

Register No.: Name:

SAINTGITS COLLEGE OF ENGINEERING (AUTONOMOUS)

(AFFILIATED TO APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY, THIRUVANANTHAPURAM)

FOURTH SEMESTER B.TECH DEGREE EXAMINATION (R,S), MAY 2024**CIVIL ENGINEERING****(2020 SCHEME)****Course Code : 20CET204****Course Name: Geotechnical Engineering - I****Max. Marks : 100****Duration: 3 Hours**

Graph paper may be supplied on request

PART A

(Answer all questions. Each question carries 3 marks)

1. Using phase diagram, define the terms (a) void ratio (b) degree of saturation (c) air content
2. List the major soil deposits of India
3. Explain the corrections applied to hydrometer readings
4. List the factors affecting permeability.
5. Define effective stress and what its importance is in the engineering behavior of soil.
6. What are the limitations of Boussinesq's solution?
7. What are the causes of preconsolidation?
8. Differentiate between compaction and consolidation.
9. Explain Mohr Coulomb shear strength theory.
10. Explain the rotational failure of slopes.

PART B

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

MODULE I

11. a) Derive the relation between water content, void ratio, specific gravity and degree of saturation from the fundamentals. (5)
- b) A compacted cylindrical specimen, 50mm dia and 100mm length is to be prepared from oven dried soil. If the specimen is required to have a water content of 15% & percentage air voids of 20%, calculate the mass of the soil & water required for the preparation of the sample. Take $G = 2.69$. (9)

OR

12. a) Explain different types of soil structures. (6)

- b) The porosity of a soil sample is 35% & $G = 2.7$. Calculate its void ratio, dry density, saturated density and submerged density. (8)

MODULE II

13. a) An air dry soil sample weighing 25kg was sieved in a laboratory. The results are given below

IS Sieve (mm)	Mass retained (kg)
2	0
1	2.02
0.6	3.51
0.425	7.53
0.212	8.15
0.15	2.81
0.075	0.9
Pan	0.08

(9)

Draw the grain size distribution curve and determine the coefficient of curvature and uniformity coefficient

- b) Classify the soil with the following properties according to IS classification system. Gravel size = 2%, sand size = 95%, silt and clay size = 3%, $C_u = 4.5$, $C_c = 1.5$ (5)

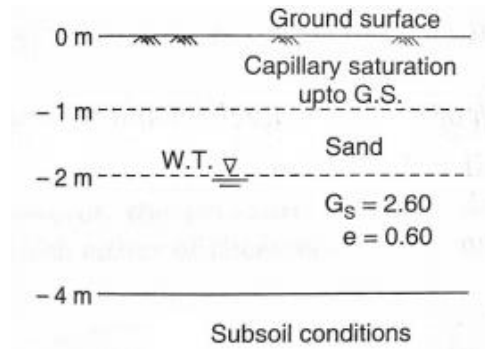
OR

14. a) A soil has a liquid limit of 25% & a flow index of 12.5%. If the plastic limit is 15%, determine the plasticity index and toughness index. If the water content of the soil in its natural condition in the field is 20%, find the liquidity index and the consistency index. (8)

- b) In a falling head permeability test on a sample 12.2cm high & 44.1 cm² in cross-sectional area, the water level in a stand pipe of 6.25mm internal diameter dropped from a height of 75cm to 24.7cm in 15 minutes. Find coefficient of permeability. (6)

MODULE III

15. a) For the subsoil conditions shown in figure what are the effective stress values at 1m, 2m and 4m depths. Assume $\gamma_w = 10 \text{ kN/m}^3$. (9)
Consider capillary saturation upto ground surface.



- b) Describe the use of Newmark's influence chart. (5)

OR

16. a) Explain briefly the phenomenon of quicksand condition and critical hydraulic gradient. (5)
- b) A soil profile consist of a surface layer of sand 3.5 m thick and unit weight is 16 kN/m^3 , an intermediate layer of clay 3 m thick and having saturated unit weight of 17 kN/m^3 and bottom layer of gravel 4 m thick and saturated unit weight of 18 kN/m^3 . The water table is at the upper surface of the clay layer. Sketch the variation in total stress, effective stress and pore water pressure. (9)
- ($\gamma_w = 10 \text{ kN/m}^3$)

MODULE IV

17. a) What are the factors affecting compaction? (5)
- b) In a laboratory consolidometer test on a 20mm thick sample of saturated clay taken from a site, 50% consolidation point was reached in 10 min. Estimate the time required for the clay layer of 5m thickness at the site for 50% compression if there is drainage only towards the top. Assume that the lab sample and the clay layer at the site are both subject to the same increase in stress. How much time is required for the clay layer to reach 90% consolidation? What is the time required for the clay layer to reach 50% consolidation if the layer has double drainage instead of single drainage? (9)

OR

18. a) What are the assumptions of Terzaghi's theory of one dimensional consolidation? (6)
- b) Determine the degree of saturation of a soil sample given that its MDD and OMC are 19.6 kN/m^3 and 12.5% respectively. Assume the specific gravity of the soil solids as 2.68. Also compute the percentage of air voids of the soil sample. (8)

MODULE V

19. a) A slope is to be made in clay for which the cohesion is 25 kN/m^2 and $\Phi=0$. The density of soil is 18 kN/m^3 . Find the maximum (5)

height of slope if the side slope is 1.5 to 1, and the factor of safety is to be 1.5. Take Taylor's stability number as 0.17.

- b) In a drained triaxial compression test on dense sand the cell pressure was 200kPa and the deviator stress to cause failure was 550kPa. Calculate the angle of shearing resistance. Also find the angle made by the failure plane with respect to the major principal plane (9)

OR

20. a) Compare the merits and demerits of a triaxial compression test (5)
b) Explain Friction Circle method of slope stability analysis (9)
