B. Tech Degree V Semester Examination, November 2009

CE 501 A/B GEOTECHNICAL ENGINEERING I

(2002 Scheme)

Time : 3 Hours Maximum Marks : 100

I. (a) Derive the relationship between unit weight of soil in terms of specific gravity of soil solids, water content and void ratio. (8)

(b) A sample of wet silty clay soil weighs 1.26 kN. The following data were found from laboratory tests on the sample.

Wet density (r) = 21kN/m^3

Specific gravity (G) = 2.7

Water content (W) = 15%

Determine :

(i) dry density (ii) porosity

(iii) void ratio (iv) degree of saturation (12)

OR

II. (a) Explain the various corrections required to be applied to hydrometer readings in the sedimentation analysis. (6)

(b) Explain and discuss the use of plasticity chart for the classification of fine grained soils. (6)

(c) The Atterberg limits of a clay soil are liquid limit = 75%, plastic limit = 45% and shrinkage limit = 25%. If a sample of this soil has a volume of 30 cm^3 at the liquid limit and a volume of 16.6 cm^3 at the shrinkage limit, determine the specific gravity of solids and shrinkage ratio. (8)

III. (a) State Darcy's law and its limitations. (4)

(b) What are the factors that affect the co-efficient of permeability? (4)

(c) The data given below relate to two falling head permeability tests performed on different soils.

Stand pipe	=	400 mm^2
Permea meter sample area	=	2800 mm^2
Permea meter sample height	=	50 mm
Initial water head in stand pipe	=	1000 mm
Final water head in stand pipe	=	200 mm
Time taken for fall in the water head		
Soil 1	=	500 sec
Soil 2	=	15 sec

Determine the co-efficient of permeability of each of the these soils.
If these two soils form adjacent layers each 1.50 m thick, calculate the average permeability in directions parallel and perpendicular to the layers. (12)

OR

IV. (a) The formation soil at the toe of a masonry dam has a porosity of 40% and specific gravity of grains is 2.7. To assume safety against piping, the specification state that the upward gradient should not exceed 25% of the gradient at which a quick condition occurs. What is the maximum permissible gradient? (8)

(b) In a deposit of sand 8m thick, the water table is at a depth of 2m below the surface. Above the water table the sand is saturated with capillarity. The bulk density of sand is 20kN/m^3. Calculate the effective stress at 1m, 2m, 8m from the surface. (12)

V. (a) Differentiate between primary consolidation and secondary consolidation. (3)

(b) Explain the terms

(i) Compression Index

(ii) Co-efficient of volume compressibility

(iii) Normally consolidated clay. (9)

(Turn Over)

(c) A 2m thick saturated clay layer is sandwiched between two highly pervious coarse sand layers. When a building is constructed on the ground surface, it starts settling due to the consolidation of the clay layer. If the average co-efficient of consolidation of clay is 4.5×10^{-4} cm^2/sec, in how many days will the building reach half of its final settlement. (8)

OR

VI. (a) Explain how preconsolidation pressure is determined. (5)

(b) Describe the Casagrande's method of determination of co-efficient of consolidation. (5)

(c) Two clay layers A and B are respectively 4m and 5m thick. The time taken for layer A to reach 50% consolidation is 6 months. Calculate the time taken by the layer B to reach the same degree of consolidation. The co-efficient of consolidation of layer B is half the C_V for layer A. Layer A is having double drainage and B is having single drainage. (10)

VII. (a) What are the advantages of triaxial test over direct shear test. (5)

(b) A vane, 10.8 cm long and 7.2 cm in diameter, was pressed into a soft clay at the bottom of a borehole. Torque was applied and the value at failure was 45Nm. Find the shear strength of the clay if both ends of the vane shear device take part in shear. (15)

OR

VIII. (a) Explain the Mohr-Coulom theory. (4)

(b) Distinguish clearly between CD, CU and UU tests. (6)

(d) The following test results were obtained from direct shear test. Determine the values of the shear parameters.

Normal stress (kPa)	50	100	200	300
Shear stress (kPa)	36	80	154-	235

Examine whether failure will occur in the soil mass at a point where the shear stress is 120 kPa and normal stress is 245 kPa. (10)

IX. (a) Bring out the usefulness of compaction test in the laboratory in soil engineering practice. (5)

(b) The following data are obtained in a compaction test. Specific gravity = 2.65

Moisture content (1%)	2	4.2	5.5	6.6	7.5	10
Wet density (kN/m^3)	20.2	20.8	21.7	22	22.1	22.0

Determine the maximum dry density and OMC of the soil. Also compute the void ratio and degree of saturation at optimum condition. (15)

OR

X. (a) Explain how the stability of slopes could be determined for a C-ϕ soil. (8)

(b) An embankment is inclined at an angle of 35^0 and its height is 15m. The angle of shearing resistance is 15^0 and the cohesion intercept is 200 kN/m^2. The unit weight of soil is 18 kN/m^3. If Taylor's stability number is 0.06. Find the factor of safety with respect to cohesion. (12)

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