U.S.N.										

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: 20CV5PCGTE **Max Marks: 100**

Course: Geotechnical Engineering-II

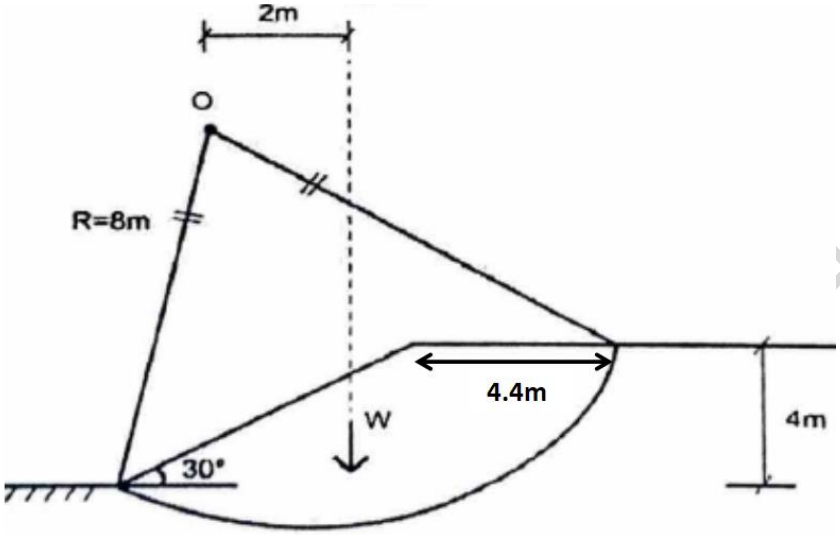
Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

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)	With neat figures explain the spring analogy proposed by Terzaghi to explain the consolidation process	CO1	PO1	6
	b)	Describe with a neat sketch Casagrande's method to determine preconsolidation pressure.	CO1	PO1	6
	c)	A saturated soil has a compression index of 0.28. Its void ratio at a stress of 12kN/m^2 is 2.05 and its permeability is 3.5 x 10^{-6}m/s. Compute i. Change in void ratio, if the stress is increased to 20kN/m^2 ii. Settlement, if the soil stratum is 5m thick iii. Time required for 50% consolidation if drainage is two way. Take T_V=0.197	CO1	PO2	8
		OR			
2	a)	List the assumptions of Terzaghi's one dimensional consolidation theory	CO1	PO1	6
	b)	Explain the Taylor's square root of time method of determining the rate of consolidation of a soil for any pressure increment.	CO1	PO1	6
	c)	Plot e-log P curve for the data given below and also determine Compression index.	CO1	PO2	8

Effective pressure (kPa)	6.25	12.5	25	50	100	200	400	800
Void ratio, e	1.590	1.585	1.575	1.550	1.500	1.445	1.390	1.335

			UNIT - II			
	3	a)	Discuss the different types of lateral earth pressure acting on retaining walls with neat sketches.	*CO2*	*PO1*	**6**
		b)	List the assumptions and limitations of Rankine's earth pressure theory	*CO2*	*PO1*	**6**
		c)	A retaining wall 10m high retains a cohesionless soil having an angle of internal friction of 35º. The surface of the soil is level with the top of the wall. The top 3m of the fill has a unit weight of 16kN/m^3 and that of the rest is 20kN/m^3. Determine the magnitude and point of application of the resultant active earth pressure. Assume angle of internal friction is same for both the strata.	*CO2*	*PO2*	**8**
			OR			
	4	a)	List the differences between Rankine's theory and Coulomb's theory	*CO2*	*PO1*	**4**
		b)	A retaining wall with smooth vertical back retains a purely cohesive soil (ϕ=0). Height of the wall = 12m, unit weight of backfill = 20kN/m^3, C= 10kPa. Determine i. Depth of tensile crack ii. Critical depth of a vertical cut iii. Active earth pressure before formation of tensile crack along with a pressure diagram.	*CO2*	*PO2*	**8**
		c)	A smooth vertical wall 10m high retains a cohesionless backfill having horizontal surface with angle of shearing resistance ϕ=30º. The water table is located at depth of 3m from ground surface. The specific gravity of sand G=2.65 and void ratio e=0.65 i. Draw the profile ii. Determine the resultant active earth pressure and its point of action iii. Sketch the pressure diagram	*CO2*	*PO2*	**8**
			UNIT - III			
	5	a)	Discuss Fellenious method to find the centre of critical slip circle	*CO3*	*PO1*	**6**
		b)	Explain with a neat sketch, the procedure for determining Factor of safety using method of slices for slopes in c- ϕ soils.	*CO3*	*PO1*	**6**
		c)	A 5m deep canal has side slopes of 1V:1H. The properties of soil are C_U= 20kN/m^2 , ϕ_U=10°, e=0.8 and G=2.8. If Taylor's stability number is 0.108, determine the factor of safety with respect to cohesion when the canal runs full. Also find the same in case of sudden drawdown, if Taylor's stability number for this condition is 0.137.	*CO3*	*PO2*	**8**
			OR			

