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QUESTION BANK (DESCRIPTIVE)

Subject with Code : Geotechnical Engineering - II (16CE127) **Course & Branch**: B.Tech - CE

Year & Sem: III B.Tech & II-Sem **Regulation:** R16

UNIT –I
SOIL EXPLORATION

1. (a) What are the different purposes of conducting soil exploration? [5M][L2]
   (b) Explain how bore hole are advanced in soils with augers. [5M][L2]

2. (a) Discuss various methods available for conducting soil exploration. [5M][L2]
   (b) Sketch scraper bucket sample and explain how an undisturbed soil sample is extracted using it. [5M][L2]

3. Describe with a neat sketch how will you carry out the wash boring method of soil exploration. [10M][L2]

4. (a) How boring operations are carried out using rotary drilling and percussion drilling? [5M][L2]
   (b) Describe the construct of a split spoon sampler. Explain how undisturbed soil sample is extracted using it. [5M][L1][L2]

5. Explain how an undisturbed soil sample is extracted using of Shellby tube with a neat sketch. [10M][L2]

6. Give a detailed account on how Standard Penetration Test is conducted. What are the relevant corrections applied to SPT number? [10M][L2]

7. Draw the Static Cone Test assembly and explain how this test is conducted. [10M][L2]

8. A SPT was conducted at a depth of 2 m in a sand deposit with a unit weight of 20 kN/m^3. The water table at this site was at 1 m below ground surface. The N value was observed to be 5. What would the corrected N value be? At this site for the SPT conducted at 15 m below ground surface, the N value observed was 21. What would be the corrected N value? [10M][L4]

9. Describe in detail how soil exploration is planned and performed. [10M][L2]

10. Describe various salient features of a good soil report. [10M][L2]

UNIT –II
EARTH SLOPE STABILITY

1. (a) What is an earth slope and give its engineering applications? [4M][L1]
   (b) Explain different types of slope failures with neat sketches. [6M][L2]

2. Derive the equation for factor of safety of an infinite slope when soil is dry and cohesionless. What will happen to the factor of safety when the same slope is under submergence. [10M][L3]

3. Discuss the stability of an infinite slope made out of cohesive soil by drawing $\tau - \sigma$ graph. Derive the equation for critical height when the soil is dry. [10M][L3]

4. The shearing strength parameters of the soil are $c' = 26.7$ kN/m^2, $\Phi' = 15^o$, $cm' = 26.7$ kN/m^2 and $\Phi_m' = 12^o$. Calculate the factor of safety (a) with respect to strength (b) with respect to cohesion and (c) with respect to friction. The average intergranular pressure on the failure surface is 102.5 kN/m^2. [10M][L4]

5. A cut 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^2. A hard stratum exists at a depth of 18 m below the ground surface. Determine from Tylor's charts if a 30^o sloe is safe. If a factor of safety of 1.5 is desired, what is a safe angle of slope? [10M][L4]

6. A canal is to be excavated through a soil with c = 15 kN/m^2, $\Phi = 20^o$, 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? [10M][L4]

7. Analyze the slope, if it is made of clay having $c' = 30$ kN/m^2, $\Phi' = 20^o$, e = 0.65 and G = 2.67 and under the following conditions: (i) When the soil is dry (ii) When water seeps parallel to the surface of the slope (iii) When the slope is submerged slope angle = 25^o. [10M][L4]

8. Give the step by step procedure of analyzing stability of a finite slope using Swedish circle method. [10M][L2]

9. With the help of a neat sketch show various forces considered for the analysis of a finite slope using Bishop's simplified method. Mention the equation for factor of safety given by this method. [10M][L3]

10. Explain in detail how the stability of an earth dam is tested under different conditions. [10M][L2]

UNIT –III
EARTH PRESSURE THEORIES AND RETAINING WALLS

1. (a) With the help of a neat sketch explain active, passive and at rest earth pressure. [5M][L2]
   (b) Derive the equation for Rankine's coefficient of active earth pressure. [5M][L3]

