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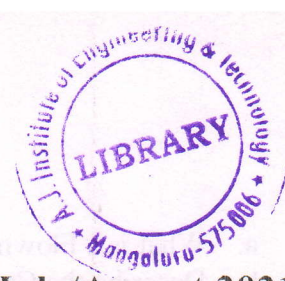
Fifth Semester B.E. Degree Examination, July/August 2021
Basic Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. With the help of 3 -- phase diagram, define Void ratio , Porosity , Water content and Degree of saturation. **(08 Marks)**

  b. The mass of wet soil when compacted in a mould was 19.17N. The water content of the soil mass was 16%. If the volume of mould was 0.945 litres, determine
  i) Dry density   ii) Void ratio   iii) Degree of saturation   iv) Percent air voids.
  Take $G = 2.68$. **(12 Marks)**

2 a. Define Liquid limit, Plastic limit and Shrinkage limit ;   Liquidity index and Relative consistency. **(06 Marks)**

  b. Explain determination of In-situ density of soil by Sand replacement method. **(08 Marks)**

  c. The liquid limit test on soil sample gives the following results. The plastic limit of the soil is 40%.

No. of Blows	12	18	22	34
Water content %	56	52	50	45

  Plot a flow curve and obtain i) Liquid limit   ii) Flow Index   iii) Plasticity Index and iv) Toughness Index. **(06 Marks)**

3 a. List and explain various soil structures. **(06 Marks)**

  b. Briefly explain the factors affecting compaction. **(06 Marks)**

  c. A standard proctor test was performed on a soil sample of specific gravity 2.70, with the following results :
  Maximum dry unit weight = $18 kN/m^3$;   Optimum moisture content = 16%.
  If the compaction effect was increased so that the maximum unit weight is $19.2 kN/m^3$, assuming same degree of saturation, what should be the corresponding OMC. **(08 Marks)**

4 a. Explain Common clay minerals with sketches. **(06 Marks)**

  b. Explain Electrical diffuse double layer and adsorbed water. **(06 Marks)**

  c. A soil in the borrowpit is at a dry density of $16.67 kN/m^3$ with water content of 12%. If the soil of $2000m^3$ is excavated from it and compacted in an embankment with porosity of 0.32, calculate the volume of embankment which can be constructed out of this material.
  Take $G = 2.70$. **(08 Marks)**

5 a. Explain the following : i) Effective stress analysis   ii) Seepage analysis. **(06 Marks)**

  b. With the help of a neat sketch, derive the equation to determine permeability by Falling Head Permeability Test. **(06 Marks)**

  c. Calculate the seepage through an earth dam resting on an impervious foundation. The relevant data are given below :
  Height of Dam = 60.0m   ;   Free Board = 2.5m   ;   Upstream slope = 2.75 : 1 ;
  Crest width = 8.0m ; Downstream slope = 2.50 : 1 ; Length of drainage blanket = 120.0m.
  Coefficient of permeability of the embankment material in x – direction = 8×10^{-7} m/s ;
  y – direction = 2×10^{-7} m/s. **(08 Marks)**

6 a. What is a Flownet? What are the characteristics and uses of the Flownet? (06 Marks)

 b. Describe the Casagrande's method to locate the phreatic line in a homogeneous earth dam with a horizontal filter @ its toe. (06 Marks)

 c. A soil sample of height 60mm with cross sectional area 8000mm² was subjected to a falling head permeability test. In a time interval of 6 minutes, the head dropped from 750mm to 300mm. If the cross sectional area of stand pipe is 150mm², compute the coefficient of permeability. If the same sample is subjected to a constant head of 200mm, compute the total quantity of water that will get discharged through the sample in a time interval of 10 minutes. (08 Marks)

7 a. Explain Mohr – Coulomb failure theory of soil. (06 Marks)

 b. List the different methods to measure the shear strength of soil. Explain any one of them. (06 Marks)

 c. A shear test was carried out and the following results are recorded :

Normal stress (kN/m²)	200	250
Shear stress (kN/m²)	100	125

 Find shear parameters, what would be the deviator stress at failure if a biaxial test is carried out from the same soil with cell pressure of 100kN/m². (08 Marks)

8 a. Explain the advantages of Triaxial shear test over Direct shear test. (06 Marks)

 b. What are the factors affecting the shear strength of soil? (06 Marks)

 c. A cylindrical specimen of saturated clay 40mm in diameter and 80mm in length is tested in an unconfined compression test. Find shear strength of clay, if the specimen fails under an axial load of 350N. The change in length of the specimen @ failure is 8mm. Also find the shear parameters if the angle made by the failure plane with horizontal is 50°. (08 Marks)

9 a. Enumerate the assumptions and limitations of Terzaghi's Consolidation theory. (06 Marks)

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

 c. A soil sample 20mm thick takes 20 minutes to reach 20% consolidation. Find the time taken for a clay layer 6m thick to reach 40% consolidation. Assume double drainage in both cases. (08 Marks)

10 a. Explain Mass – Spring Analogy. (06 Marks)

 b. Explain determination of coefficient of consolidation by square root of Time Fitting method. (06 Marks)

 c. In a consolidation test, the void ratio of soil sample decreases from 1.20 to 1.10. When the pressure increased from 200kN/m² to 400kN/m². Calculate the coefficient of consolidation if the coefficient of permeability is 8×10^{-7} mm/s. (08 Marks)

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