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

Autonomous Institute Affiliated to VTU

January / February 2025 Semester End Main Examinations

Programme: B.E. **Semester: V**

Branch: Civil Engineering **Duration: 3 hrs.**

Course Code: 23CV5PCGTE / 22CV5PCGTE **Max Marks: 100**

Course: Geotechnical Engineering-II

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

		UNIT - I	CO	PO	Marks
1	a)	Explain with neat sketches, the mechanism of consolidation by means of Piston and Spring analogy.	CO1	PO1	**10**
	b)	In a consolidation test, the void ratio of the specimen was 1.068 under the effective pressure of 214 kN/m^2, changed to 0.994 when the pressure was increased to 429 kN/m^2. Calculate the coefficient of compressibility, compression index and the coefficient of volume compressibility. Determine the settlement of foundation resting on above type of clay, if the thickness of layer is 8 m and the increase in pressure is 10 kN/m^2.	CO1	PO2	**10**
		OR			
2	a)	List the assumptions of Terzaghi's theory of one-dimensional consolidation.	CO1	PO1	**04**
	b)	A soil sample 20mm thick takes 20minutes to reach 20% consolidation. Find the time taken for a clay layer of 6m thick to reach 40% consolidation. Assume double drainage in both cases.	CO1	PO2	**06**
	c)	A consolidation test on a undisturbed clay soil sample obtained from 4m below ground surface is given below. Plot the curve. Find i) compression index ii) Pre consolidation pressure.	CO1	PO2	**10**

Normal pressure (N/mm^2)	0.08	0.16	0.32	0.64	1.28
Equilibrium void ratio	1.35	1.28	1.14	0.96	0.78

		UNIT - II			
3	a)	List the assumptions of coulomb's wedge theory.	CO1	PO1	**05**
	b)	A retaining wall 10 m high retains a cohesionless soil with an angle of internal friction of 30°. The top of the soil is level with	CO1	PO2	**15**

			the top of the wall and is horizontal. The bulk unit weight of the top 3 m of the fill is 20 kN/m^3 and that of the rest is 30 kN/m^3. Determine the total active thrust on the wall and its point of application. Assume angle of internal friction of 30° for both the strata.			
			OR			
	4	a)	Compare Rankine's and Coulomb's earth pressure theories.	CO1	PO1	**06**
		b)	Compute the intensity of passive earth pressure at a depth of 8 m in cohesionless sand with an angle of internal friction of 30°, when water rises to the ground level. Take saturated unit weight of sand as 21 kN/m^3.	CO1	PO2	**04**
		c)	A retaining wall with a smooth vertical back retains a purely cohesive fill. Height of wall is 12 m. Unit weight of fill is 20 kN/m^3. Cohesion is 1 N/cm^2. What is the total active Rankine thrust on the wall? At what depth is the intensity of pressure zero and where does the resultant thrust act?	CO1	PO2	**10**
			UNIT - III			
	5	a)	Discuss the types of failures of finite slope with neat sketches.	CO3	PO1	**06**
		b)	Describe the Fellinious method of locating centre of a critical slip circle with sketch.	CO3	PO1	**06**
		c)	A cutting of 9 m deep is to be made in a clay with a unit weight of 18 kN/m^3 and a cohesion of 27 kN/m^2. A hard stratum exists at a depth of 18 m below the ground surface. Determine from Taylor's charts if a 30° slope is safe. If a factor of safety of 1.50 is desired, what is a safe angle of slope? (Refer Figure 1)	CO3	PO2	**08**
			OR			
	6	a)	Explain with a neat sketch, the Swedish method of slices for a cohesive frictional soil.	CO3	PO1	**10**
		b)	A canal is to be excavated through a soil with c = 15 kN/m^2, ϕ= 20°, e = 0.9 and G = 2.67. The side slope is 1 in 1. The depth of the canal is 6 m. Determine the factor of safety with respect to cohesion when the canal runs full. What will be the factor of safety if the canal is rapidly emptied? (Refer Figure 1).	CO3	PO2	**10**
			UNIT - IV			
	7	a)	List the objectives of soil exploration.	CO2	PO1	**04**
		b)	A ring foundation is of 3.60 m external diameter and 2.40 m internal diameter. It transmits a uniform pressure of 135 kN/m^2. Calculate the vertical stress at a depth of 1.80 m directly beneath the centre of the loaded area.	CO2	PO2	**06**
		c)	Construct an isobar, using Boussinesq's theory for the following data: σ_z = 50 kN/m^2 and Q = 1200 kN.	CO2	PO2	**10**
			OR			
	8	a)	Explain with a neat sketch, the seismic refraction method of soil exploration.	CO2	PO1	**08**

