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CBCS SCHEME

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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.***

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-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)

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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)**

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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 trick 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 40kN/m^2 when the normal stress on the specimen was 50kN/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)**

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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, ϕ =20° and C=15kN/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 (1.2m×1.2m) rests on a saturated clay layer of 4m deep. Determine the primary consolidation settlement 4nt if the footing carries a load of 300kN. Take liquid limit as 30%. Saturated unit weight=17.8 kN/m^3, natural moisture content =28% and G=2.68. **(08 Marks)**

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