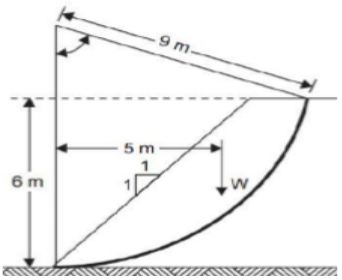
DEPARTMENT OF CIVIL ENGINEERING

(IV YR - I SEM) GEOTECHNICAL ENGINEERING – II

QUESTION BANK

UNIT-I STABILITY OF SLOPES

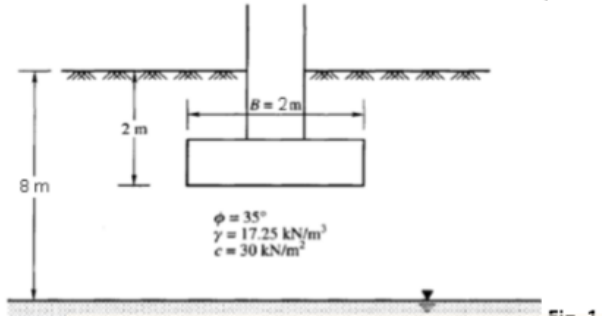
S.NO	QUESTION	MARKS	COGNITIVE LEVEL
1	a) Explain finite and infinite slopes. Why slopes fail? Discuss different types of slope failure.	5M	L3
	b) An embankment is inclined at an angle of 35° and its height is 15 m. φ = 15° and the cohesion intercept is 200 kN/m^2 . The unit weight of soil is 18 kN/m^3 . If the Taylor's stability number is 0.06, find the factor of safety with respect to cohesion. Also estimate the critical height of the slope	5M	L3
2	a) Describe the method of slices to analyse a slope? b) Figure shows the details of an embankment made of cohesive soil with Ø = 0^0 and c = 30kN/m^2. The unit weight of the soil is 18.90kN/m^3. Determine the factor of safety against sliding along the trial circle shown. The weight of the sliding mass is 360kN acting at an eccentricity of 5.0m from the centre of rotation. Assume that no tension crack develops. 	10M	L3
3	a) A cut 10m deep is to be made in a stratum of cohesive soil (c= 35kN/m^2 , unit weight of soil is 18.5kN/m^{3}and φ=0). The bed rock is located 15m deep below original ground surface. Determine the factor of safety against failure if the slope is 30^0, the stability number is given as 0.164	5M	L3
	b) An excavation has to be made with an inclination of 40^{0}in a soil with c=40KPa, φ=10^{0}and unit weight of soil is 18kN/m^3. What is the maximum height of the slope with a factor of safety of 2.01? The Taylors stability number for the above condition is given as 0.097	5M	
4	Find the factor of safety of a slope of infinite extent having a slope angle = 25°. The slope is made of cohesive soil. The soil made of clay having c' - 30 kN/m2, φ' = 20°, e = 0.65 and Gs = 2.7 and under the following conditions: (i) when the soil is dry, (ii) when water seeps parallel to the surface of the slope, and (iii) when the slope is submerged.	10M	L3
5	Compute the factor of safety of an infinite slope in cohesion less soil for a steady state seepage condition, when the flow is parallel to the slope an embankment is inclined at an angle of 30° and its height is 10 m. The φ = 15° and the C= 40kN/m^2. The unit weight of soil is 16kN/m^3. If Taylor's stability number is 0.14, find the factor of safety with respect to cohesion.	10M	L3
6	a) Write the formula to determine the stability number, and explain the terms in it? (3M) b) Write the formula to determine the factor of safety of a dry infinite slope made of cohesion less soil, and explain the terms in it.(3M) c) Why upstream slopes fail? Discuss the reasons with neat sketch.(4M)	10M	L2
7	Write the different types of slope failures with the help of neat sketch	10M	L1

