



CBCS SCHEME

21CV54

Fifth Semester B.E./B.Tech. Degree Examination, June/July 2026

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 a neat sketch explain Phase diagram. (06 Marks)
- b. Derive equation $GW = Se$. (06 Marks)
- c. A Soil weighing 19 KN/m^3 has a water content of 30%. The specific gravity of soil particular is 2.68. Determine void ratio, porosity and degree of saturation. (08 Marks)

OR

- 2 a. Briefly discuss Indian Standard classification of Soils. (08 Marks)
- b. Derive equation $r_d = \frac{r}{1+w}$. (04 Marks)
- c. Following are the results of Liquid Limit Test on a clay sample whose natural water content is 35% and plastic limit is 28%

Number of blows	34	23	18	12
Water Content (%)	44.6	49.4	51.4	55.6

Plot the flow curve and obtain:

- i) Liquid Limit
- ii) Plasticity Index
- iii) Flow index
- iv) Consistency Index

(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.

Module-2

- 3 a. Outline the factors affecting Permeability of Soils. (06 Marks)
- b. With a neat sketch explain Quick Sand Phenomena. (06 Marks)
- c. A permeameter of 82 mm diameter contains a sample of soil length 350 mm. It can be used for either constant head or falling head tests. The stand pipe has a diameter of 25mm. In the constant head test the loss of head was 1160 mm measured on a length of 250mm, when the rate of flow was 2.73 ml/s. Find the coefficient of permeability of the soil. If a falling head test was then conducted how much time would be taken for the head to drop from 1.5m to 1 m? (08 Marks)

OR

- 4 a. With a neat sketch, explain Darcy's Law and list its assumptions. (06 Marks)
- b. Briefly discuss effective stress concept and its importance in construction of structures. (06 Marks)
- c. Explain permeability of Stratified Soils. (08 Marks)

Module-3

- 5 a. With a neat sketch explain the principles of compaction. (06 Marks)
- b. With a neat sketch explain mass-spring analogy. (06 Marks)
- c. The following data were obtained from Standard Proctor compaction test:

Waters content (%)	9	11	13	15	16	17	18
Bulk Unit weight (KN/m ³)	18	19	19.9	20.8	21	20.5	20.1

Plot the compaction curve and find out MDD and OMC. Also determine e & s at MDD. Take $G = 2.6$. (08 Marks)

OR

- 6 a. Explain the factors affecting compaction. (06 Marks)
- b. With a neat sketch explain pre-consolidation pressure and its determination by Casagrande's method. (06 Marks)
- c. A soil sample 20mm thick takes 20 minute to reach 20% consolidation. Find the time taken for a clay layer 6m thick to reach 40% consolidation. Assume double drainage in both cases. (08 Marks)

Module-4

- 7 a. With a neat sketch explain Mohr-Coulomb failure criterion. (06 Marks)
- b. With neat sketch explain Laboratory Direct Shear test procedure. (06 Marks)
- c. A specimen of clean, dry cohesionless sand and is tested in shear box and the soil failed at a shear stress of 40 kN/m^2 when the normal stress on the specimen was 50 kN/m^2 . Determine:
- i) The angle of shearing resistance
 - ii) The Principal stress during failure
 - iii) The directions of the principal stress with respect to the direction of plane of shearing. (08 Marks)

OR

- 8 a. Discuss the factors affecting shear strength. (06 Marks)
- b. Differentiate between Sensitivity and Thixotropy. (06 Marks)
- c. A soil has an unconfined compressive strength of 120 kN/m^2 . In a triaxial compression test, a specimen of the same soil when subjected to a chamber pressure of 40 kN/m^2 , failed at an additional stress of 160 kN/m^2 . Determine: i) Shear strength of parameter of the Soil (ii) Angle made by failure plane in the triaxial shear test. (08 Marks)

Module-5

- 9 a. With a neat sketch explain the effect of water table on bearing capacity of soil. (06 Marks)
- b. Explain different types of settlements and its importance. (06 Marks)
- c. Determine the safe bearing capacity of a square footing with 2.1m width placed at a depth of 1.5m in a soil with moist unit weight of 17kN/m^3 , $\phi = 20^\circ$ and $C = 15\text{kN/m}^2$. Take $N_c = 11.8$, $N_q = 3.9$ and $N_r = 1.7$. What is the change in bearing capacity if the water table raises to 0.5m above the base of footing? Assume factor safety of 3. (08 Marks)

OR

- 10 a. Explain the factor affecting bearing capacity of soils. (06 Marks)
- b. Briefly discuss differential and total settlements. (06 Marks)
- c. A square footing ($1.2\text{m} \times 1.2\text{m}$) rests on a saturated clay layer of 4m deep. Determine the primary consolidation settlement s_{nt} if the footing carries a load of 300kN. Take liquid limit as 30%. Saturated unit weight $= 17.8\text{ kN/m}^3$, natural moisture content $= 28\%$ and $G = 2.68$. (08 Marks)

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