

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (S), AUGUST 2023

CIVIL ENGINEERING

(2020 SCHEME)

Course Code: 20CET204

Course Name: Geotechnical Engineering - I

Max. Marks: 100

Duration: 3 Hours

Graph sheets and charts may be used wherever required.

PART A

(Answer all questions. Each question carries 3 marks)

1. Describe the three phase diagram of soil.
2. Describe any one major soil deposit found in India.
3. Enumerate the assumptions in Stoke's law .
4. Differentiate liquidity index, consistency index and flow index.
5. Define neutral stress and effective stress in soils.
6. Summarize quick sand condition.
7. Define coefficient of compressibility and compression index.
8. Differentiate consolidation and compaction of soils.
9. Describe the shear strength parameters of the soil.
10. Enumerate different types of slope failure.

PART B

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

MODULE I

11. a) Describe how density of soil is found using core cutter method. (7)
b) A sample of saturated soil has a water content of 23% and a bulk unit weight of 20 kN/m³. Determine the dry density, void ratio and specific gravity of solid particles. What would be the bulk unit weight of same soil at same void ratio, but at a degree of saturation of 75% ? (7)
Take unit weight of water, $\gamma_w = 10 \text{ kN/ m}^3$.

OR

12. a) Enumerate various soil structures and explain any three with neat sketches. (7)

- b) 15 kg of soil is at natural water content of 5%. This soil has to be used for construction of embankment to construct road. The field placement water content is 15%. How much water should be added to soil? (7)

MODULE II

13. Describe how dry sieve analysis is done and explain the particle size distribution graph with its uses. (14)

OR

14. a) Define coefficient of permeability and explain any three factors affecting the permeability of soil. (8)
- b) Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 5 m, 2.5 m and 3 m and having the coefficient of permeability of 2×10^{-2} mm/sec, 3×10^{-4} mm/sec, 3×10^{-2} mm/sec respectively. Assume the layers are isotropic. (6)

MODULE III

15. a) A sand deposit is 10 m thick and overlies a bed of soft clay. The ground water table is 4 m below the ground surface. If the sand above the ground water table has a degree of saturation of 50%, plot the diagram showing the variation of the total stress, pore water pressure and the effective stress. The void ratio of the sand is 0.70. (8)
- Take $G = 2.65$ and unit weight of water, $\gamma_w = 10 \text{ kN/m}^3$.
- b) Explain the use of Newmark's chart. (6)

OR

16. a) Describe pressure isobars with its significance. (6)
- b) A concentrated load of 2500 kN is applied at ground surface. Determine the vertical stress at a point P which is 7 m directly below the load. Also calculate the vertical stress at a point R which is at a depth of 7 m, but at a horizontal distance of 5 m from the axis of the load. (8)

MODULE IV

17. a) Explain normally consolidated, over consolidated and under consolidated clays. (6)
- b) Describe the procedure of standard proctor test done on soil. (8)

OR

18. A 3 m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an impervious rock. The coefficient of

consolidation of the clay was found to be $0.028 \text{ cm}^2/\text{minute}$. The final expected settlement for the layer is 10 cm.

- a) How much time will it take for 75% of the settlement to take place?
- b) Determine the time required for a settlement of 3.5 cm to occur.
- c) Compute the settlement that would occur in one year.

MODULE V

19. a) Explain Mohr-Coulomb failure criterion. (8)
- b) Differentiate UU, CU and CD test systems. (6)

OR

20. a) A shear vane of 6 cm diameter and 11 cm length was used to measure the shear strength of soft clay. If a torque of 550 N-m was required to shear the soil, calculate the shear strength. The vane was then rotated rapidly to cause remoulding of the soil. The torque required in the remoulded state was 200 N-m. Determine the sensitivity of the soil. (6)
- b) In a direct shear test, at the time of failure, sample yielded the following observations: (8)
Normal load – 0.6 kN
Shear load – 0.43 kN
Sample size was 6 cm x 6 cm. Assume $c=0$. Find (i) the principal stress (ii) the angle of internal friction