		b)	Compute the intensity of vertical pressure and horizontal shear stress at a point 4m directly below a 20kN point load acting at a horizontal ground surface. What will be the vertical pressure and horizontal shear stress at a point 2m horizontally away from the axis of loading but at the same depth of 4m?	CO2	PO2	**08**
		c)	The outside and inside diameters of a sampling tube are 103mm and 98mm respectively. The cutting edge has outside and inside diameters of 108mm and 93mm respectively. Determine area ratio, inside clearance and outside clearance.	CO2	PO2	**04**
			UNIT - V			
	9	a)	List the assumptions and limitations of Terzaghi's analysis for bearing capacity of soils.	CO3	PO1	**06**
		b)	Discuss the effect of ground water table on bearing capacity with neat sketches.	CO3	PO1	**06**
		c)	A circular footing is resting on a stiff saturated clay with unconfined compressive strength of 250 kN/m^2. The depth of foundation is 2 m. Determine the diameter of the footing if the column load is 600 kN. Assume a factor of safety as 2.5. The bulk unit weight of soil is 20 kN/m^3. Terzaghi's factors for $\phi = 0°$ are $N_c = 5.7$, Nq = 1, and $N_\gamma = 0$.	CO3	PO2	**08**
			OR			
	10	a)	List the characteristics of Local shear failure.	CO3	PO1	**06**
		b)	Determine the ultimate bearing capacity of a circular footing of 1m diameter resting on the surface of a saturated clay of unconfined compression strength of 100 kN/m^2 ? Terzaghi's factors for $\phi = 0°$ are $N_c = 5.7$, Nq = 1, and $N_\gamma = 0$.	CO3	PO2	**04**
		c)	Compute the safe bearing capacity of a square footing 1.5 m × 1.5 m, located at a depth of 1 m below the ground level in a soil of average density 20 kN/m^3. Take F = 3, c = 0, $\phi = 20°$, $N_c = 17.7$, $N_q = 7.4$, and $N_\gamma = 5.0$. Assume that the water table is very deep. Also compute the reduction in safe bearing capacity of the footing if the water table rises to the ground level.	CO3	PO2	**10**

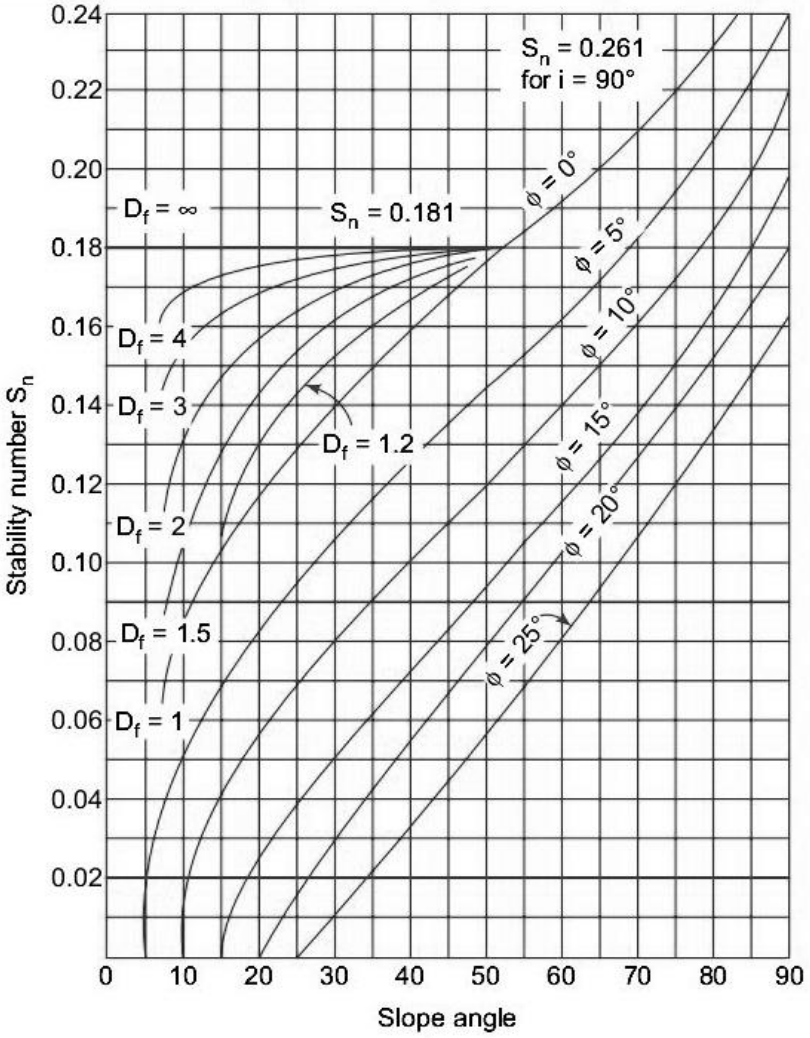

Figure 1: Taylor's Stability Number chart (Q.No. 5c and Q. No. 6b)

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