2. A cantilever retaining wall of 7 m height retains sand. the properties of sand are e = 0.5, $\Phi = 30^o$ and G = 2.7. Using Rankine's theory determine the active earth pressure at the base when the backfill is (i) dry (ii) saturated and (iii) submerged, and also the resultant active force in each case. In addition, determine the total water pressure under the submerged condition. [10M][L3]

3. A smooth backed vertical wall is 6.3 m high and retains a soil with a bulk unit weight of 18 kN/m^3 and $\Phi = 18^o$. The top of the soil is level with top of the wall and is horizontal. If the soil surface carries a uniformly distributed load of 4.5 kN/m^2, determine the total active thrust on the wall per linear meter of the wall and its point of application. [10M][L3]

4. Determine the percentage error introduced by assuming a level fill when the angle of surcharge actually equal 20^o. Assume a friction angle of 35^o and the wall vertical. Comment on the use of the erroneous result. [10M][L4]

5. A retaining wall, 7.5 m high, retains a cohesionless backfill. At top 3 m the fill has a unit weigh of 18 kN/m^3 and $\Phi = 30^o$ and the rest has a unit weight of 24 kN/m^3 and $\Phi = 20^o$. Determine the pressure distribution on the wall. [10M][L3]

6. A 5 m high retaining wall is having angle of internal friction as 30^o, unit weight 17.5 kN/m^3 and cohesion 5 kN/m^2. Determine the Rankine active pressure on the wall (a) Before the formation of the crack (b) after formation of the crack. Draw the active pressure distribution in both the cases. [10M][L3]

7. Determine the stresses at the top and the bottom of the cut for the soil having $\Phi = 12^o$, c = 20 kN/m^2 and γ = 18 kN/m^3. Also determine the maximum depth of potential crack and maximum depth of unsupported excavation. [10M][L3]

8. For a retaining wall system, the following data were available; (i) Height of wall = 7 m, (ii) Properties of backfill: Dry density of soil = 16 kN/m^3 and angle of internal friction = 35^o (iii) Angle of wall friction, $\delta = 20^o$ (iv) bac of wall is inclined at 20^o to the vertical (positive batter), and (v) backfill surface is sloping at 1:10. Determine the magnitude of all active earth pressure by Culmann's method. [10M][L3]

9. Give the sequence of steps adopted for determining active earth pressure using Rebhann's graphical method with a neat sketch. [10M][L3]

10. A masonry retaining wall is 1.5 m wide at the top, 3.5 m wide at the base 6 m high. It is trapezoidal in section and has a vertical face on the earth side. The backfill is level with top. The nit weight of the fill is 16 kN/m^3 for the top 3 m and 23 kN/m^3 for the rest of the depth. The unit weight of masonry is 23 kN/m^3. Determine the total lateral pressure on the wall per meter run and the maximum and minimum pressure intensities of normal pressure at the base. Assuming $\Phi = 30^o$ for both grades of soil. [10M][L4]

UNIT –IV
BEARING CAPACITY & SETTLEMENT

1. Elaborate on various points to be considered while fixing the depth of foundation. [10M][L2]

2. Give salient points on general, local and punching shear failures with neat sketches. [10M][L2]

3. Derive Terzaghi's bearing capacity equation for shallow foundation. What are assumptions made? [10M][L2]

4. Describe how the plate load test is conducted with a neat sketch. [10M][L2]

5. A circular foundation is of 2.4 m diameter. If he depth of foundation is 1 m, determine the net allowable load. Take $\gamma = 19$ kN/m^3, $c' = 30$ kN/m^2, $\Phi' = 15^o$ and factor of safety as 3.0. use Terzaghi's equation and assume local shear failure. [10M][L3]

6. (a) Discuss different types of foundation settlements. [5M][L2]
   (b) Determine the ultimate bearing capacity of strip footing, 1.20 m wide, an having the depth of foundation of 1.0 m. Use Terzaghi's theory and assume general shear failure. Take $\Phi' = 35^o$, $\gamma = 18$ kN/m^3 and $c' = 15$ kN/m^2. [5M][L3]