<table>
<tr>
<td>8</td>
<td>a) Derive the expression to determine the stability number of a slope?
b) A canal 3m deep runs through a soil having the following properties c_u=10kPa, Φ_u=100, e=0.80, G=2.72. The angle of slope of the banks is $\beta=45^0$. Determine the factors of safety with respect to cohesion, when the canal is full up to the top of the banks, and when there is a sudden drawdown?
<table>
<tr><th>β</th><th>Φ</th><th>Taylor's Stability number</th></tr>
<tr><td rowspan="2">45^0</td><td>10^0</td><td>0.11</td></tr>
<tr><td>4.89^0</td><td>0.15</td></tr>
</table>
</td>
<td>10M</td>
<td>L3</td>
</tr>
</table>

UNIT- II EARTH RETAINING STRUCTURES

S.N O	QUESTION	MARKS	COGNITIVE LEVEL
1	Critically comments on the assumptions of Rankine's earth pressure theory and Differentiate critically between Rankine and Coulomb theories of earth pressure	10M	L3
2	An 10m retaining wall of smooth vertical back retains a backfill material with horizontal surface having the properties C=16KN/m^2 ,angle of internal friction is 35^0 and unit weight of soil is 20kN/m^3. Determine the Rankines active and passive earth pressure on the retaining wall	10M	L2
3	a) A 7m retaining wall with a smooth vertical back face has a stratified back fill and a surcharge load of 10kPa. The properties of soil are as follows up to 3.5m height from top unit weight of soil is 15kN/m^3, angle of shearing resistance $30^0$and cohesion is 0, below 3.5m level unit weight of soil is 20kN/m^3 and angle of internal friction is10^0 and C= 10kN/m^2. Draw the resultant thrust on the wall and its position	7M	L3
	b) Discuss depth of tension crack and unsupported height in clay backfill.	3M	L2
4	A retaining wall 8m high retains sand with angle of internal friction 30^0 and unit weight of soil 24kN/m^3. From 4 to 8m, the material is cohesive soil having C= 20kN/ m^2 and $\varphi = 20^0$ and γ=18kN/m^3. The water table is at a depth 5m from ground level. γ_{sat} = 21kN/m^3 for cohesive soil. Find the total active thrust on the wall along with its point of application	10M	L3
5	Explain Culmann's graphical method along with construction steps and also its advantages.	10M	L2
6	Explain the following with neat sketches (i) active earth pressure (ii) at rest earth pressure and (iii) passive earth pressure.	10M	L2
7	A sandy loam backfill has cohesion of 12kN/m2 and angle of internal friction 20. The unit weight of soil is 17kN/m3. What is the depth of tension crack? (5M)	5M	L3
	b) An unsupported excavation is to be made in soil having $\varphi = 12^0$, C=19kN/m^2, γ 19kN/m^3 what is the maximum depth of unsupported excavation in soil? Draw the active pressure distribution diagram	5M	L3
8	Explain the Rankine's theory for various backfill conditions to calculate active and passive state earth pressure	10M	L2
9	(a) Explain the Coulomb wedge theory with neat sketches	4M	L2
	b) A vertical gravity retaining wall 12m high, is to retain a clayey soil for which C_u=25kN/m^2, φ_u=15^0 and the bulk unit weight of soil 19kN/m^3. The soil surface is horizontal and level with top of the wall. The water table is horizontal and with the bottom of the wall. Determine the magnitude and direction of the minimum forces on the wall for a trail wedge whose slip surface raises from the bottom of the wall at $70^0$to the horizontal. Assume that the angle of wall friction is 10^0 and the wall adhesion is 15^0	6M	
10	Compute the intensities of active and passive earth pressure at depth of 8m in dry cohesion less sand with an angle of internal friction of 35^0 and unit weight of soil 18kN/m^3. What will be the intensities of active and passive earth pressure if the water level rises to the ground level? Take the saturated unit weight of sand as 22kN/m^3	10M	L3

