

Roll No.

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**B.TECH. IV SEMESTER MAIN/BACK NEW
SCHEME ACADEMIC SESSION 2024-25**

CIVIL ENGINEERING

(4CE4-01) - Geotechnical Engineering - I

Time : 3 Hours]

[Max. Marks : 70

[Min. Passing Marks :

Instructions to Candidates :

Part-A : Short Answer Type Questions (up to 25 words) $10 \times 2 = 20$ marks. All 10 questions are compulsory.

Part-B : Analytical/Problem Solving questions $5 \times 4 = 20$ marks. Candidates have to answer 5 questions out of 7.

Part-C : Descriptive/Analytical/Problem Solving questions 3×10 marks = 30 marks. Candidates have to answer 3 questions out of 5.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of the following supporting materials is permitted during examination.
(Mentioned in form no. 205).

1 _____

2 _____

B-020

(1)

P.T.O.

Part-A

1. Define origin of soil. [2]
2. Draw the figure of element separated soil into three phases. [2]
3. Compute the range for capillary rise in silt deposits. Assume value of void ratio as 0.7. [2]
4. Define consistency limits. [2]
5. Differentiate between activity and sensitivity. [2]
6. Briefly explain single grain structure. [2]
7. What is Mohr's circle? Discuss its important characteristics. [2]
8. What are the methods for compaction used in field? [2]
9. Discuss the advantages of direct shear test. [2]
10. List the factors affecting permeability of soils. [2]

Part-B

1. A sample of saturated soil has a water content of 40%. The specific gravity of solids is 2.65. Determine its void ratio, porosity, saturated unit weight and dry unit weight. [4]
2. The sieve analysis and consistency limit tests conducted on a soil sample gave the following results: Percentage passing 4.75 mm sieve=82; percentage passing 75 micron sieve=9; $D_{10}=0.11$ mm; $D_{30}=0.45$ mm; $D_{60}=1.12$ mm; liquid limit= 22%; plastic limit=12%. Classify the soil by Indian standard classification. [4]
3. A horizontal stratified soil deposit consists of three uniform layers of thickness 6, 4 and 12 m respectively. The permeability of these layers are 8×10^{-4} cm/s, 52×10^{-4} cm/s and 6×10^{-4} cm/s, find the effective average permeability of the deposit in the horizontal and vertical direction. [4]

4. A sand deposit is 6-m thick and overlies a bed of soft clay. The GWT is 2.0 m below the ground surface. If sand above GWL has 40% saturated, plot the diagram showing the variation of total stress, pore water pressure and effective stress. Take $G = 2.68$ and $e = 0.8$ for sand deposits. [4]
5. A homogenous earth dam of 8m height has coefficient of permeability 5×10^{-5} cm/s. When a flow net was constructed, 12 potential drops and 8 flow channels were observed. Calculate the seepage loss per meter length of dam. [4]
6. A soil in the borrow pit is at a dry density of 17 kN/m^3 with moisture content of 10%. The soil is excavated from this pit and compacted in an embankment to a dry density of 18 kN/m^3 with a moisture content of 15%. Compute the quantity of soil to be excavated from the borrow pit and the amount of water to be added for 100 m^3 of compacted soil in the embankment. [4]
7. When a UCC test is conducted on a cylinder of soil, it fails under axial stress of 1.2 kg/cm^2 . The angle of failure plane was found to be 50° with the horizontal. Determine the cohesion and angle of internal friction of the soil.

Part-C

1. The following results were obtained from a standard compaction test on a sample of soil. [10]

Water content (%)	0.12	0.14	0.16	0.18	0.20	0.22
Mass of wet soil (kg)	1.68	1.85	1.91	1.87	1.87	1.85

The volume of mould used was 950cc. Make the necessary calculations and plot the compaction curve and obtain maximum dry density and OMC. Also, calculate the void ratio, degree of saturation and the theoretical maximum dry density. (Take $G = 2.70$).

2. Discuss in details the Mohr-Coulomb's theory of shear failure of soils. [10]
3. What are the different laboratory methods to determine coefficient of permeability?
Derive an expression to determine coefficient of permeability of soil by conducting
pumping-out test in the case of confined aquifer. [10]
4. Derive the Laplace's equation of continuity with all assumptions. [10]
5. What is soil Stabilization? Explain the different types of Soil Stabilization Methods.
[10]
