Roll No.									

B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2011

CIVIL ENGINEERING BRANCH

FOURTH SEMESTER

25

CE9255 – SOIL MECHANICS

(REGULATIONS 2008)

Time : 3 hr Max Mark: 100

Answer ALL Questions

Part - A (10 × 2 = 20 Marks)

1. Differentiate clay and clay size fraction.
2. What is the use of Zero Air Voids line?
3. The coefficient of permeability of a soil sample is found to be 9×10^{-2}mm/s at a void ratio of 0.45. Estimate its permeability at a void ratio of 0.63.
4. Why the flow lines and equipotential lines of a flow net are orthogonal to each other?
5. In a saturated soil stratum, water table exists at the surface. The effective stress in the soil, at a depth of 3m is 30kN/m^3. If the water table rises by 0.5m, during floods what will be change in the effective stress?
6. Compare Boussinesq's analysis with Westergaard's analysis for stress distribution.
7. In a triaxial test a soil specimen was consolidated under a cell pressure of 700kN/m^2 and the increased pore pressure reading was 450kN/m^2. The axial load was then increased to give a deviator stress of 570kN/m^2 and pore pressure reading of 650kN/m^2. Calculate the pore pressure parameter B.
8. Explain the basic differences between direct shear test and a triaxial shear test for soils.
9. What is the effect of seepage flow parallel to the surface of an infinite slope on the factor of safety of stability of slope?
10. How do you differentiate finite slopes and infinite slopes?

Part -B (5 × 16 = 80 Marks)

11. a(i) A sample of clay taken from a natural stratum was found to be partially saturated and when tested in the laboratory gave the following results. Compute the degree of saturation. Specific gravity of soil particles = 2.6; wet weight of sample = 2.50 N; dry weight of sample = 210N; and volume of sample = 150cm^3. (8)

    a(ii) A certain soil has 99% by weight finer than 1mm, 80% finer than 0.1mm, 25% finer than 0.01mm, 8% finer than 0.001mm. Sketch the grain size distribution curve and determine the percentage of sand, silt and clay fractions as per IS nomenclature. Determine effective size and uniformity coefficient. (8)

12. a(i) A sample in a variable head permeameter is 8cm in diameter and 10cm high. The permeability of the sample is estimated to be 10×10^{-4}cm/s. If it is desired that the head in the stand pipe should fall from 24cm to 12cm in 3min., determine the size of the standpipe which should be used. (8)

    a(ii) What are the various parameters that affect the permeability of soil in the field? Critically discuss. (8)

    or

    b(i) An unconfined aquifer is known to be 32m thick below the water table. A constant discharge of 2 cubic meters 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 15m and 70m from the tube well show falls of 3m and 0.7m respectively from their static water levels. Find the permeability of the aquifer. (8)

    b(ii) For a homogeneous earth dam 32m high and 2m free board, a flow net was constructed with four flow channels. The number of potential drops was 20. The dam has a horizontal

filter at the base near the toe. The coefficient of permeability of the soil was 9×10^{-2}mm/s. The dam is full upto the designed capacity. Determine the anticipated seepage, if the length of the dam is 100m. (8)

13. a(i) A uniform soil deposit has a void ratio 0.6 and specific gravity of 2.65. The natural ground water is at 2.5m below natural ground level. Due to capillary moisture, the average degree of saturation above ground water table is 50%. Determine the neutral pressure, total pressure and effective pressure at a depth of 6m. Draw a neat sketch of effective stress distribution from the ground level upto 6m depth. (8)

a(ii) The settlement analysis (based on the assumption of the clay layer draining from top and bottom surfaces) for a proposed structure shows 2.5cm of settlement in four years and an ultimate settlement of 10cm. However, detailed sub surface investigation reveals that there will be no drainage at the bottom. For this situation determine the ultimate settlement and the time required for 2.5cm settlement. (8)

or

b(i) A layer of soft clay is 6m thick and lies under a newly constructed building. The weight of sand overlying the clayey layer produces a pressure of 260kN/m^2 and the new construction increases the pressure by 100kN/m^2. If the compression index is 0.5, compute the settlement. Water content is 40% and specific gravity of grains is 2.65. (8)

b(ii) A ring foundation is of 3m external diameter and 2m internal diameter. It transmits a uniform pressure of 90kN/m^2. Calculate the vertical stress at a depth of 1.5m directly beneath the centre of the loaded area. (8)

14. a(i) The following results were obtained in a shear box test. Determine the angle of shearing resistance and cohesion intercept. (8)

Normal stress, kN/m^2	100	200	300
Shear stress, kN/m^2	130	185	240

a(ii) 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 unit weight 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_u=45kN/m^2; ϕ_u=18°; c'=35kN/m^2; ϕ'=27°. Estimate the shearing resistance of the silt on a horizontal plane, (a) when the shear stress builds up rapidly and (b) when the shear stress builds up very slowly. (8)

or

b(i) The following data relate to a triaxial compression tests performed on a soil sample:

Cell pressure, kN/m^2	80	150	210
Max. deviator stress, kN/m^2	175	240	300
Pore pressure at max. deviator stress, kN/m^2	45	50	60

Determine the total and effective shear strength parameters. (10)

b(ii) A vane, 10.8cm long , 7.2cm in diameter, was pressed into a soft clay at the bottom of a bore hole. Torque was applied and the value at failure was 45Nm. Find the shear strength of the clay on a horizontal plane. (6)

15. a. An embankment is made of soil having c'=10kN/m^2, ϕ'=23° and γ=19kN/m^3. The embankment is of 9m height and has a slope of 30°.Using method of slices, determine the factor of safety of the slope. Assume a centre of rotation of the slip surface such that it passes through the toe of the slope and 3m horizontally away from the crest. (16)

or

b(i) The unit weight of a soil of a 30° slope is 17.5kN/m^3. The shear strength parameters c and ϕ or the soil are 10kN/m^2 and 20° respectively. Given the height of the slope is 12m and the stability number obtained from the charts for the given slope and angle of internal friction is 0.025, compute the factor of safety. (6)

b(ii) Explain the procedure for analysing the stability of slopes using friction circle method. (10)

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