UNIT 3 SHALLOW FOUNDATION

S.NO	QUESTION	MARKS	COGNITIVE LEVEL
1	a) Write the assumptions of Terzaghi bearing capacity theory and discuss their limitations.	4M	L1
	b) Compute the safe bearing capacity of a continuous footing 2.0 m wide and resting on a clayey sand at a depth of 1.5 m if c = 16 kN/m2, friction= 25^0, Y_{sat} = 19 kN/m3, Nc = 25, N_q= 12.5, N_Y= 10 and F.S.=3.0.	6M	L3
2	State the basic requirements of a foundation. And also derive the derivation for minimum depth of foundation according to Rankine's analysis?	10M	L3
3	(a) A 30cm square bearing plate settles by 8mm in the plate load test on cohesion less soil, when the intensity of loading is 180kN/m^2 estimate the settlement of a shallow foundation of 1.6m square under the same intensity of loading b) A rectangular footing of size 3mX6m is founded at a depth of 1m in a homogeneous c- Φ soil. Water table is at a great depth. The unit weight of soil is 18kN/m^3 . determine net ultimate bearing capacity C=50kpa & Φ= 20^0 Nc =17.7, N_q= 7.4, N_Y=5	10M	L3
4	A strip footing (Fig. 1) of width 2 m is founded at a depth of 2 m below the ground surface in a (c - φ) soil having a cohesion c = 30 kN/m^2 and angle of shearing resistance, ϕ = 35°. The water table is at a depth of 8 m below ground level. The moist weight of soil above the water table is 17.25 kN/m^3. Determine (i) the ultimate bearing capacity of the soil, (ii) the net bearing capacity, and (iii) the net safe bearing pressure and the load/m for a factor of safety of 3. Use the general shear failure theory of Terzaghi. For ϕ = 35°, N_c = 57.8, N_q =41.4, and $N\gamma$ = 42.4. 	10M	L3
5	a) Differentiate the terms (i) Gross pressure and net pressure (ii) Ultimate bearing capacity and net ultimate bearing capacity and (iii) Safe bearing pressure and allowable bearing pressure.	6M	L2
	b) Explain types of foundations and factors to be considered in their location	4M	L2
6	(a) Describe the procedure to conduct the plate load test with a sketch and state its limitations along with Load-Settlement curves or pressure-settlement curves from the plate load test?	6M	L2
	b) Explain IS code method for determining soil bearing capacity.	4M	L2
7	a) Write a brief note on types of failures in shallow foundations. .	3M	L1

	b) A 1.8 m square column is founded at a depth of 1.8 m in sand, for which the corrected N- value is 24. The water table is at a depth of 2.7 m. Determine the net allowable bearing pressure for a permissible settlement of 40 mm and a factor of safety of 3 against shear failure	7M	L3
8	Determine the size of a square footing at the ground level to transmit a load of 900 kN in sand unit weight 18 kN/m3 and having an angle of shearing resistance of 36^0 (N_Y = 46, Nq = 43). Factor of safety is 3. What will be the modification in the result, if the footing may be placed at a depth of 1 m below ground surface? Assume, in this case, the water table may rise to the ground surface. Submerged unit weight = 9 kN/m3. Use the Terzaghi's theory	10M	L1
9	A loading test was conducted with a 300 mm square plate at depth of 1m below the ground surface in pure clay deposit. The water table is located at a depth of 4 m below the ground level. Failure occurred at a load of 45 kN. What is the safe bearing capacity of a 1.5 m wide strip footing at 1.5 m depth in the same soil? Assume γ= 18 kN/m3 above the water table and a factor of safety of 2.5. The water table does not affect the bearing capacity in both cases. For Φ= 0°, Terzaghi's factors are Nc= 5.7, Nq = 1, and Nγ= 0.	10M	L1
10	a) Determine the allowable bearing capacity of a 1.5mX1.5m square deposit having a unit weight of 19kN/m^3 with observed SPT value of 37. Water is at depth of 1.5m. determine the allowable bearing capacity for 50mm, settlement after applying suitable correction	4M	L3
	b) Differentiate between total settlement and differential settlement. What are the problems associated with the differential settlements on structures? What are the possible remedial measures?	3M	L2
	c) Estimate the immediate settlement of a concrete footing 1.5 m x 1.5 m in size founded at a depth of 1 m in silt soil whose modulus of elasticity is $9x10^4$ kN/m^2 . The footing is expected to transmit a unit pressure of 200 kN/ m2. Assume μ = 0.35, I_f = 0.82 for a rigid footing.	3M	L3