

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (Regular), JULY 2022

CIVIL ENGINEERING
(2020 SCHEME)

Course Code: 20CET204

Course Name: Geotechnical Engineering - I

Max. Marks: 100

Duration: 3 Hours

Graph sheet will be provided on request

PART A

(Answer all questions. Each question carries 3 marks)

1. Define void ratio, degree of saturation, water content and specific gravity and derive the relationship between these parameters.
2. Explain how specific gravity of soil can be measured in laboratory.
3. Define relative density and explain its significance.
4. With neat sketch explain well graded and gap graded soils.
5. Summarize quick sand condition.
6. Explain pressure bulb.
7. Differentiate normally consolidated, under consolidated and over consolidated soils.
8. Explain the significance of Optimum Moisture Content (OMC) and Maximum Dry Density (MDD).
9. Describe the shear strength parameters of the soil.
10. A cylindrical specimen of saturated clay, 3.5 cm in diameter and 8 cm in height was tested in an unconfined compression testing machine. Find the unconfined compressive strength, if the specimen failed under an axial load of 0.4kN when the axial deformation was 9 mm.

PART B

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

MODULE I

11. Describe how density of soil is determined using sand replacement method. (14)

OR

12. a) Differentiate sensitivity and thixotropy. (4)
- b) A sample of soil extracted in its natural state using sampling tube of volume 0.001 m^3 was found to have a mass of 1800 g. The degree of saturation being 85% and oven dried mass 1380 g, determine i) water content ii) specific gravity (10)
- iii) voids ratio iv) bulk density v) saturated density vi) submerged density.

MODULE II

13. a) Enumerate the limitations of Stoke's law in sedimentation analysis (4)

- b) In a sedimentation analysis 60 g of soil passing 75 μ sieve is dispersed in 1000 ml of water. In order to estimate percentage of particle size less than 0.006 mm, how long after the commencement of the sedimentation is the hydrometer reading to be taken? The centre of hydrometer is 160 mm below the surface of the water. Specific gravity of soil is 2.65 and viscosity of water is 0.001 Ns/m². (10)

OR

14. a) A test for the determination of the liquid limit was carried out on a soil sample. The following sets of observations were taken. Plot the flow curve and determine the liquid limit and the flow index. Also find the plasticity index if the plastic limit is 30%. (10)

No. of Blows (N)	37	27	21	13
Water content (%)	47	49	52	54

- b) Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 6 m, 2 m and 3.5 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. (4)

MODULE III

15. a) Explain the assumptions and limitations of Boussinesq solutions. (6)
- b) A concentrated load of 2500 kN is applied at the 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)

OR

16. A sand deposit is 10 m thick and overlies a bed of soft clay. The ground water table is 2 m below the ground surface. If the sand above the ground water table has a degree of saturation of 40%, 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. Take $G = 2.65$. (14)

MODULE IV

17. A 2 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 0.025 cm²/minute. The final expected settlement for the layer is 9 cm. (14)
- (a) How much time will it take for 70% of the settlement to take place? (b) Determine the time required for a settlement of 3 cm to occur. (c) Compute the settlement that would occur in one year.

OR

18. a) Explain how coefficient of consolidation can be determined using laboratory test. (7)
- b) Explain any two methods of compaction used in field. (7)

MODULE V

19. a) Explain Mohr-Coulomb failure criterion. (5)
b) Describe the different types of slope failures. (9)

OR

20. a) Explain the Swedish Circle method for stability analysis. (7)
b) A shear vane of 5 cm diameter and 11 cm length was used to measure the shear strength of soft clay. If a torque of 500 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 180 N-m. Determine the sensitivity of the soil. (7)
