Register No.: ..... Name: .....

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), DECEMBER 2023

CIVIL ENGINEERING

(2020 SCHEME)

Course Code : 20CET305

Course Name: Geotechnical Engineering – II

Max. Marks : 100 **Duration: 3 Hours**

Use of attested bearing capacity charts and IS codes are permitted.

PART A

(Answer all questions. Each question carries 3 marks)

1. Describe active and passive earth pressures with the help of a neat sketch.
2. Elucidate the functions of a foundation.
3. Differentiate general, local and punching shear failures.
4. Define i) net safe bearing capacity and ii) net safe settlement pressure.
5. Define allowable settlement.
6. Explain the types of raft foundation.
7. Classify piles on the basis of method of load transfer.
8. Sketch and label the components of a well foundation.
9. Explain depth of exploration.
10. Discuss the objectives of site investigation.

PART B

(Answer one full question from each module, each question carries 14marks)

MODULE I

11. a) What are the assumptions in Rankine's earth pressure theory? (5)

    b) A smooth backed vertical wall is 7 m high and retains a soil with a bulk unit weight of 18 kN/m^3 and φ = 20°. 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 5 kN/m^2, determine the total active thrust on the wall per linear meter of the wall and its point of application. (9)

OR

12. a) Discuss the concept of the critical depth of a vertical cut. (4)

    b) A 5 m high retaining wall supports a soil of bulk unit weight 18 kN/m^3, Angle of internal friction 30˚, and Cohesion 7kN/m^2. Determine the Rankine's active earth pressure on the wall, (10)

    i. Before the formation of tension crack.

    ii. After the formation of tension crack.

MODULE II

13. a) What are bearing capacity factors? Discuss the effect of water table on the bearing capacity of soils. (5)

b) A strip footing 1.5 m wide, with its base at a depth of 1 m, resting on saturated soil with c = 30 kN/m^2, γ=17 kN/m^3, φ = 30^0. Determine the net ultimate bearing capacity of footing if the ground water table is (9)
i) 0.5 m below the ground surface
ii) 0.5 m below the base of footing

OR

14. a) What are the assumptions in Terzaghi's bearing capacity theory? (5)

b) Determine the net ultimate bearing capacity of a square footing of size 2 m, laid at a depth of 1.3 m below the ground surface, if (9)
i. the water table rises to the level of the base,
ii. the water table rises to the ground surface, and
iii. the water table is 1 m below the base.
Take γ = 20 kN/m^3, φ = 30°, and c' = 0.

MODULE III

15. a) Design a square reinforced footing for a column load of 800 kN and allowable soil pressure of 200 kN/m^2. Size of the column is 0.4 m x 0.4 m. (6)

b) Design a rectangular combined footing to support two adjacent columns each of size 0.40 m x 0.40 m at a distance of 5 m and carrying column loads 3 MN and 4 MN. The column with lighter load is near the property line. The allowable soil pressure is 400 kN/m^2. (8)

OR

16. a) A rectangular footing 2 m x 3 m carries a column load of 600 kN at the ground level. The ground strata is found to be a c - ϕ soil having 6 m thickness and Poisson's ratio of 0.25. Young's modulus is 20 MN/m^2. Take I=1.06. Calculate the immediate settlement. (4)

b) Explain plate load test and its limitations. (10)

MODULE IV

17. a) Discuss the methods to rectify the tilts and shifts of well foundations. (6)

b) A pile group of 9 pile foundations each of 30 cm diameter and 10 m length driven in place has a square pattern. Determine the safe load for a FOS of 3. Take undrained cohesion as 100 kN/m^2, unit weight of soil as 20 kN/m^3, α=0.6 and center-to-center (8)

distance between the pile as 0.75 m.

OR

18. a) How will you determine the safe load capacity of single pile in sand by static method? (4)

b) A precast concrete pile (0.35 m x 0.35 m) is driven by a single acting steam hammer. Estimate the allowable load using Heiley Formula. Use the following data. (10)

FOS = 4
Maximum rated energy = 3500 kN-cm
Weight of hammer = 35 kN
Weight of Pile = 73.5 kN
Coefficient of restitution = 0.5
Efficiency of hammer = 0.8
Number of blows for last 25.4 mm = 6
Length of pile = 15 m
Modulus of elasticity of concrete = 2×10^7 kN/m^2

MODULE V

19. a) Explain any three types of samplers. (6)

b) Describe the Standard Penetration Test used in soil exploration. What are the corrections recommended by IS: 2131-1981 for the field value of N? (8)

OR

20. a) What are the IS guidelines for choosing spacing and depth of borings? (6)

b) Explain any two geophysical methods used for soil exploration. (8)

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