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Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) (09 SCHEME) DEGREE EXAMINATION, NOVEMBER 2014

CE / PTCE 09 504—GEO-TECHNICAL ENGINEERING

Time : Three Hours Maximum : 70 Marks

Part A

Answer **all** *questions.*

1. Differentiate between residual soil and transported soil.
2. Distinguish between relative density and relative consistency.
3. State the advantages of direct shear tests.
4. Define coefficient of volume change and coefficient of compressibility.
5. Bring out the differences between active and passive earth pressure conditions.

(5 × 2 = 10 marks)

Part B

Answer any **four** *questions.*

1. A clay soil has a liquid limit of 52%. The volume of the soil sample in the shrinkage dish at the liquid limit is $0.0401 \times 10^{-3} m^3$ and it shrinks to a volume of $0.0261 \times 10^{-3} m^3$ at the shrinkage limit. The specific gravity of the solids is 2.72. Determine the shrinkage limit of the soil.
2. A layer of sand 8 m thick lies above a layer of clay. The water table is at a depth of 1 m below the ground surface. Above the water table, the sand is saturated with cappillary moisture. The saturated unit weight of sand is 20 kN/m^3 and its dry unit weight is 17 kN/m^3. Plot the total stress, neutral stress and effective stress with depth upto a depth of 8 m.
3. Two samples of soil were tested in a triaxial machine. The all-round pressure maintained for the first sample was 200 kN/m^2 and failure occurred at an additional axial stress of 770 kN/m^2. For the second sample these values were 500 kN/m^2 and 1370 kN/m^2, respectively. Find c and ϕ of the soil.
4. The average effective pressure in a normally consolidated clay layer 3 m thick is doubled due to the construction of a structure. The initial void ratio of the clay is 1.0 and its liquid limit is 54%. Calculate the consolidation settlement of the clay layer.
5. An earthen embankment is to be compacted to a dry density of 18 kN/m^3 at a placement water content of 12%. The soil for the embankment is to be taken out of a borrow area having a bulk density of 16.8 kN/m^3 and moisture content of 12%. How much volume of borrow soil is to be dry to form 100 m^3 of the compacted fill ?

Turn over

6. A retaining wall 4 m high supports a backfill with horizontal top. The wall is pushed towards the fill. Compute the total force acting on the wall. The properties of the fill are as follows : Cohesion is 25 kN/m^2, the angle of shearing resistance is 20° and the unit weight is 18 kN/m^3. Use Rankine's method.

(4 × 5 = 20 marks)

Part C

Answer any **one** *question from each unit.*

Module I

1. (a) State the various corrections required for a hydrometer reading. How these corrections are determined ?

   (b) A dry sample of weight 50 g is mixed with distilled water to prepare a suspension of 1000 ml for hydrometer analysis. The reading of the hydrometer taken after 5 minutes was 25 and the depth of the centre of the bulb below the water surface when the hydrometer was in the jar was 150 mm. The volume of the hydrometer was 62 cm^3 and the area of cross-section of the jar was 55 cm^2.

   Assuming G = 2.68 and $\eta = 1.0 \times 10^{-5}$ g-sec/cm^2, determine the co-ordinates of the point corresponding to above observation.

Or

2. (a) Discuss field identification methods for soils. What is the use of classification of soils ?

   (b) Discuss Indian standard classification system.

Module II

3. (a) What is the effect of surcharge and the capillary action on the effective stress ?

   (b) A sand deposit consists of two layers. The top layer is 2.5 m thick (γ = 17 N/m^3) and the bottom layer is 3.5 m thick (γ_{sat} = 20 kN/m^3). The water table is at a depth of 3.5 m from the surface and the zone of capillary saturation is 1 m above the water table. Draw the diagram showing the variation of total stress, neutral stress and effective stress.

Or

4. (a) Discuss the shear characteristics of cohesionless soils and cohesive soils.

   (b) A shear vane 7.5 cm dia and 11.25 cm long was pressed into soft day at the bottom of a bore hole. Find the shear strength of the day if the torque required for failure was 400 kg-cm.

Module III

5. A 3 m thick clay layer beneath a building is overlain by a permeable stratum and is underlain by an imperious rock. The coefficient of consolidation of the clay was found to be 0.025 cm^2/minute.

   The final expected settlement of the layer is 8 cm.

   (a) How much time will it take for 80% of the total settlement to take place ?

   (b) Determine the time required for a settlement of 2.5 cm to occur.

   (c) Compute the settlement that would occur in one year.

Or

6. The following are the results of a standard compaction test performed on a sample of soil :

Water content (%)	7.7	11.5	14.6	17.5	19.7	21.2
Weight of wet soil (kg)	1.70	1.89	2.03	1.99	1.96	1.92

   If the volume of the mould used was 950 cc and the specific gravity of soil grains was 2.65, make necessary calculation and plot the water content-dry density curve and obtain the optimum water content and the maximum dry density.

Module IV

7. A vertical retaining wall 10 m high supports a cohesionless soil (γ = 18 kN/m^3). The upper surface of the back fill rises from the crest of the wall at an angle of 15° with the horizontal. Determine the total active pressure by Gulmann's method. Take ϕ = 30° and δ = 20°.

Or

8. Describe how a slope is analysed using Swedish circle method. Derive an expression for the factor of safety.

(4 × 10 = 40 marks)