U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

August 2024 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: Civil Engineering **Duration: 3 hrs.**
Course Code: 23CV4PCGTE **Max Marks: 100**
Course: Geotechnical Engineering-I

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT – I	CO	PO	Marks
1	a)	Define the terms: Degree of saturation, Percentage air voids and Unit weight of solids, with the help of three phase diagram.	CO 1	PO1	**08**
	b)	List the different types of transported soils and the agency which transports them. Explain the characteristic feature of aeolian deposits.	CO 1	PO1	**06**
	c)	One cubic metre of wet soil weighs 19.80 kN. If the specific gravity of soil particles is 2.70 and water content is 11%, determine the dry unit weight, void ratio and degree of saturation.	CO 1	PO2	**06**
		UNIT – II			
2	a)	Define the following: i) Consistency Index ii) Volumetric Shrinkage	CO 1	PO1	**04**
	b)	Following are the properties of two soils, obtained from laboratory tests. Classify them according to Indian Standards.	CO1	PO2	**08**

Soil Sample	Soil-A	Soil-B
Percentage passing through 0.075mm sieve	10	59
Percentage passing through 4.75mm sieve	64	100
D_{10} (mm)	0.3	-
D_{30} (mm)	1.0	-
D_{60} (mm)	2.0	-
Liquid Limit (%)	-	36
Plastic Limit (%)	-	20

		c)	The in-situ porosity of a sand deposit is 34%. For determining the density index, dried sand from the stratum was first filled loosely in 1000 cm^3 mould and was then vibrated to give a maximum density. The loose dry mass in the mould was 1610 g and the dense dry mass at maximum density was found to be 1980 g. Determine the density index of the sand, if G = 2.67.	CO 1	PO2	**08**
			OR			
	3	a)	List and discuss the tests involved in field identification of soils.	CO 1	PO1	**10**
		b)	In a liquid limit test specimens of certain sample of clay, following readings are obtained: Water content (%): 55.8, 51.9, 49.5, 45.6 No. of blows: 12, 18, 23, 34 The plastic limit of clay is 27.20 % natural water content is 32.80 %. Determine liquid limit, plasticity index, liquidity index, relative consistency, flow index and toughness index of soil.	CO 1	PO2	**10**
			UNIT - III			
	4	a)	Explain with neat sketches Kaolinite and Montmorillonite clay minerals.	CO 2	PO1	**10**
		b)	A uniform soil deposit has a void ratio 0.6 and specific gravity of 2.65. The natural ground water is at 2.5 m below natural ground level. Due to capillary moisture, the average degree of saturation above ground water table is 50%. Determine the neutral pressure, total pressure and effective pressure at a depth of 6 m. Also draw the pressure diagrams.	CO 2	PO2	**10**
			UNIT – IV			
	5	a)	Discuss the effect of compaction on soil properties.	CO 2	PO1	**10**
		b)	Calculate the coefficient of permeability of a soil sample 6 cm in height and 50 cm^2 in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective constant head of 40 cm. On oven drying, the test specimen weighs 498 g. Also calculate the seepage velocity of water, take G = 2.65.	CO 2	PO2	**10**

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<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>6</td><td>a)</td><td>List the assumptions of Darcy’s law.</td><td>CO 2</td><td>PO1</td><td>04</td></tr>
<tr><td></td><td></td><td>b)</td><td>A horizontal stratified soil deposit consists of three layers each uniform in itself. The permeabilities of these layers are 8×10^{-4} cm/s, 52×10^{-4} cm/s, and 6×10^{-4} cm/s, and their thicknesses are 7, 3 and 10 m respectively. Find the effective average permeability of the deposit in the horizontal and vertical directions.</td><td>CO 2</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td>c)</td><td>The observations of a standard proctor test are given below:
<table>
<tr><td>Bulk density (g/cm^3)</td><td>1.616</td><td>1.756</td><td>1.861</td><td>1.890</td><td>1.878</td><td>1.713</td></tr>
<tr><td>Water Content (%)</td><td>5.02</td><td>8.81</td><td>11.25</td><td>13.05</td><td>14.40</td><td>19.25</td></tr>
</table>
i) Plot the compaction curve and determine OMC and MDD.
ii) Also plot the zero air voids line. Take G = 2.70.</td><td>CO 2</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT – V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>List the advantages of triaxial shear test over direct shear test.</td><td>CO 2</td><td>PO1</td><td>06</td></tr>
<tr><td></td><td></td><td>b)</td><td>In a drained triaxial compression test, a saturated specimen of cohesionless sand fails under a deviator stress of 535 kN/m^2 when the cell pressure is 150 kN/m^2. Find the effective angle of shearing resistance of sand and the approximate inclination of the failure plane to the horizontal.</td><td>CO 2</td><td>PO2</td><td>06</td></tr>
<tr><td></td><td></td><td>c)</td><td>Two identical soil specimens were tested in a triaxial apparatus. First specimen failed at a deviator stress of 770 kN/m^2, when the cell pressure was 200 kN/m^2. Second specimen failed at a deviator stress of 1370 kN/m^2, when the cell pressure was 400 kN/m^2. Determine the value of c and ϕ. If the same soil is tested in a direct shear apparatus with a normal stress of 600 kN/m^2, estimate the shear stress at failure.</td><td>CO 2</td><td>PO2</td><td>08</td></tr>
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