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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2013

CIVIL ENGINEERING BRANCH

FOURTH SEMESTER

CE 9255 – Soil Mechanics

(Regulation 2008)

Time: 3 Hours Answer ALL Questions Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What is the difference between water content and Degree of saturation?
2. List various factors affecting compaction.
3. State whether the following statement is true or false. Justify your answer. " A sample of sand and a sample of clay have the same void ratio; both samples will exhibit the same permeability"
4. State Darcy's law with its limitations.
5. What are the assumptions made in the Terzaghi's theory of one dimensional consolidation?
6. Compare Boussinesq's and Westergaard's Analysis of stress distribution.
7. Under what conditions unconsolidated undrained test and a drained test results used for design purposes?
8. Write the Skempton's expression for pore pressure parameters? Explain the terms involved.
9. Differentiate finite and infinite slopes.
10. What are different factors of safety used in the stability of slopes?

Part – B (5 x 16 = 80 marks)

11. i) An earth embankment is compacted at water content of 18% to a bulk unit weight of 19.2 kN/m^3. If specific gravity of the solids is 2.7, find void ratio and degree of saturation of the compacted embankment. (8)

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) A sample of sand, 5cm in diameter and 15cm long, was prepared at a porosity of 60% in a constant head apparatus. The total head was kept constant at 30cm and the amount of water collected in 5 seconds was $40cm^3$. Calculate the coefficient of permeability and the seepage velocity. (8)

a(ii) Discuss in detail various factors affecting permeability. (8)

OR

b(i) A pumping test was carried out in a soil bed of thickness 15m and the following measurements were recorded. Rate of pumping was $10.6\times10^{-3} m^3/s$; draw downs in observation wells located at 15m and 30m from the center of the pumping well were 1.6m and 1.4m respectively, from the initial groundwater level. The initial ground water level was located at 1.9m below ground level. Determine the permeability of soil. Estimate the effective grain size using Hazen's equation. (8)

b(ii) A dam retains 10m of water. A sheet pile wall on the upstream side, which is used to reduce seepage under the dam, penetrates 7m into a 20m thick silty sand stratum.The average coefficient of permeability of the silty sand is 2.0×10^{-4}cm/s. The flow net constructed for the analysis consist of 14 equipotential drops and 4 flow channels. The smallest length of the flow fileld at the exit is 2m. Calculate the seepage loss. Will piping occur if the void ratio of the silty sand is 0.8 and specific gravity is 2.70? (8)

13. a(i) Compute the total, effective and pore pressure at a depth of 15m below the bottom of a lake 6m deep. The bottom of the lake consists of soft clay with a thickness of more than 15m. The average water content of the clay is 50% and the specific gravity of soils may be assumed to be 2.70. (8)

a(ii) A ring foundation is of 3.6m external diameter and 2.4m internal diameter. It transmits a uniform pressure of 135kN/m^2. Calculate the vertical stress at a depth of 1.8m directly beneath the center of the loaded area. (8)

OR

b(i) A saturated soil has a compression index of 0.25. Its void ratio at a stress of 10kN/m^2 is 2.02 and its permeability is 3.4×10^{-7} mm/s. compute:

i) Change in void ratio if the stress is increased to 19kN/m^2
ii) Settlement in (i) if the soil stratum is 5m thick; and
iii) Time required for 40% consolidation if drainage is one way. (10)

b(ii) Discuss briefly the basis of Construction of Newmark's chart and the steps to use the chart to get the stress at a point below the loaded soil mass. (6)

14. a(i) A thin layer of silt exists at a depth of 18m below the surface of the ground. The soil above this level has an average dry density of 15.3kN/m^3 and an average water content of 36%. The water table is almost at the surface. Tests on undisturbed samples of the silt indicate the following values. c'=35kN/m^2; ϕ'=27°. Estimate the shearing resistance of the silt on a horizontal plane. (8)

a(ii) Discuss in detail the Mohr-coulomb strength theory for soils. (8)

OR

b(i) A triaxial compression test on a cohesive sample cylindrical in shape yields a deviatoric stress of 600kN/m^2 when the confining stress was 200kN/m^2. Angle of inclination of rupture plane is 60° to the horizontal. Present the above data, by means of a Mohr's circle of stress diagram. Find the cohesion and angle of internal friction. Verify the results by analytical method. (8)

b(ii) Explain stress-strain and volume change characteristics of cohesionless soils in different states during shear. (8)

15. a(i) An embankment 10m high is inclined at 35° to the horizontal. A stability analysis by the method of slices gave the following forces: Total normal force = 1000kN; Total tangential force = 450kN; Total neutral force = 220kN. If the length of the failure arc is 25m, find the factor of safety with respect to cohesion, friction and shear strength. The soil has c=20kN/m^2 and ϕ=15°. (10)

a(ii) Discuss various methods for improving the stability of slopes. (6)

OR

b(i) An infinite mass of sand has a unit weight of 20kN/m^3 and is just stable at a slope of 30°. Case (a) If the entire mass is inundated and ends up below the water table will the slope remain stable? If not at what inclination will it be stable? Case (b) If water flows through the sand down the slope will the slope remain stable? If not at what inclination will it be stable? (8)

b(ii) Discuss the friction circle method for the stability analysis of slopes. (8)

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