CBCS SCHEME

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15CV45

Fourth Semester B.E. Degree Examination, June/July 2019
Basic Geotechnical Engineering

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Missing data if any may be suitably assumed and clearly stated.***
3. ***Use of Plasticity chart allowed 1498-1970.***

Module-1

1 a. With the help of three phase diagram, explain i) Void ratio ii) Porosity iii) Degree of saturation iv) Water content v) Submerged unit weight vi) Specific gravity. **(08 Marks)**

b. The following data were obtained in a shrinkage limit test :
Initial weight of saturated soil = 0.956N ; Initial volume of saturated soil = 6.85×10^{-5} m^3
Final dry volume = $2.41 \times 10^{-5} m^3$; Final dry weight = 0.435N.
Determine the shrinkage limit , initial bulk , unit weight , dry unit weight , specific gravity of soil solids, initial and final void ratios. **(08 Marks)**

OR

2 a. Explain IS classification system for coarse and fine grained soils as per 1498 – 1970. Use plasticity chart at the appropriate level. **(08 Marks)**

b. In an earthen embankment under construction the bulk unit weight is 16.50kN/m^3 at water content 11%. If the water content has to be increased to 15% , compute the quantity of water to be added per cubic meter of soil. Assuming no change in void ratio, determine the degree of saturation at this water content by taking G = 2.70. **(08 Marks)**

Module-2

3 a. With relevant sketches, explain the following : i) Single grained structure ii) Honey combed structure iii) Floccullant structure iv) Dispersed structure. **(08 Marks)**

b. Following are the observations of a compaction test :

Water content (%)	7.7	11.5	14.6	17.5	19.5	21.2
Weight of wet soil (N)	16.67	18.54	19.92	19.52	19.23	18.83

If the compaction mould is 950CC and by assuming G = 2.65.
i) Draw the compaction curve.
ii) Report the optimum moisture content and maximum dry unit weight.
iii) Draw 100% saturation line. **(08 Marks)**

OR

4 a. With the help of neat sketch, explain any two principle clay minerals. **(08 Marks)**

b. Laboratory compaction test on soil having specific gravity of 2.7 gave a maximum dry unit weight of 18kN/m^3 and a water content of 15%. Determine the degree of saturation , air content and percentage air void at the maximum dry unit weight. What would be the theoretical maximum dry unit weight corresponding to zero air void at the optimum water content? **(08 Marks)**

Module-3

5 a. Explain the following : i) Effective stress concept ii) Seepage and superficial velocity iii) Quick sand condition iv) Capillary rise of water in soil. **(08 Marks)**

b. A soil stratum with permeability $K = 5 \times 10^{-7}$ cm/s overlies an impervious stratum. The impervious stratum lies at a depth of 18m below the ground surface. A sheet pile wall penetrates 8m into the permeable soil stratum. Water stands to a height of 9m on upstream side and 1.5m on downstream side above the surface of soil stratum. Sketch the flow net and determine the quantity of seepage. **(08 Marks)**

OR

6 a. Describe the Casagrande's method to locate the phreatic line in a homogeneous earth dam with a horizontal filter at its toe. **(08 Marks)**

b. In a falling head permeability test, the soil sample used is 20cm long with a cross – sectional area $24cm^2$. Calculate the time required for the head causing flow to drop from 250mm to 120mm. The area of cross – section of the stand pipe is $2cm^2$. The soil sample is made up of 3 layers. The thickness of first layer from the top is 8cm and has a value of K as 2×10^{-4} cm/s. The second layer has thickness of 7cm and it has $K = 5 \times 10^{-4}$cm/s. The bottom most layer has a K value of 7×10^{-4} cm/s. Flow is in a direction perpendicular to the layers. **(08 Marks)**

Module-4

7 a. Explain Mass – spring anology theory of consolidation of soil. **(08 Marks)**

b. A clay soil, tested in a consolidometer , showed a decrease in void ratio from 1.20 to 1.10 when the pressure was increased from 0.25 to 0.50 Kgf/cm^2. Calculate the coefficient of compressibility (a_v) and the coefficient of volume compressibility (m_v). If the coefficient of consolidation (C_v) determined in the test for the given stress increment was $10m^2$/year, calculate the coefficient of permeability in cm/s. **(08 Marks)**

OR

8 a. With the help of neat sketch , explain determination of preconsolidation pressure by Casagrande's method. **(04 Marks)**

b. Briefly explain normally consolidated, under consolidation and over consolidated soils. **(06 Marks)**

c. Following data were obtained from a consolidation test on a clay sample with double drainage conditions : Void ratio at 100 KPa = 1.37 ; Void ratio at 200 KPa = 1.25. Thickness of the soil sample at 100KPa = 20mm ; Coefficient of permeability = 5×10^{-7} mm/s. Calculate i) Compression index ii) Coefficient of volume change iii) Coefficient of consolidation in mm^2/year. **(06 Marks)**

Module-5

9 a. List the various test to determine shear strength parameters of soil and explain briefly any one method. **(06 Marks)**

b. In a direct shear test conducted on a dense sand, the sample fails at a shear stress of 75 kN/m^2, when the normal stress was held constant at $100kN/m^2$. Draw the Mohr circle for the failure condition and determine i) the angle of shearing resistance ii) the orientation of the major and minor principal planes and the stress acting on them iii) the orientation of the plane of maximum shear stress. If a specimen of this soil were to be tested in a triaxial shear test under CD condition at a cell pressure of $125kN/m^2$, at what axial stress would the sample fail? **(10 Marks)**

OR

10 a. Explain the types of shear test based on different drainage condition. **(06 Marks)**

b. An unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 37.5mm and was 80mm long. The load at failure measured by the proving ring was 28N and the axial deformation of the sample at failure was 13mm. Determine the unconfined compressive strength and the undrained shear strength of the clay. **(10 Marks)**