Reg. No.:									

B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL/MAY 2012

CIVIL ENGINEERING BRANCH

FOURTH SEMESTER

CE 9255 – SOIL MECHANICS

(REGULATIONS 2008)

Time : 3 hr Max Mark: 100

Answer ALL Questions

Part - A (10 × 2 = 20 Marks)

1. Derive the relationship between 'e' and 'n'.
2. What are the factors considered for the classification of soils?
3. What is Darcy's law? What are its limitations?
4. List the properties of flow net.
5. Compare Boussinesque analysis with Westergaard analysis of stress distribution.
6. Write Terzaghi's one dimensional equation for consolidation. Explain the terms involved.
7. Draw the strength envelope for over consolidated and normally consolidated clay under drained conditions.
8. What are the advantages of triaxial test over direct shear test?
9. What are different modes of failure of slopes?
10. A cutting is to be made in clay for which the cohesion is 30kN/m^2. The density of the soil is 18kN/m^3. Find the maximum depth for a cutting of side slope 1.5 to 1 if the factor of safety is to be 1.5. Take the stability number as 0.17.

Part -B (5 × 16 = 80 Marks)

11. a(i) A sample of saturated soil has a water content of 35%. The specific gravity of soil solids is 2.65. Determine its void ratio, dry unit weight and saturated unit weight. (6)

    a(ii) The following data refer to a sample of soil: Percent passing 4.75mm IS sieve = 64; Percent passing 0.075mm IS sieve = 7; Uniformity coefficient = 8; Coefficient of curvature = 2.6; Plasticity index = 2.7; Classify the soil as per IS soil classification system. (6)

    a(iii) Write briefly the effect of compaction on various engineering properties of soil. (4)

12. a(i) What are the different types of soil water? Describe each one briefly. (6)

    a(ii) A permeameter of 8.2cm internal diameter contains a sample of soil of length 35cm. It can be used either for constant head or falling head tests. The stand pipe used for the later has a diameter of 2.5cm. In the constant head test the loss of head was 116cm measured on a length of 25cm when the rate of flow was 2.73ml/s. Find the coefficient of permeability of the soil. If a falling head test was then made on the same soil, how much time would be taken for the head to fall from 150cm to 100cm? (10)

    or

    b(i) Determine the coefficient of permeability of a confined aquifer 10m thick which gives a steady discharge of 40litres per second through a well of 0.3m radius. The height of water in the well which was 20m above the base before pumping dropped to 18m after pumping. Take the radius of influence as 300m. (8)

    b(ii) Determine the seepage discharge through the foundation of an earth dam if the flow net has 10 equipotential drops and 3.5 flow channels. The length of the dam is 200m and the

coefficient of permeability of the soil is 2×10^{-4}cm/sec. The level of water above the base of the dam is 10m on the upstream and 2m on downstream. (8)

13. a(i) A 12m thick bed of sand in underlain by a layer of clay 7m thick. The water table which was originally at the ground surface is lowered by drainage to a depth of 2m, whereupon the degree of saturation above the lowered water table is reduced to 25%. Determine the increase in the magnitude of the vertical effective pressure at the middle of the clay layer due to lowering of water table. The saturated unit weights of sand and clay are respectively 21kN/m^3 and 18kN/m^3, and dry unit weight of sand is 17kN/m^3. (8)

a(ii) A line load of 150kN/m extends to a very long distance. Determine the intensity of vertical normal stress at a point 3m below the surface. (i) directly under the line load, and (ii) at a distance of 2m perpendicular to the line load. Use Boussinesq's theory. (8)

or

b(i) An undisturbed sample of a clay stratum 4m thick was tested in the laboratory and the average value of the coefficient of consolidation was found to be 2×10^{-4}cm^2/sec. If a structure is built on the clay stratum, how long will it take to attain half the ultimate settlement under the load of the structure? Assume double drainage. (8)

b(ii) Describe log fitting method for evaluation of C_v from laboratory consolidation test. (8)

14 a(i) Write a brief critical note on unconfined compression test. (6)

a(ii) Undrained triaxial tests are carried out on four identical samples of silty clay and the following results are obtained:

Cell pressure, kPa	50	100	150	200
Deviator stress at failure, kPa	350	440	530	610
Pore pressure, kPa	5	10	12	18

Determine the values of the effective angles of shearing resistance and the cohesion. (10)

or

b(i) Sketch and discuss the stress-strain and volume change relationship for dense and loose sand as well as for normally consolidated and overconsolidated clay. (8)

b(ii) Remoulded samples of sandy clay were tested in a shear box 36cm^2 in area under undrained condition. The observations for normal load and maximum shear force are given below:

Normal load, N	90	180	270	360	450
Maximum shear force, N	125	155	185	225	255

Plot a failure envelope for the soil and determine the values of shear strength parameters. (8)

15. a(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)

a(ii) Discuss the slope protection measures that can be adopted to improve the stability of slopes. (8)

or

b(i) An embankment 10m high is inclined at an angle of 35° to the horizontal. A stability analysis by the method of slice gave the following forces per unit length: $\sum$Shearing forces=440kN; $\sum$Normal forces=880kN; $\sum$Neutral forces=200kN; The length of the failure arc is 26m. Laboratory tests on the soil indicated the effective values cohesion and angle of internal friction as 20kN/m^2 and 18° respectively. Determine the factor of safety of the slope with respect to (a) shearing strength; and (b) cohesion. (10)

b(ii) What is a stability number? What is its utility in the analysis of stability of slopes? Discuss the uses of stability charts. (6)

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