KUMARAGURU
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B.E. **DEGREE EXAMINATIONS: NOV/DEC 2024**

(Regulation 2018)

Fifth Semester

CIVIL ENGINEERING

U18CEI5202: Soil Mechanics

COURSE OUTCOMES

CO1: Identify and classify soils as per Bureau of Indian Standards (BIS).

CO2: Estimate effective stress and vertical stress of soil below ground level.

CO3: Determine permeability, and seepage through soil and prepare flow net diagram.

CO4: Understand compaction and compressibility parameters and estimate the total, time rate settlement of soil.

CO5: Analyse shear properties of cohesive and cohesionless soils.

Time: Three Hours   **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1. What are the different types of soil based on formation?	CO1	[K$_1$]
2. The specific gravity of a soil sample is 2.7 and its void ratio is 0.945. If it is fully saturated, what will be the moisture content of the soil?	CO1	[K$_3$]
3. Calculate the total stress at the bed of a lake having water up to 3.0 m depth. Consider unit weight of water as 10 kN/m^3.	CO2	[K$_3$]
4. Define pressure bulb.	CO2	[K$_1$]
5. Define coefficient of permeability.	CO3	[K$_1$]
6. What is quick condition of soil?	CO3	[K$_1$]
7. Suggest a suitable compaction equipment for compacting i) Clayey soil and ii) Sandy soil	CO4	[K$_2$]
8. Define compression index.	CO4	[K$_1$]
9. What are shear strength parameters in terms of total and effective stresses.	CO5	[K$_2$]
10. Calculate the center and radius of Mohr's circle, for the value of major and minor principal stresses 100 MPa and 50 MPa respectively.	CO5	[K$_3$]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Briefly explain how to determine liquid limit of soil in the laboratory.	8	CO1	[K$_2$]
	b)	A core cutter method is used to determine the in-situ density of an embankment, compacted at a water content of 14%. The empty mass of the cutter was 1285 g and the cutter full of soil has a mass of 3185 g and the volume of the cutter being 1000 cm^3. Determine the bulk density, dry density and the degree of saturation of the embankment. Consider specific gravity of soil solids G$_s$ as 2.72.	8	CO1	[K$_3$]

12.	a)	For the subsoil condition shown in figure calculate total, neutral and effective stress at 1 m, 3 m and 6 m below ground level and draw the stress distribution diagrams. Assume $\gamma_w = 10 \text{ kN/m}^3$.	10	CO2	[K$_3$]
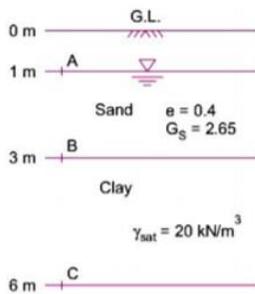
	b)	A water tank is supported by a ring foundation having outer diameter of 10.0 m and inner diameter of 7.5 m. The ring foundation transmits a uniform load intensity of 160 kN/m^2. Compute the vertical stress induced at a depth of 4.0 m below the centre of ring foundation using Boussinesq analysis.	6	CO2	[K$_3$]

13.	a)	List the characteristics of flow net.	6	CO3	[K$_2$]
	b)	A horizontal stratified soil deposit consists of three uniform layers of thickness 6, 4 and 12 m respectively. The permeabilities of these layers are 8 x 10^{-4} cm/s, 52 x 10^{-4} cm/s and 6 x 10^{-4} cm/s, find the effective average permeability of the deposit in the horizontal and vertical directions.	10	CO3	[K$_3$]

14.	a)	State the assumptions made in Terzaghi's one dimensional consolidation theory.	6	CO4	[K$_2$]

b) Explain in detail how you will estimate the coefficient of consolidation of a clay soil by square root time fitting method.   10   CO4   [K$_3$]

15. a) A cylindrical sample of soil, having cohesion of 0.8 kg / cm^2 and angle of internal friction of 20°, is subjected to a cell pressure of 1.0 kg/cm^2. Calculate the maximum deviator stress at which the sample will fail and the angle made by the failure plane with the axis of the sample.   8   CO5   [K$_3$]

b) In an in-situ vane shear test on a saturated clay, a torque of 35 N-m was required to shear the soil. The diameter of the vane was 50 mm and length 100 mm. Calculate the undrained shear strength of the clay. The vane was then rotated rapidly to cause remolding of the soil. The torque required to hear the soil in the remolded state was 20 N-m. Determine the sensitivity of the clay.   8   CO5   [K$_3$]

16. a) A soil specimen has a water content of 12 % and a wet unit weight of 19 kN/m^3. If the specific gravity of solids is 2.67, determine the dry unit weight, void ratio, porosity, and degree of saturation. Consider unit weight of water $\gamma_w = 10$ kN/m^3.   10   CO1   [K$_3$]

b) It is planned to construct an embankment for the proposed formation of pavement for national highway, for which a borrow area has been identified nearby. Explain in detail how you will assess the suitability of the soil from the borrow area for the embankment construction.   6   CO4   [K$_3$]

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