7. Determine the allowable gross load and net allowable load for a square footing of 2 m side and with a depth of foundation of 1.0 m. Use Terzaghi's theory and assume local shear failure. Take a factor of safety of 3.0. The soil at the site has $\gamma = 18$ kN/m3, c' = 15 kN/m^2 and $\Phi' = 35^o$. [10M][L3]

8. Compute the safe bearing capacity of a square footing 1.5 m x 1.5 m, located at a depth of 1 m below the ground level in a soil of average density 20 kN/m^3, $\Phi = 20^o$, $N_c = 17.7$, $N_q = 7.4$ and $N_\gamma = 5.0$. Assume a suitable factor of safety and that the water table is very deep. Also compute the reduction in safe bearing capacity of the footing if the water table raises to the ground level. [10M][L3]

9. A circular footing is resting on a stiff saturated clay wit unconfined compression strength 250 kN/m^2. The dept of foundation is 2 m. determine the diameter of the footing if the column load is 600 kN. Assume a factor of safety of 2.5. The bulk unit weight of the soil is 20 kN/m^3. [10M][L3]

10. Two plate load tests were conducted at the level of a prototype foundation in cohesionless soil close to each other. The following data are given:

Size of plate	Load applied	Settlement recorded
0.3 m x 0.3 m	30 kN	25 mm
0.6 m x 0.6 m	90 kN	25 mm

If a footing is to carry a load of 100 kN, determine the required size of the footing for the same settlement of 25 mm. [10M][L4]

UNIT –V
PILE FOUNDATIONS

1. Explain in detail under what circumstances pile foundations becomes necessary. [10M][L2]

2. Classify the piles based on its intended function with neat sketches. [10M][L2]

3. (a) Define the phenomenon of negative skin friction with neat drawing. [5M][L2]
   (b) A wooden pile is being driven with a drop hammer weighing 20 kN and having a free fall of 1.0 m. The penetration in the last 5 blows is 5 mm. Determine the load carrying capacity of the pile according to the Engineering News Formula. [5M][L3]

4. With a neat sketch explain how plate load test is carried out on a test pile. [10M][L2]

5. Explain how Standard Penetration Test and Dutch Cone Test results used for estimating the pile capacity. [10M][L2]

6. Explain in detail how ultimate capacity of a single pile driven in sand is estimated using static method. [10M][L2]

7. A precast concrete pile (35 cm x 35 cm) is driven by a single acting steam hammer. Estimate the allowable load using (a) Engineering News Record Formula (F.S = 6) (b) Hiley Formula (F.S = 4) Use following data:
   a) Maximum rated energy = 3500 kNm b) Weight of hammer = 35 kN c) Length of pile = 15 m
   d) Efficiency of hammer = 0.8 e) Coefficient of restitution = 0.5 f) Weight of pile cap = 3 kN
   g) Number of blows for last 25.4 mm = 6 h) Modulus of elasticity of concrete = 2×10^7 kN/m^2
   Assume any other data, if required. Take the weight of pile as 73.5 kN [10M][L4]

8. A concrete pile, 30 cm diameter, is driven into a medium dense sand ($\Phi = 35^o$, K = 1.0, $\gamma = 21$ kN/m^3, tan(δ) = 0.70) for a depth of 8 m. Estimate the safe load, taking a factor of safety of 2.50. What will be safe load for the pile, if the water table raise t 2 m below the ground surface. Take $\gamma_w = 10$ kN/m^3. [10M][L3]

9. A group of 16 piles of 50 cm diameter is arranged with a centre to centre spacing of 1.0 m. The piles are 9 m long and are embedded in soft clay with cohesion 30 kN/m^2. Bearing resistance may be neglected for the piles. Adhesion factor is 0.6. Determine the ultimate load capacity of the pile group. [10M][L3]

10. Explain in detail how the settlement of pile groups is analyzed in both cohesive and cohesionless soils. [10M][L2]