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

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FIFTH SEMESTER B.TECH DEGREE EXAMINATION (S), FEBRUARY 2024
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. Differentiate between active and passive earth pressures.
2. List the factors that influence the selection of type of foundations?
3. Explain the following.
   a. Ultimate Bearing Capacity
   b. Net Ultimate Bearing Capacity
   c. Net Safe Bearing Capacity
4. List the different bearing capacity failure mechanisms of a shallow foundation.
5. Comment on the advantages and disadvantages of Plate Load Test?
6. What are Combined Footings? State the situations in which trapezoidal footings are recommended.
7. State the circumstances under which pile foundations are recommended. Give the classification of piles based on mode of load transfer.
8. Define negative skin friction? How does it affect the load transfer in a pile foundation?
9. Differentiate between disturbed and undisturbed soil samples. What is the necessity of collecting undisturbed soil samples?
10. Distinguish between a Boring Log and Soil Profile.

PART B

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

MODULE I

11. Compute the depth of tension crack and safe height for a vertical cut in case of a 6m high wall retaining in a purely cohesive soil of c' = 30 kN/m^2 and effective unit weight of 17.5 kN/m^3. Assume the back face of the wall to be smooth and vertical.
    Also compute: (14)
    a. Active earth pressure and point of application before the

formation of tension crack.

b. Active earth pressure after the formation of tension crack.

OR

12. a) A 7 m high retaining wall with vertical face supports a backfill of unit weight 17.5 kN/m^3, cohesion of 11 kN/m^2 and angle of internal friction of 28°. There is a uniform surcharge of 25 kN/m^2 on the backfill and the water table is well below the level and has no influence. Determine Rankine's passive earth pressure. (8)

b) With neat sketches, explain any two types of shallow foundations and their specific uses. (6)

MODULE II

13. a) A square footing of 1.5 m side carries a uniaxial load of 800 kN. The depth of foundation is 2 m and cohesion of the soil is 18 kN/m^2, angle of internal friction 25° and unit weight 17 kN/m^3. Assume general shear failure and the factor of safety as 3. Compute allowable bearing pressure of the foundation, if: (10)

i. Water table is at a great depth and

ii. Water table is at the ground surface (G = 2.6, e = 0.7 and Υ_w = 10 kN/m^3, S = 1)

b) List the assumptions in Terzaghi's bearing capacity theory. (4)

OR

14. a) A circular footing carries a uniaxial load of 600 kN at a depth of 1.5 m in medium dense sand. If the angle of internal friction of soil is 20° and unit weight is 18 kN/m^3, using Terzaghi's bearing capacity theory, find the allowable bearing pressure for a factor of safety 3. What will be the mode of bearing capacity failure and why? (8)

b) Discuss the factors influencing the bearing capacity of soils. (6)

MODULE III

15. a) Explain Plate Load Test with neat sketches. (7)

b) Compute the expected settlement of a 1.6 m square footing in a granular soil, if the 30 cm plate settled by 16 mm for a load intensity of 180 kN/m^2 during the Plate Load Test on the same soil. (7)

OR

16. a) A trapezoidal footing is to be designed to support two square columns of 0.4 m and 0.5 m sides respectively. Center to center spacing between the columns are 5 m and safe bearing capacity of the soil is 380 kN/m^2. The larger column carries 4500 kN and smaller ones carries 2800 kN. Design a suitable size of the footing so that it does not extend beyond the face of the columns. (10)

b) Explain the design principles of a raft foundation. (4)

MODULE IV

17. a) Discuss the estimation of bearing capacity of a single pile in clay and sand with the help of figures. (7)

    b) A square pile group of 9 piles passes through a strata of depth 5 m which was filled recently. The unconfined compressive strength of the strata consisting of cohesive soil is 55 kN/m^2 and unit weight is 16 kN/m^3. Compute the negative skin friction of the pile group if α = 0.4, diameter of the pile is 350 mm and center to center spacing between piles is 1 m. (7)

OR

18. a) Discuss Pile load test in detail and explain the computation of allowable load from the test. (7)

    b) Design a friction pile group to carry a load of 3500 kN in a clay stratum of 25 m depth underlain by a hard stratum. The unconfined compressive strength of the soil is 82 kN/m^2 and consider a safety factor of 2.5. (7)

MODULE V

19. a) An SPT was conducted in a sand deposit of 15 m where the water table is at a depth of 6m from ground surface. The unit weight of sand above the water table is 18.5 kN/m^3 and 19.2 kN/m^3 below the water table. If the N value is 34, find the corrected N value. (6)

    b) Discuss any three methods of sub-surface exploration with sketches in detail. (8)

OR

20. a) Discuss the two geophysical methods of soil exploration. What are the advantages and disadvantages of both? (7)

    b) Compute the inside clearance, outside clearance, and area ratio of a sampler with following dimensions.
    Inside diameter of sampling tube: 70 mm
    Outer diameter of sampling tube: 74 mm
    Inside diameter of cutting edge: 68 mm and
    Outside diameter of cutting edge: 76 mm.
    Does this sampler yield undisturbed soil samples? (7)

****