

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (S), SEPT 2022

CIVIL ENGINEERING

(2020 SCHEME)

Course Code: 20CET204

Course Name: Geotechnical Engineering - I

Max. Marks: 100

Duration: 3 Hours

PART A

(Answer all questions. Each question carries 3 marks)

1. Explain the three phase diagram for soil.
2. Define void ratio, porosity and water content.
3. Explain the different corrections to be applied to hydrometer reading.
4. What is the use of particle size distribution curve.
5. Define neutral and effective pressure in soil
6. Write a note on the concept of pressure bulb
7. Write a note on Proctors needle.
8. Distinguish between normally consolidated and over consolidated soil.
9. Write about unconfined compression test and triaxial test.
10. What are the different types of slope failures?

PART B

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

MODULE I

11. a) Derive from the first principle the expression $\gamma_d = \frac{G \gamma_w}{(1+e)}$ (5)
- b) One cubic metre of wet soil weighs 18.50 kN. Its dry weight is 16.65 kN If the specific gravity of solid particles is 2.65 find void ratio, dry density and degree of saturation. (9)

OR

12. a) With neat sketch explain different soil structure (6)
- b) A soil has a bulk density of 20kN/m³ and water content of 15%. Calculate the water content if the soil partially dries to a density of 18 kN/m³ and the void ratio remains the same (8)

MODULE II

13. a) Draw IS plasticity chart and mark the details. What is its practical application (7)
- b) An oven dry soil sample of volume of 225 cm³ weighs 4N. If the specific gravity of solids is 2.62, determine the void-ratio and shrinkage limit. (7)

OR

14. a) Define coefficient of permeability and explain any 4 factors that affect permeability of a soil stratum (6)
- b) Determine the average horizontal and vertical permeabilities of a soil mass made up of three horizontal strata, each 1m thick, If the coefficients of permeability are 2×10^{-1} mm/s, 4×10^{-1} mm/s, 8×10^{-2} mm/s for the three layers (8)

MODULE III

15. a) Explain Quick sand condition (4)
- b) Sketch the variation in total stress, effective stress and pore water pressure up to a depth of 8m below the ground level, given the following data. The water table is at 4m below ground level. The dry density of the soil is 18 kN/m^3 , water content is 15%, specific gravity 2.7. (10)

OR

16. a) A raft of size 4m x 4m carries a uniform load of 150 kN/m^2 . Using the point load approximation with four equivalent point loads, calculate the stress increment at a point in the soil which is 4m below the centre of the loaded area. (6)
- b) A rectangular foundation 2m x 3m transmits a pressure of 360 kN/m^2 to the underlying soil. Determine the vertical stress at a point 1 meter vertically below a point lying outside the loaded area, 0.5 m away from long edge and 0.8 m away from short edge. Use Boussinesq's theory. (8)

MODULE IV

17. a) How can be the pre consolidation pressure on clay be estimated (5)
- b) A 25 mm. thick specimen of soil takes 15 minutes to reach 50% consolidation in the laboratory when drainage is permitted only from one side. Calculate the coefficient of consolidation. Also, calculate the time required for 90% consolidation for the above sample. How much time will it take for 90% consolidation of 5m thick similar sample in the field with drainage permitted only from one side? Also, calculate the time when there is double drainage. (9)

OR

18. a) What do you understand by light compaction and heavy compaction? Under what circumstances light and heavy compaction tests adopted. (6)
- b) The optimum moisture content and maximum dry density of a soil obtained from the standard Proctor's tests are 12% and 1.62 g/cc . If the specific gravity of soil solids is 2.7, determine the degree of saturation of the soil at OMC and the dry density corresponding to a zero air voids condition at OMC (8)

MODULE V

19. a) State any 4 merits of triaxial test over direct shear test (4)

- b) The data obtained for a direct shear test are as follows. Normal pressure 20 kN/m², tangential pressure = 16 kN/m². Angle of internal friction = 20°, cohesion = 8 kN/m². Represent the data by Mohr circle and compute the principal stress and the direction of principal planes. Also draw the failure plane. (10)

OR

20. a) What is meant by stability number and stability chart? (6)
- b) What are the forces considered in friction circle method of slope analysis? Suggest any 4 methods for improving the stability of a slope. (8)
