=30°. Natural water table is at a depth of 2m below the ground surface. Use IS method.  
 $N_c' = 30.14$   $N_q' = 18.4$   $N_{\gamma}' = 22.4$ .

**OR**

- b) A strip footing of 1.5m wide, resting on a sand stratum with its base at a depth of 1m. The properties of the sand are  $\gamma = 17 \text{ KN/m}^3$ ,  $\gamma_{\text{sat}} = 20 \text{ KN/m}^3$ ,  $\phi = 35^\circ$  and  $C = 0$ . Determine the ultimate bearing capacity of the footing using Terzaghi's theory if the ground water table is located at a depth of 0.5m below the base of the footing.  
 Take  $N_c = 57.8$ ,  $N_q = 41.4$ ,  $N_{\gamma} = 42.4$ .

33. a) The plate loads were conducted in a C-Φ soil on plate of 2 different sizes and the following results were obtained. 10 K3 CO3

| Load  | Size      | Settlement |
|-------|-----------|------------|
| 40kN  | 0.3X0.3 m | 25mm       |
| 100kN | 0.6X0.6 m | 25 mm      |

Find the size of the square footing to carry a load of 800kN at same specified settlement of 25mm.

**OR**

- b) What is differential settlement? What are the causes? Explain the remedial measures to be taken to minimize the differential settlement. 10 K2 CO3

34. a) Proportion a strap footing for uniform pressure under dead load plus reduced live load with the following data. 10 K3 CO4  
Allowable pressures: 180 KN/m<sup>2</sup> for DL + reduced LL and 270 KN/m<sup>2</sup> for DL + LL

| Column Loads | Column A | Column B |
|--------------|----------|----------|
| DL           | 500KN    | 660KN    |
| LL           | 400KN    | 850KN    |

Proportion the footing for uniform pressure under DL + reduced LL .

Distance c/c of columns = 5.4m. Projection beyond column A not to exceed 0.6 m.

**OR**

- b) i) Write short notes on Floating foundation. 5 K2 CO4  
 ii) Briefly discuss about the various types of footing with neat sketch. 5 K2 CO4

35. a) A square group of 9 piles was driven into soft clay extending to a large depth. The diameter and length of the piles were 30cm and 9m respectively. If unconfined compression strength of the clay is 90KN/m<sup>2</sup>, and the pile spacing is 90cm centre to centre. What is the capacity of the group? Assume a factor of safety of 2.5 and adhesion factor 0.75. 10 K3 CO5

**OR**

- b) Explain the pile load test to determine load carrying capacity of pile. 10 K2 CO5

36. a) A retaining wall is 5 meters high. Its back is vertical and it has got sandy backfill up to its top. The top of the fill is horizontal and carries a uniform surcharge of  $80 \text{ kN/m}^2$ . Determine the magnitude and direction of total active earth pressure on the wall per meter length of wall. Water table is 1.5m below the top of the fill. Dry density of soil =  $18.5 \text{ kN/m}^3$ . Moisture content of soil above water table = 13%. Angle of internal friction of soil =  $30^\circ$ , Specific gravity of soil particles = 2.6. Porosity of backfill = 30%. The wall friction may be neglected. 10 K3 CO6

**OR**

- b) Illustrate the procedure to determine the active lateral earth pressure on rigid retaining wall using Culmann's graphical method. 10 K2 CO6