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Question Paper Code: 41011

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2015.

Fourth Semester

Civil Engineering

01UCE402 – SOIL MECHANICS

(Regulation 2013)

Duration: Three hours

Maximum: 100 Marks

(Nessam chart and data may be permitted)

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define percentage air voids.
2. State the various classification systems of soils.
3. What is called quicksand condition?
4. Distinguish total stress and effective stress in soils.
5. What is an isobar?
6. List any two assumptions of Terzaghi's theory of one dimensional consolidation.
7. Define shear strength of soil?
8. In an Unconfined compression strength test, the UCC strength of clay is obtained as 96 kN/m^2 . Find its cohesion?
9. Distinguish finite and infinite slopes.
10. Sketch the different types of slope failures.

PART - B (5 x 16 = 80 Marks)

11. (a) (i) A natural soil deposit has a bulk unit weight of 18 kN/m^3 and water content 5%. Calculate the amount of water required to be added to 1 m^3 of soil to raise the water content to 15%. Assume the void ratio to remain constant. What will then be the degree of saturation? Assume $G = 2.67$. (8)
- (ii) Derive the relation between γ , G , w , e and γ_w (8)

Or

- (b) (i) A soil sample has a porosity of 50 percent. The specific gravity of solids is 2.70. Calculate voids ratio, dry density and unit weight if the soil is 50% saturated. (8)
- (ii) What are the factors affecting compaction? (8)
12. (a) (i) A saturated sand layer over a clay stratum is 5m in depth. The water is 1.5m below ground level. If the bulk density of saturated sand is 19.66 kN/m^3 , calculate the effective and neutral pressure on the top of the clay layer. (8)
- (ii) Derive the equation to determine the value c_o – efficient of permeability ‘K’ from a falling Head permeability test in detail. (8)

Or

- (b) (i) A falling head permeability test was performed on a sample of clean uniform sand. The initial hydraulic head was 900mm, the final head was 400mm and 60 seconds were required for the water level in the stand pipe to fall. The cross sectional area of the stand pipe was 100 mm^2 . The sample was of 40 mm diameter, and had a length of 180mm. Determine the coefficient of permeability as per Darcy’s law. (8)
- (ii) Give the properties and uses of flow net. (8)
13. (a) (i) A reinforced concrete water tank of size 6m x 6m and resting on ground surface carries a uniformly distributed load of 200 kN/m^2 . Estimate the maximum pressure at a depth of 12 meters vertically below the centre of the base. (8)
- (ii) Explain Terzaghi’s theory of one dimensional consolidation. (8)

Or

- (b) (i) Explain Newmark’s influence chart and its uses. (8)

(ii) A 10m thick clay layer settles by 80mm in 2 years under single drainage condition. The coefficient of consolidation is $5 \times 10^{-3} \text{ cm}^2/\text{s}$. Calculate the ultimate consolidated settlement and find how long it will take to undergo 90% of this settlement. (8)

14. (a) (i) A sample of cohesionless soil in a direct shear test fails under a shear stress of 170 kN/m^2 when the normal stress is 200 kN/m^2 . Find the angle of shearing resistance and the major principal stress at failure. (8)
- (ii) Describe triaxial compression test. (8)

Or

- (b) (i) The results of the triaxial tests conducted on two samples of a soil are given below.

Test No	Sample 1	Sample 2
Cell pressure, KPa	100	200
Deviator stress at failure, KPa	375	575

If a third sample of the same soil is tested under a cell pressure of 400kPa, at what value of deviator stress will the sample fail? (8)

- (ii) Discuss the factors affecting, shear strength of soil. (8)
15. (a) (i) Discuss methods for finding the stability of slopes and derive an expression for finding the factor of safety of slopes in cohesive soils. (8)
- (ii) Indicate how the stability of a slope is affected by seepage of water. (8)

Or

- (b) (i) A 1V : 1.5H cut slope was made in a clay deposit. The depth of cut is 10m. Unit weight of clay deposit is 20 kN/m^3 . Determine the factor of safety on a slip plane which makes an angle of 20° at the toe of the cut if average static water head is 2m on the plane. Assume strength parameters of clay on the slip plane are $C' = 15 \text{ kN/m}^3$ and $\phi' = 20^\circ$. (8)
- (ii) Write short notes on Taylor's stability number. (8)