U.S.N.										

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

Autonomous Institute Affiliated to VTU

June 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 - 2

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.

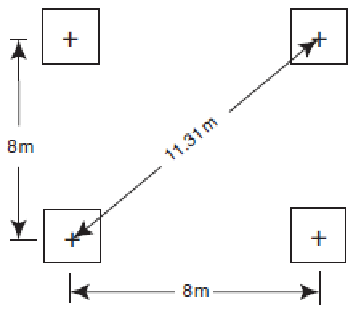
			CO	PO	Marks
		UNIT - I			
1	a)	Define the following terms with relevant expressions: i) Compression Index ii) Coefficient of Compressibility iii) Coefficient of Volume change	CO1	PO1	**6**
	b)	List the assumptions and limitations made in Terzaghi's one dimensional consolidation theory	CO1	PO1	**6**
	c)	A 2m clay layer (e = 0.92, G = 2.72, C_C = 1/3) is overlain with 3m thick sand layer (e = 0.5, G = 2.62, Moisture Content = 0). The water table is 1.5m below the ground (sand) surface. If a 3m thick landfill (γ = 17.3 kN/m^3) is placed over the existing ground surface, Compute the consolidation settlement of the clay layer	CO1	PO2	**8**
		OR			
2	a)	Explain determination of pre-consolidation pressure by Casagrande method with neat sketch.	CO1	PO1	**6**
	b)	Explain with a neat sketch the principle and methodology of determining coefficient of consolidation by square root time fitting method	CO1	PO1	**6**
	c)	A 3.2m thick layer of saturated clay under a surcharge loading underwent 90% primary consolidation in 80 days with double drainage. For U > 0.60, $T_V = 1.7813 - 0.9332 \log_{10}(100 - U\%)$ (i) Determine the coefficient of consolidation for the pressure range (ii) For a 10cm thick, specimen of the said clay, how long will it take to undergo 90% consolidation in the laboratory for a similar pressure range?	CO1	PO2	**8**

<table>
<tr><td></td><td></td><td></td><td>UNIT - II</td><td></td><td></td><td></td></tr>
<tr><td></td><td>3</td><td>a)</td><td>Discuss critically the Rankine’s and Coulomb’s earth pressure theory</td><td>CO1</td><td>PO1</td><td>6</td></tr>
<tr><td></td><td></td><td>b)</td><td>A smooth retaining wall 6m high retains dry granular backfill weighing 16kN/m^3. The Active earth thrust on the wall is 96kN/m of the wall. Find the angle of internal friction of the soil.</td><td>CO1</td><td>PO2</td><td>4</td></tr>
<tr><td></td><td></td><td>c)</td><td>A retaining wall of height 9m retains two soils. The top soil consists of 4.5m thick with γ=16 kN/m^3, ϕ=30º, c=0. The bottom soil consists of γ_{sat}=18 kN/m^3, ϕ=35º, c=5kPa. The water table is located at a depth of 4.5m from the ground surface. Considering 1m length of the wall,
(i) Draw the pressure diagram across the length of the wall
(ii) Determine the total active force acting on the wall
(iii) Determine the location of the total active force measured from the bottom of the wall.</td><td>CO1</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>4</td><td>a)</td><td>Discuss three types of lateral earth pressure with sketches and examples</td><td>CO1</td><td>PO1</td><td>6</td></tr>
<tr><td></td><td></td><td>b)</td><td>Sketch and explain the pressure diagram for retaining wall with cohesive backfill.</td><td>CO1</td><td>PO1</td><td>4</td></tr>
<tr><td></td><td></td><td>c)</td><td>A two-layer cohesive horizontal backfill is supported by a 10 m high vertical smooth wall. Determine the Rankine active force per unit length of the wall before a tensile crack occurs in the top layer. Also, determine the line of action of the resultant in both cases. The soil layer parameters are given below:
<table>
<tr><td>0-5m</td><td>Top layer</td><td>C_U = 12kPa</td><td>ϕ_U = 0°</td><td>γ =17 kN/m^3</td></tr>
<tr><td>5–10 m</td><td>Bottom layer</td><td>C_U = 35kPa</td><td>ϕ_U = 10°</td><td>γ =18 kN/m^3</td></tr>
</table></td><td>CO1</td><td>PO2</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>Explain causes for slope instability and also list the methods of stabilisation of slopes</td><td>CO3</td><td>PO1</td><td>6</td></tr>
<tr><td></td><td></td><td>b)</td><td>Explain Swedish slip circle method for the stability analysis of slope in cohesive soil?</td><td>CO3</td><td>PO1</td><td>6</td></tr>
<tr><td></td><td></td><td>c)</td><td>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</td><td>CO3</td><td>PO2</td><td>8</td></tr>
</table>

			i) When the canal runs full. ii) When the canal is rapidly emptied.			

