Roll. No.										

B.E./B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2011

CIVIL ENGINEERING BRANCH

FOURTH SEMESTER

CE 284 – SOIL MECHANICS

(REGULATIONS 2004)

Time : 3 hr Max Mark: 100

Answer ALL Questions

Part - A (10 × 2 = 20 Marks)

1. A sample of clay soil has liquid limit of 62%, and its plasticity index is 32%. What is the state of consistency of the soil if the soil in its natural state has a water content of 34%?
2. List any four equipment used for field compaction.
3. Compute the height of capillary rise in a soil whose D_{10} is 0.1mm, and void ratio is 0.70.
4. How do you know that the flow through a soil obeys Darcy's law?
5. The effective stress is 20kN/m^2 at a depth of 1m for a soil stratum where the water table is at ground level. During flooding the water was free standing for a depth of 1m. What is the change is effective stress?
6. Differentiate compaction and consolidation?
7. Draw the Mohr-coulomb strength envelopes for saturated sand specimens subjected to UU and CD tests.
8. What are the advantages and disadvantages of direct shear test?
9. What are different modes of failure of finite and infinite slopes?
10. List few measures to protect the slopes.

Part -B (5 × 16 = 80 Marks)

11. a(i) A moist soil sample weighs 3.52N. After drying in an oven, its weight is reduced to 2.9N. The specific gravity of solids and the mass specific gravity are, respectively, 2.65 and 1.85. Determine the water content, void ratio, porosity and the degree of saturation. (8)

a(ii) Explain how coarse grained soils are classified according to IS soil classification system. (8)

12. a(i) Discuss in detail various factors affecting compaction of soils. (8)

a(ii) Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 5m, 1m and 2.5m and having the coefficients of permeability of 3x10^{-3}cm/sec, 3x10^{-6}cm/sec and 3x10^{-3}cm/sec respectively. Assume the layers are isotropic. (8)

or

b(i) A pumping test was carried out at a site where a 8m thick clay stratum overlies a fine sand stratum 1.5m thick. Below the sand stratum lies an impermeable rock stratum. After a steady state was established, the pumping rate from a well-boring was measured as 15,000cc/s. The average water levels in the two observation wells made at 6m and 15m radius were respectively 5.0m and 4.5m below ground surface. Determine the coefficient of permeability of the sand. (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 300m and the

coefficient of permeability of the soil is 2.5×10^{-4}cm/sec. The level of water above the base of the dam is 12m on upstream and 4m on downstream. (8)

13. a(i) The water table in a deposit of uniform sand is located at 2m below the ground surface. Assuming the soil above the water table is dry, (a) determine the effective stress at a depth of 5m below the ground surface. The void ratio is 0.75 and the specific gravity of solids is 2.65. (b) If the soil above the water table is saturated by capillary action, what is the effective stress at the depth of 5m? (10)

a(ii) Discuss various factors influencing settlement characteristics of soils. (6)

or

b(i) A water tower has a circular foundation of 10m diameter. If the total weight of the tower, including the foundation is 2×10^{4}kN, calculate the vertical stress at a depth of 2.5m below the foundation level. (8)

b(ii) A settlement analysis carried out for a proposed structure indicates that 8cm of settlement will occur in 5 years and that the final settlement will be about 40cm. The computation was made on the basis of double drainage condition. However, subsequent borings established only single drainage condition. Make an estimate of the final settlement and settlement in 5 years for the changed situation. (8)

14 a(i) An oil tank is to be constructed on a deposit of saturated clay. In oil tank the main load consists of the weight of the oil; Oil is often pumped into the tank from some source and the filling process is quite rapid. For investigating the foundation for bearing capacity failure, discuss (a) What strength parameters or shear strength is relevant? (b) What test/s will provide this relevant property? (c) On what soil samples would these tests be conducted, i.e. where would one get these samples from? (6)

a(ii) In a drained triaxial compression test, a saturated specimen of cohesionless sand fails under a deviator stress of 535kN/m^2 when the cell pressure is 150kN/m^2. Find the effective angle of shearing resistance of sand and the approximate inclination of the failure plane to the horizontal. Solve this problem both by graphical method and analytical method and compare the results. (10)

or

b(i) Discuss the shear characteristics of cohesionless soils and cohesive soils. (8)

b(ii) A direct shear test was performed on a 6cm×6cm sample of dry sand. The normal load was 360N. The failure occurred at a shear load of 180N. Plot the Mohr strength envelope, and determine the angle of shearing resistance. Assume c=0. Also determine the principal stresses at failure. (8)

15. a(i) A long natural slope in an overconsolidated clay ($c'=10$kN/m^2 and $\phi'=25°$. Unit weight of the saturated soil = 20kN/m^3) is inclined at 10° to the horizontal. The water table is at the surface and the seepage is paralled to the slope. If a plane slip had developed at a depth of 5m below the surface, determine the factor of safety. (8)

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

or

b(i) A 5m deep canal has side slopes of 1:1. The properties of soil are $c_u=20$kN/m^2, $\phi_u=10°$ and Saturated unit weight = 19kN/m^3. If Taylor's stability number is 0.108, determine the factor of safety with respect to cohesion, when the canal runs full. Also find the same in case of sudden drawdown, if Taylor's stability number for this condition is 0.137. (10)

b(ii) An embankment 10m high is inclined at 36° to the horizontal. A stability analysis by the method of slices gave the following forces: Total normal force = 900kN; Total shearing force = 450kN; Total neutral force = 216kN. If the length of the failure arc is 27m, find the factor of safety with respect to (a) shear strength and (b) cohesion. The soil has $c=20$kN/m^2 and $\phi=18°$. (8)

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