2024

GEOTECHNICAL ENGINEERING

Full Marks: 100

Time : Three hours *The figures in the margin indicate full marks for the questions. Answer any five questions. "Assumptions made should be clearly stated" "Illustrate answers with real sketches whenever required"*

1.	a)	Classify soil according to ISSCS.	5
	b)	How many Atterberg's limits are available? Define liquid limit, plastic limit and shrinkage limit of soil in detail.	1+9 = 10
	c)	Establish a relationship between void ratio (e) and porosity (n) of a soil mass.	5
2.	a)	The total unit weight of the soil in 6 kN/m ³ . The specific gravity of the soil solids is 2.67. The water content of the soil is 17%. Assume that unit weight of water is 9.81 kN/m ³ . Calculate the following, a) Dry unit weight b) Porosity c) Void ratio d) Degree of saturation 2006 	10
	b)	Explain the procedure for determining the MDD and OMC from a compaction curve of a fine grained soil.	10
3.	a)	Define effective stress? How pore water pressure is generated within a soil mass. What does it mean by capillary rise of water?	1+2+2=5
	b)	A masonry dam has pervious sand as foundation. Determine the critical hydraulic gradient, if a factor of safety of 4 is required against boiling/quick sand condition. Assume for the sand, n=45% and $G_{s=}2.65$.	5
	c)	Derive the expression for coefficient of permeability of a stratified soil mass under the condition of horizontal flow.	10
4.		A clay soil, tested in a consolidometer, showed a decrease in void ratio from 1.20 to 1.10 when the pressure was increased from 0.25 to 0.50 kgf/cm ² . Calculate the coefficient of compressibility (a_v) and the coefficient of volume compressibility (m_v) . If the coefficient of consolidation (c_v)	15+5 = 20

		determined in the test for the given stress increment was 10 m ² /year, calculate the coefficient of permeability in cm/s.	
		For a layer of 3.0 m thickness consisting of same clay, determine the consolidation settlement resulting from the given stress increment.	
5.	a)	Draw a Mohr circle diagram (not necessarily in scale) for state of stress at a point in cylindrical soil sample with the help of principal stresses. Write down the equations for normal stress and shear stress in terms of principal stresses.	6+4 = 10
	b)	The effective stress shear strength parameters of completely saturated clay are: $c' = 20 \text{ kN/m}^2$; $\phi' = 25^{\circ}$. A sample of this clay is tested in a UU test under a cell pressure of 200 kN/m ² and the principal stress difference at failure was 110 kN/m ² . If pore water pressure is measured, then what is the value of pore water pressure at failure?	10
6.	a)	An embankment is to be made of a soil which has the following shear strength parameters under the existing conditions: $c' = 30 \text{ kN/m}^2$, $\phi' = 15^0$. if it is assumed that different margins of safety are available for cohesion components and friction component of shearing strength and the mobilized values of cohesion and friction are: $c_m = 22 \text{ kN/m}^2$, $\phi_m = 12^0$, what is the FoS w.r.t (a) cohesion and (b) friction? If the average effective normal stress on failure surface is 120 kN/m ² , what is the value of true FoS.	10
	b)	A retaining wall, 8 m high, with a smooth vertical back, retains a clay backfill with $c' = 15^0$ and $\gamma = 18$ kN/m ³ . Calculate the total active thrust on the wall assuming that tension cracks may develop to the full theoretical depth.	10

ESTD. : 2006 असतो मा सत गमय तमसो मा ज्योतिर्गमय

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