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Fifth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026 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 3 – phase diagram explain:
 i) Void ratio ii) Porosity iii) Water content (06 Marks)
- b. With usual notation prove that $e = \frac{WG}{S_r}$ (06 Marks)
- c. A sample of soil has a volume of 1000 CC and a weight of 17.5 N. The specific gravity of the soil is 2.52. If dry weight is 15.8 KN/m³, determine the water content, void ratio, submerged unit wt and degree of saturation. (08 Marks)

OR

- 2 a. Define liquid limit, plastic limit and shrinkage limit. (06 Marks)
- b. Explain the determination of in situ density of soil by sand replacement method. (06 Marks)
- c. A liquid limit test on a clay sample gave following results –
 The plastic limit of the soil is 20%

Number of blows	12	18	22	34
Water Content	56	52	50	40

Plot the flow graph and obtain liquid limit, flow index. Plasticity index and toughness index. (08 Marks)

Module-2

- 3 a. Define soil structure and explain the types of soil structures. (07 Marks)
- b. With a neat sketch explain the different clay minerals in soil. (07 Marks)
- c. Write a note on: i) Absorbed water ii) Soil - water (06 Marks)

OR

- 4 a. Explain the factors affecting soil compaction. (06 Marks)
- b. With a neat sketch explain the Standard Proctor Modified Test. (07 Marks)

- c. The following data was obtained from standard proctor test.

Water content in %	5.9	7.5	9.7	11.65	13.85
Wt of wet sample (N)	18.2	19.5	20.1	20.0	19.7

$G = 2.7$, Volume of the mould = $9.5 \times 10^{-4} \text{ m}^3$ Plot the composition curve and zero air void line. Determine OMC and MDD. (07 Marks)

Module-3

- 5 a. Explain Darcy's law along with its assumptions and limitations. (10 Marks)
- b. Derive the equation for co-efficient of permeability 'K' using falling head permeability test. (10 Marks)

OR

- 6 a. List the assumptions and limitations of laplace equation. (06 Marks)
- b. Define flow net and explain its applications and characteristics. (07 Marks)
- c. Calculate the quantity of water seeping under a weir per day for which the flow net has been constructed. The co-efficient of permeability is $2 \times 10^{-2} \text{ mm/s}$. Take $N_f = 5$ and $N_d = 18$. The difference in water level between upstream and downstream is 3 m and the length of the weir is 60 m. (07 Marks)

Module-4

- 7 a. Explain the factors affecting the shear strength of soil. (08 Marks)
- b. Explain the types of shear test based on drainage condition. (12 Marks)

OR

- 8 a. Explain the method of Direct Shear Test. (10 Marks)
- b. The results of shear box test are as follows:

Trial No	1	2	3	4
Normal force (N)	50	100	200	300
Shear force (N)	36	80	154	235

Determine the shear parameters. Will the failure occur on the plane within the soil mass, when the shear stress is 122 KN/m^2 and normal stress is 246 KN/m^2 . (10 Marks)

Module-5

- 9 a. Explain Mass – Spring analogy theory of consolidation of soils. (07 Marks)
- b. Explain the assumptions and limitations of Terzaghi's one – dimensional theory. (06 Marks)
- c. In a consolidation test the void ratio of the sample decreases from 1.2 to 1.1, when the pressure is increased from 160 to 320 KN/m^2 . Calculate the co-efficient of consolidation if the co-efficient of permeability is $8 \times 10^{-10} \text{ m / sec}$. (07 Marks)
- OR**
- 10 a. Explain normally consolidated, under consolidated and over consolidated soil. (06 Marks)
- b. Explain the method of determination of pre-consolidation pressure by Casagrande's Method. (08 Marks)
- c. Write a note on consolidation characteristics of soil. (C_c , a_v , m_v and C_v) (06 Marks)