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10CV54

**Fifth Semester B.E. Degree Examination, Dec.2017/Jan.2018**  
**Geotechnical Engineering - I**

Time: 3 hrs.

Max. Marks:100

**Note:** Answer any FIVE full questions, selecting atleast TWO questions from each part.

**PART - A**

- 1
  - a. Explain three phase system of soil, with a sketch. Differentiate between void ratio and percentage voids. (06 Marks)
  - b. With usual notation show that  

$$e = \frac{Gw}{Sr}$$
 (06 Marks)
  - c. Soil sample in its natural state is fully saturated with a water content of 30%. Determine the void ratio, dry unit weight and wet unit weight. Also calculate total weight of water required to fully saturate a soil mass of volume  $50\text{m}^3$ . Take  $G = 2.60$ . (08 Marks)
- 2
  - a. Determine the moisture content of soil sample by Pycnometer method. At what situation this method is preferred? (07 Marks)
  - b. Discuss advantages and limitations of sedimentation analysis. Explain the corrections to be applied to Hydrometer readings. (07 Marks)
  - c. A dry sample of weight 50gms is mixed with distilled water to prepare a suspension of 1000 ml for hydrometer analysis. The reading of the hydrometer taken after 5 minutes is 25 and the depth of the centre of the bulb below the water surface when the hydrometer was in the jar was 150mm. The volume of the hydrometer 62ml and cross section area of Jar  $55\text{ cm}^2$ . Assuming  $G = 2.68$  and  $\eta = 1.0 \times 10^{-5}\text{ g-sec/cm}^2$ . Determine the co-ordinates of the point corresponding to above observation. (06 Marks)
- 3
  - a. With a neat sketch, explain plasticity chart and describe its use in classifying fine grained soil. (06 Marks)
  - b. Explain with neat sketches, the structure of the following minerals :  
 i) Kaolinite      ii) Montmorillonite. (06 Marks)
  - c. Following are the results obtained from the tests conducted on two soils A and B. Classify them as per IS classification system. Show the salient steps involved. (08 Marks)

Soil	LL	PL	% Retained on IS 75 $\mu\text{m}$ Sieve	% Retained on IS 4.75 mm Sieve	Cu	Cc
A	110	50	40	Zero	-	-
B	-	-	97	05	7	2

- 4
  - a. State Darcy's Law. With a neat sketch, derive an expression for the co-efficient of permeability of a soil in a falling head permeability test. (08 Marks)
  - b. Explain the factors affecting the permeability of soil. (06 Marks)
  - c. A sample of soil for constant head permeability test yielded the following data :
    - i) Diameter of sample = 7.6cm.
    - ii) Length of sample = 20cm.
    - iii) Head causing the flow = 15cm.
    - iv) Quantity of water collected in 10min = 150 CC.

Assume  $G = 2.65$ ,  $\gamma_d = 18 \text{ kN/m}^3$ .

Determine : i) Co-efficient of Permeability ii) Discharge velocity iii) Seepage Velocity. (06 Marks)

**PART – B**

- 5 a. Explain Mohr – Coulomb failure theory of soils. Sketch Coulomb failure envelope for pure sand and pure clay. (06 Marks)
- b. Explain the following terms : i) Sensitivity and Thixotropy of clay. ii) Total, neutral and effective stresses in soils. (06 Marks)
- c. Two identical specimens 4cm diameter and 8cm height of partly saturated compacted soil are tested in a triaxial cell under undrained conditions. The first specimen failed at deviator load of 720N under a cell pressure of  $100 \text{ kN/m}^2$ . Second specimen failed at deviator load of 915N under a cell pressure of  $200 \text{ kN/m}^2$ . The increase in the volume of first specimen at failure is 1.2ml and shortens by 0.6cm. The increase in the volume of second specimen at failure is 1.6ml and shortens by 0.8cm. Determine apparent cohesion and angle of shearing resistance by analytical method. (08 Marks)
- 6 a. Obtain the value of compactive energy imported to the soil during Light compaction and Heavy compaction test. (04 Marks)
- b. What are the objectives of Compaction? Discuss the factors affecting compaction. (06 Marks)
- c. Following are the results obtained from a standard compaction test :

Water content, W(%)	13.5	20.2	25	35	45
Bulk unit weight, $\gamma_b$ kN/m <sup>3</sup>	16.3	19.4	18.8	18	17.2

Plot compaction curve and obtain maximum dry unit weight and OMC. Also plot 100% saturation line. Show specimen calculation.  $G = 2.65$ . (10 Marks)

- 7 a. Define the following terms : i) Compression index ii) Co-efficient of compressibility iii) Co-efficient of volume compressibility. (06 Marks)
- b. Explain with a neat sketch, Casagrande's method of obtaining Pre – consolidation pressure. (06 Marks)
- c. A saturated soil stratum 5m thick lies above an impervious stratum. It has a compression index of 0.25 and co-efficient of Permeability  $3.2 \times 10^{-3} \text{ mm/sec}$ . If void ratio is 1.90 at a normal stress of  $0.15 \text{ N/mm}^2$ . Compute i) void ratio due to increase in stress to  $0.2 \text{ N/mm}^2$  ii) settlement of soil stratum due to above increase in stress. (08 Marks)
- 8 a. List the merits and demerits of Triaxial shear test over Direct shear test. (06 Marks)
- b. Explain the determination of co-efficient of consolidation by square root of time fitting method. (06 Marks)
- c. In a direct shear test on a specimen of clean dry sand a normal stress of  $200 \text{ kN/m}^2$  was applied and failure occurred at a shear stress of  $140 \text{ kN/m}^2$ . Determine i) Angle of shearing resistance ii) Principal stresses during failure iii) Direction of principal planes with respect to plane to shearing. Draw a neat sketch of Mohr circle showing the directions of Major and Minor principal planes with reference to shearing. (08 Marks)

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