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Question Paper Code : X10248

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2020 AND
APRIL/MAY 2021
Fifth/Sixth Semester
Civil Engineering
CE 8591 – FOUNDATION ENGINEERING
(Common to Environmental Engineering)
(Regulations 2017)

Time : Three Hours

Maximum : 100 Marks

Answer ALL questions

PART – A

(10×2=20 Marks)

1. State the objectives of site investigation.
2. What are disturbed and undisturbed samples ?
3. Mention the function of a 'foundation'.
4. Define ultimate bearing capacity.
5. Draw the contact pressure distribution below the rigid footing resting on sand.
6. What is a 'raft foundation' ? When is it preferred ?
7. Define group efficiency.
8. What is negative skin friction ?
9. Give one practical example for active state of soil behind retaining wall.
10. Draw the variation of lateral earth pressure with respect to movement of retaining wall.

PART – B

(5×13=65 Marks)

11. a) Describe, with neat sketch, the wash boring method to drill borehole.

(OR)

- b) Explain the salient features of bore log and soil investigation report.



12. a) i) A continuous footing of width 2.5 m rests 1.5 m below the ground surface in clay. The unconfined compressive strength of the clay is 150 kN/m^2 . Calculate the ultimate bearing capacity of the footing. Assume unit weight of soil is 16 kN/m^3 . For $\phi = 0^\circ$. Terzaghi's bearing capacity factors are $N_\gamma = 0$, $N_q = 1$ and $N_c = 5.7$. **(8)**

- ii) What are the criteria for deciding the depth of foundations. **(5)**

(OR)

- b) A footing 2 m square is founded at a depth of 1.5 m in a sand deposit, for which the corrected value of N is 27. The water table is at a depth of 2 m from the surface. Determine the net allowable bearing pressure, if the permissible settlement is 40 mm and a factor of safety of 3 is desired against shear failure.

13. a) i) Design a rectangular combined footing for two columns 6 m apart. The exterior column of size $0.3 \text{ m} \times 0.3 \text{ m}$ carries a load of 600 kN and interior column of size $0.4 \text{ m} \times 0.4 \text{ m}$ carries a load of 900 kN. The allowable soil pressure is 150 kN/m^2 . **(10)**

- ii) What are different types of shallow foundations ? **(3)**

(OR)

- b) Describe the design of mat foundation by rigid method.

14. a) A group of 12 short piles, each having a diameter of 500 mm and an embedded length of 8 m, supports the platform of jetty. The piles are arranged in 3 identical rows and are spaced at 1.75 m from each other. The subsoil has the following properties $\gamma_{\text{sat}} = 21 \text{ kN/m}^3$, $\phi = 0^\circ$, $c = 37.5 \text{ kN/m}^2$, $\alpha = 0.72$. Determine the safe axial load carrying capacity of the pile group.

(OR)

- b) A concrete pile of 40 cm diameter is driven into a homogeneous mass of cohesionless soil. The pile carries a safe load of 650 kN. A static cone penetration test conducted at the site indicates an average value of $q_c = 40 \text{ kg/cm}^2$ along the pile and 120 kg/cm^2 below the pile tip. Compute the length of the pile with $F_s = 2.5$.

15. a) Discuss in detail Culmann's graphical method for the determination of active earth pressure.

(OR)

- b) A smooth backed vertical wall is 6.3 m high and retains a soil with a bulk unit weight of 18 kN/m^3 and $\phi = 18^\circ$. The top of the soil is level with the top of the wall and is horizontal. If the soil surface carries a uniformly distributed load of 4.5 kN/m^2 . Determine the total active thrust on the wall per meter length of the wall.



PART – C

(1×15=15 Marks)

16. a) i) Compute the safe bearing capacity of a square footing $1.5 \text{ m} \times 1.5 \text{ m}$, located at a depth of 1 m below the ground level in a soil of average density 20 kN/m^3 . $\phi = 20^\circ$, $N_c = 17.7$, $N_q = 7.4$ and $N_y = 5.0$. Assume a suitable factor of safety and that the water table is very deep.

Also compute the reduction in safe bearing capacity of the footing if the water table rises to the ground level. **(10)**

- ii) A pile is driven with a single acting steam hammer of weight 15 kN with a free fall of 900 mm. The final set, the average of the last three blows, is 27.5 mm. Find the safe load using the Engineering News Formula. **(5)**

(OR)

- b) It is required to construct a pile foundation comprised of 20 piles arranged in 5 columns at distances of 90 cm center to center. The diameter and lengths of the piles are 30 cm and 9 m respectively. The bottom of the pile cap is located at a depth of 2.0 m from the ground surface. The details of the soil properties etc. are as given below with reference to ground level as the datum. The water table was found at a depth of 4 m from ground level.

Depth, m from	To	Soil properties
0	2	Silt, saturated, $\gamma = 16 \text{ kN/m}^3$
2	4	Clay, saturated, $\gamma = 19.2 \text{ kN/m}^3$
4	12	Clay, saturated, $\gamma = 19.2 \text{ kN/m}^3$, $q_u = 120 \text{ kN/m}^2$, $e_0 = 0.80$, $C_c = 0.23$
12	14	Clay, $\gamma = 18.24 \text{ kN/m}^3$, $q_u = 90 \text{ kN/m}^2$, $e_0 = 1.08$, $C_c = 0.34$
14	17	Clay, $\gamma = 20 \text{ kN/m}^3$, $q_u = 180 \text{ kN/m}^2$, $e_0 = 0.70$, $C_c = 0.2$
17	-	Rocky stratum

Compute the consolidation settlement of the pile foundation if the total load imposed on the foundation is 2500 kN.
