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B.E / B. Tech / B.Arch (Full Time) END SEMESTER EXAMINATIONS April / May 2019

CIVIL ENGINEERING

Semester 4

CE8402 & Soil Mechanics

(Regulation 2012)

Time: 3 Hours | Answer ALL Questions | Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. How is the plasticity chart useful for classifying fine grained soil?
2. Void ratios of a sand sample in the densest and loosest conditions are 0.4 and 1.2 respectively. Determine the relative density if the in-place void ratio is 0.6.
3. What are the applications of the capillary tube theory to soil engineering?
4. State reasons for the quantity of seepage between two successive flow lines being equal.
5. What is the basic principle involved in the development of Newmark's chart?
6. Why there is a significant time lag in the settlement of clay soils but not in sandy soil?
7. List at least six factors that govern the shear strength of cohesionless soils.
8. Draw the shear-strain and volumetric strain Vs. axial strain curve of loose sand and dense sand from tri-axial test for dry condition.
9. List the various types of failures of finite slopes indicating the situations in which they are likely to occur.
10. Distinguish between the total and effective stress approaches of stability analysis.

Part – B (5 x 16 = 80 marks)

(Question No.11 is Compulsory)

11. a) i) Explain the Indian soil classification system. (8)
ii) A compacted cylindrical specimen 50 mm in diameter and 100 mm long is to be prepared from dry soil. If the specimen is required to have a water content of 15%, find the percentage of air voids required in the preparation of the soil when the specific gravity is 2.69. (8)

12. a) i) Explain the ways by which the capillary water and the effect of capillarity can be removed from soil. (8)
ii) A falling head permeameter contains a soil sample 8 cm high and 60 cm^3 in cross-sectional area. The permeability of the sample is expected to be 1×10^{-4} cm/s. If it is desired that the head in the standpipe should fall from 30 to 10 cm in 40 minutes, determine the size of the standpipe which should be used. (8)

(OR)

b) Prove that for stratified deposits of soils, the average permeability in the horizontal direction is greater than the average permeability in the vertical direction. (16)

13. a) i) What is the basic principle involved in the development of Newmark's chart? (8)

ii) In a consolidation test on a soil, the void ratio of the sample decreases from 1.24 to 1.12 when the pressure is increased from 200 to 400 kN/m^2. Calculate the coefficient of consolidation (in m^2/year) given that the coefficient of permeability of the soil during this pressure increment is 8.5×10^{-8} cm/s. (8)

(OR)

b) i) A uniformly distributed load of infinite extent in both lateral directions, when applied at the surface of a natural soil formation, produces an increase of 75 kN/m^2 in the vertical stress at a depth of 3 m. Find the stress increment at a depth of 5 m. (8)

ii) The time to reach 60% consolidation is 35 seconds for a sample of 1.2 cm thickness tested in the laboratory under the conditions of double drainage. How long will the corresponding layer in nature require to reach the same degree of consolidation if it is 11 m thick and drained on one side only? (8)

14. a) A 7 m high embankment is constructed with a soil whose effective shear strength parameters are c' = 62 kN/m^2, ϕ' = 22° and γ = 15.8 kN/m^3. The pore pressure parameters as determined from triaxial tests are A=0.39 and B=0.94. Find the shear strength of the soil at the base of the embankment just after the fill has been raised from 7 to 10 m. Assume that the dissipation of pore water pressure during this stage of construction is negligible and that the lateral pressure at any point is held at half the vertical pressure. (16)

(OR)

b) The following results were obtained during a consolidated–undrained triaxial test with pore pressure measure: (16)

	Test no. 1	Test no. 2	Test no. 3
Chamber pressure (kN/m^2)	100	200	300
Principal stress difference (kN/m^2)	150	190	240
Pore pressure at failure (kN/m^2)	50	75	135

Estimate the effective shear strength parameters by plotting a modified Mohr-Coulomb plot.

15. a) The bank of a canal is 9.4 m in height and has a face inclination of 30°. The material is homogenous silty clay of unit weight 20 kN/m^3, cohesion 30 kPa, and angle of shearing resistance 20°. Distance of the centre of friction circle from the upper and lower side of slope is 13 m and 14.42 m respectively. For the trial slip circle, find the factor of safety with respect to cohesion by using the friction circle method, if F_ϕ=1.50. (16)

(OR)

b) A proposed cutting in a c-ϕ soil will be 15 m deep with a slope of 1V:2.5H. The soil has an average unit weight of 18.6 kN/m^3 and an average pore pressure ratio r_u of 0.45. The shear strength parameters of the soil under different conditions are (16)

c_u = 85 kN/m^2, ϕ_u = 0°

c' = 12 kN/m^2, ϕ' = 26°

Estimate the factor of safety against i) immediate shear failure and ii) long-term shear failure.