ϕ	0º	5º	10º	15º	20º	25º
i= 45º	0.170	0.136	0.108	0.083	0.062	0.044

			OR			
	6	a)	Explain Fellenious method for location of critical slip circle	*CO3*	*PO1*	**6**
		b)	A finite slope of height 9m is inclined at 1.5H:1V. If the Fellenious directional angles are α = 26º and β = 35º, calculate the factor of safety against toe failure of the slope by method of slices. Given: γ = 19kN/m^3, c = 25kPa, ϕ = 20º	*CO3*	*PO2*	**14**
			UNIT - IV			
	7	a)	Explain the design features affecting the sample disturbance	*CO2*	*PO1*	**6**
		b)	List the assumptions in Boussinesq's theory of stress distribution	*CO2*	*PO1*	**6**
		c)	An overhead water tank is supported at a depth of 3 m by four isolated square footing of sides 2 m each placed in a square pattern with a centre-to-centre spacing of 8 m. Compute the vertical stress at the foundation level (i) at the centre of the four footings and (ii) at the centre of one footing. Adopt Boussinesq's point load approximation. The load on each footing is 700 kN.	*CO2*	*PO2*	**8**



			OR			
	8	a)	Explain with neat sketch the seismic refraction method of soil exploration.	*CO2*	*PO1*	**6**
		b)	With neat sketches explain contact pressure below foundations (both flexible and rigid) for clayey and sandy type of soils	*CO2*	*PO1*	**6**
		c)	Calculate the stress in a soil mass below the centre of a uniformly loaded circular area of radius 1.5 m with a pressure of 60 kN/m^2 and thus obtain the exact depth at which the stress reduces to 10% of the applied stress.	*CO2*	*PO2*	**8**

			UNIT - V			
	9	a)	Discuss the effect of ground water table on bearing capacity of soil with a neat sketch considering various locations of GWT.	*CO3*	*PO1*	**6**
		b)	A square footing has dimensions of 2m x 2m and a depth of 2m. Determine its ultimate bearing capacity in pure clay with an unconfined compressive strength of $0.15 N/mm^2$, $\phi=0°$ and $\gamma = 16.677 kN/m^3$. Take Nc = 5.7, Nq = 1, and $N\gamma = 0$.	*CO3*	*PO2*	**6**
		c)	A circular footing 2.5m in diameter is located at a depth of 1.8m below the ground surface. The ground water table is located at a depth of 1.1m below the ground level. The unit weight of the soil above and below the water table is $18.5 kN/m^3$ and $19.2 kN/m^3$. c= 80kPa and $\phi=25°$. Assume general shear failure and use a factor of safety of 3. Given Nc=25.13, Nq=12.72, Ny=8.34 Determine i. The ultimate bearing capacity ii. The ultimate bearing capacity if the water table rises beyond the ground surface. iii. What is the percentage reduction in ultimate bearing capacities for the above cases?	*CO3*	*PO2*	**8**
			OR			
	10	a)	Distinguish between general shear failure and local shear failure	*CO3*	*PO1*	**6**
		b)	With a neat sketch explain plate load test method to evaluate bearing capacity of soils.	*CO3*	*PO1*	**6**
		c)	Plate load tests were conducted in a c- ϕ soil, using square plates of two different sizes and the following results were obtained Load / Square plate area / Settlement: 40kN / $900 cm^2$ / 2.5cm 100kN / $3600 cm^2$ / 2.5cm Determine the size of square footing to carry a load of 800kN at the same specified settlement of 25mm.	*CO3*	*PO2*	**8**

Load	Square plate area	Settlement
40kN	$900 cm^2$	2.5cm
100kN	$3600 cm^2$	2.5cm

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