	6	a)	Discuss the various types of finite slope failures with sketches	*CO3*	*PO1*	**6**
		b)	An embankment 4m high is inclined at a slope of 30º. The soil properties are c=25kN/m^2, γ = 20kN/m^3 and ϕ= 0º. The radius of trial slip circle shown below is 8m. The area of soil = 33m^2. Sketch the slope and determine factor of safety against sliding. The distance of W from the centre of slip circle =2m 	*CO3*	*PO2*	**14**
			UNIT - IV			
	7	a)	Explain with a neat sketch, the seismic refraction method of soil exploration	*CO4*	*PO1*	**6**
		b)	What are the objectives of soil exploration	*CO4*	*PO1*	**6**
		c)	During a soil exploration programme, a soil sample of length 510 mm was recovered using a split spoon sampler. The penetration length of the sample was 610mm. Dimensions of the sampler are given below: Inside and outside diameter of the sample tube = 38 and 50 mm, respectively, and , Inside and outside diameter of the cutting edge= 35 and 51 mm, respectively. Determine inside clearance, outside clearance, area ratio and recovery ratio along with a sketch.	*CO4*	*PO2*	**8**
			OR			
	8	a)	Sketch the contact pressures below foundations (both flexible and rigid) for clayey and sandy type of soils.	*CO4*	*PO1*	**4**
		b)	A rectangular area 2m x 4m carries a uniform load of 80kN/m^2 at the ground surface. Calculate the vertical pressures at 5m below	*CO4*	*PO2*	**8**

<table>
<tr><td></td><td></td><td></td><td>the centre and at corner of the loaded area by Equivalent point load method.</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>c)</td><td>A seismic refraction study gave the following data. Determine the seismic velocity for the surface and underlying layer. Also find the thickness of upper layer
<table>
<tr><td>Distance from source to geophone (m)</td><td>15</td><td>30</td><td>60</td><td>90</td><td>120</td></tr>
<tr><td>Time to receive waves (s)</td><td>0.025</td><td>0.05</td><td>0.10</td><td>0.11</td><td>0.12</td></tr>
</table></td><td>CO4</td><td>PO2</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>9</td><td>a)</td><td>Determine the size of a square footing resting on sand with c=0, ϕ=30^o to carry a safe load of 600kN. Assume FS=2.5, unit weight of sand γ= 15kN/m^3, Depth of footing = 2m. Water table is very deep. Adopt Nc=37.2, Nq=22.5, Nγ=19.7</td><td>CO5</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>A strip footing 2m wide is founded at a depth of 1.2m in sand. The saturated unit weight of sand is 19.5kN/m^3 and unit weight above water table is 16.8kN/m^3. If c=0, ϕ=35^o, Nc=57.8, Nq=41.4 and Nγ = 42.4. Adopting Terzaghi's analysis, determine the ultimate bearing capacity, with respect to shear failure when the
i. Water table is very deep
ii. Water table is at the base of the footing</td><td>CO5</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>10</td><td>a)</td><td>Differentiate between local shear failure and general shear failure</td><td>CO5</td><td>PO1</td><td>6</td></tr>
<tr><td></td><td></td><td>b)</td><td>Explain the effect of water table on bearing capacity of shallow foundation, considering varying locations of the water table.</td><td>CO5</td><td>PO1</td><td>6</td></tr>
<tr><td></td><td></td><td>c)</td><td>Plate load tests were conducted in a c-ϕ soil, using plates of two different sizes and the following results were obtained
<table>
<tr><td>Load</td><td>Sizes of plates</td><td>Settlement</td></tr>
<tr><td>40kN</td><td>0.3m x 0.3m</td><td>25mm</td></tr>
<tr><td>100kN</td><td>0.6m x 0.6m</td><td>25mm</td></tr>
</table>
Determine the size of square footing to carry a load of 800kN at the same specified settlement of 25mm</td><td>CO5</td><td>PO2</td><td>8</td></tr>
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