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Question Paper Code : 71561

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2017.

Fourth Semester

Civil Engineering

CE 6405 — SOIL MECHANICS

(Regulations 2013)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Draw the phase diagram for completely dry and fully saturated soil mass.

2. List various factors affecting compaction.

3. What is quicksand condition? Under what circumstances can it occur?

4. Write typical range of co-efficient of permeability for gravel, sand, silt and clay.

5. What is the principle behind Newmark's influence chart?

6. Define coefficient of consolidation and compression index.

7. Write the Mohr-Coulomb failure criterion for soils and explain the terms involved.

8. List the merits and demerits of triaxial test.

9. A cuffing is to be made in clay for which the cohesion is 350 kN/m^2 ; Bulk unit weight is 20 kN/m^3. Find the maximum depth for a cutting of side slope 1.5 to 1. Factor of safety to be 1.5. Take the stability number as 0.17.

10. Mention different modes of slope failure.

PART B — (5 × 13 = 65 marks)

11. (a) (i) A partially saturated soil from an earth fill has a natural water content of 22% and a bulk unit weight of 19 kN/m^3. Assuming the specific gravity of soil solids as 2.65, compute the degree of saturation and void ratio. If subsequently the soil gets saturated, determine the dry density, buoyant unit weight and saturated unit weight. (8)

(ii) Explain Indian Standard Soil classification system for classifying coarse grained soil. (5)

Or

(b) (i) Discuss the effect of compaction on various engineering properties of soils. (5)

(ii) A soil sample is found to have the following properties. Classify the soil according to I.S. classification system. Passing 75μ sieve = 10%; Passing 4.75 mm sieve = 70%; Uniformity coefficient = 8; Coefficient of curvature = 2.8; Plasticity Index = 4%. (8)

12. (a) (i) In a site reclamation project, 2.5 m of graded fill (γ = 22 kN/m^3) were laid in compacted layers over an existing layer of silty clay (γ = 18 kN/m^3) which was 3 m thick. This was underlain by a 2 m thick layer of gravel (γ = 20 kN/m^3). Assuming that the water table remains at the surface of the silty clay draw the effective stress profiles for case

(1) before the fill is placed and case

(2) after the fill has been placed. (8)

(ii) Explain about various factors affecting coefficient of permeability of a soil. (5)

Or

(b) (i) In a falling head permeability test the length and area of cross section of soil specimen are 0.17 m and 21.8 × 10^{-4} m^2 respectively. Calculate the time required for the head to drop from 0.25 m to 0.10 m. The area of cross section of stand pipe is 2.0 × 10^{-4} m^2. The sample has three layers with permeabilities 3 × 10^{-5} m/sec for first 0.06 m, 4 × 10^{-5} m/sec for second 0.06 m and 6 × 10^{-5} m/sec for the third 0.05 m thickness. Assume the flow is taking place perpendicular to the bedding plane. (8)

(ii) Define flow net. Discuss about its uses. (5)

13. (a) (i) A concentrated load 10 kN acts on the surface of a soil mass. Using Boussinesq analysis find the vertical stress at points

(1) 3 m below the surface on the axis of loading and

(2) at radial distance of 2 m from axis of loading but at same depth of 3 m. (8)

(ii) Explain Taylor's square root time $\sqrt{t}$ method for determining coefficient of consolidation. (5)

Or

(b) (i) Write a brief critical note on "the concept of pressure bulb and its use in soil engineering practice". (5)

(ii) A 1 cm thick laboratory soil sample reaches 60% consolidation in 33 seconds under double drainage condition. Find how much time will be required for a 10 m thick layer in the field to reach the same degree of consolidation if it has drainage face on one side only? (8)

14. (a) The results of three consolidated undrained triaxial tests on identical specimens of a particular soil are as follows :

Test No.	1	2	3
Confining stress, kPa	200	300	400
Deviatoric stress at peak, kpa	244	314	384
Pore water pressure at peak, kPa	55	107	159

Determine the value of total and effective shear strength parameters. (13)

Or

(b) (i) The results of a direct shear test on a 60 mm × 60 mm specimen are given below. Determine shear strength parameters. (8)

Normal load, N	300	400	500	600
Shear force at failure, N	195	263	324	399

(ii) Sketch and discuss the stress-strain and volume change relationship for dense and loose sand. (5)

15. (a) (i) A slope of very large extent of soil with properties $c' = 0$ and $\phi' = 32°$ is likely to be subjected to seepage parallel to the slope with water level at the surface. Determine the maximum angle of slope for a factor of safety of 1.5 treating it as an infinite slope. For this angle of slope what will be the factor of safety if the water level were to come down well below the surface? The saturated unit weight of soil is 20 kN/m^3. (8)

(ii) Discuss about various slope protection measures. (5)

Or

(b) (i) An embankment 10 m high is inclined at 35° to the horizontal. A stability analysis by the method of slices gave the following forces: Total normal force = 900 kN; Total tangential force = 420 kN; Total neutral force = 200 kN. If the length of the failure arc is 23 m, find the factor of safety with respect to shear strength. The soil has $c = 20$ kN/m² and $\phi = 15°$. (8)

(ii) Explain friction circle method of slope stability analysis. (5)

PART C — (1 × 15 = 15 marks)

16. (a) An unconfined aquifer is known to be 32 m thick below the water table. A constant discharge of 2 cubic metres per minute is pumped out of the aquifer through a tube well till the water level in the tube well becomes steady. Two observation wells at distances of 15 m and 70 m from the tube well show falls of 3 m and 0.7 m respectively from their static water levels. Find the permeability of the aquifer.

Or

(b) Fig. 16 (b) shows the details of an embankment made of cohesive soil with $\phi = 0$ and $c = 30$ kN/m². The unit weight of the soil is 18.9 kN/m³. Determine the factor of safety against sliding along the trial circle shown. The weight of the sliding mass is 360 kN acting at an eccentricity of 5.0 m from the centre of rotation. Assume that no tension crack develops. The central angle is 70°.

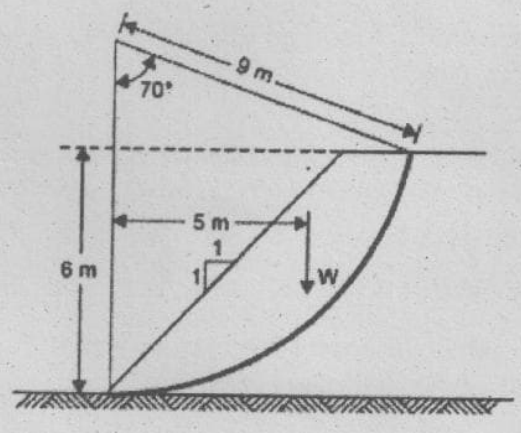

Fig. 16(b)