



Fifth Semester B.E. Degree Examination, Jan./Feb. 2023 Basic Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. With the help of three phase diagram, define the terms, water content, bulk density, dry density, void ratio, air content, relative density. (08 Marks)
- b. With usual notations prove that $\gamma_d = \frac{(1 - \eta_a)G\gamma_w}{1 + \omega G}$. (06 Marks)
- c. The total weight (unit weight) of the glacial outwash soil is 16 kN/m^3 . The specific gravity of soil particles of the soil is 2.67. The water content of the soil is 17%. Calculate Dry unit weight, porosity, void ratio and degree of saturation. (06 Marks)

OR

- 2 a. What is consistency of soil? Define liquid limit, shrinkage limit, relative consistency and shrinkage ratio. (08 Marks)
- b. Explain soil classification according to BIS classification system. (06 Marks)
- c. Draw the grain size distribution curve and determine the uniformity coefficient and coefficient of curvature of the soil for the following data :

Sieve size (mm)	2.4	1.2	0.6	0.3	0.15	0.075	Pan
Mass of Soil retained (g)	0	5	25	215	225	25	0.5

(06 Marks)

Module-2

- 3 a. What are the different types of clay minerals commonly found in soils? Explain with their structure. (08 Marks)
- b. Explain soil structure, electrical diffuse double layer and base exchange capacity. (06 Marks)
- c. Explain factors affecting compaction. (06 Marks)

OR

- 4 a. Differentiate between standard and modified proctor tests. (04 Marks)
- b. Discuss the effect of compaction on different properties of soil. (08 Marks)
- c. The observations of a standard proctor test are given below:

Dry density kN/m^3	16.16	17.06	18.61	18.95	18.78	17.13
Water content (%)	9.02	8.81	11.25	13.05	14.40	19.25

- (i) Plot the compaction curve and determine OMC.
- (ii) Also compute the void ratio and degree of saturation at optimum condition.
Take $G = 2.77$. (08 Marks)

Module-3

- 5 a. Discuss various factor affecting permeability of soils. (06 Marks)
- b. Explain quick sand and capillary phenomenon. (06 Marks)
- c. In a falling head permeability test, head causing flow was initially 500 mm and it drops 20 mm in 5 minutes. Calculate the time required for the head to fall to 250 mm. (08 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

OR

- 6 a. What is flow net? Give its characteristics. (06 Marks)
 b. Explain the method of locating the phreatic line in a homogeneous earth dam with filter. (08 Marks)
 c. Explain effective stress, total stress, neutral stress in soil. What is the significance of effective stress? (06 Marks)

Module-4

- 7 a. Explain Mohr Columb failure theory of soil. (04 Marks)
 b. What are the factors affecting the shear strength of soil? (08 Marks)
 c. The stresses on a failure plane in a drained test on a Cohesionless soil are as under :
 Normal stress (σ) = 100 kN/m²
 Shear stress (τ) = 40 kN/m²
 Determine the angle of shearing resistance and the angle which the failure plane makes with the major principal stresses. (08 Marks)

OR

- 8 a. Classify the shear tests based on drainage conditions. How are these drainage condition, realized in the field. (06 Marks)
 b. What are the advantages and disadvantages of direct shear test over triaxial test? (06 Marks)
 c. A shear vane of 75 mm diameter and 110 mm length was used to measure the shear strength of a soft clay. If a torque of 600 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. (08 Marks)

Module-5

- 9 a. Differentiate compaction from consolidation. (06 Marks)
 b. Explain mass spring analogy. (06 Marks)
 c. Explain the significance of pre consolidation pressure. Describe the Casagrande method of determining it. (08 Marks)

OR

- 10 a. Explain Pre-consolidated normally consolidated and under consolidated soil. (06 Marks)
 b. Explain curve fitting methods used in consolidation test? Explain any one with neat sketches. (08 Marks)
 c. A bed of compressible clay 4 m thick has pervious sand on the top and impervious rock at the bottom. In a consolidation test on an undisturbed sample of clay from this deposit, 90% settlement was reached in 4 hours, the sample was 20 mm thick. Estimate the time in years for the building founded over this deposit to reach 90% of its final settlement. (06 Marks)
