CBCS SCHEME

Fifth Semester B.E. Degree Examination, Jan./Feb. 2021
Geotechnical Engineering

Time: 3 hrs.   Max. Marks: 100

Note: 1. *Answer any FIVE full questions, choosing ONE full question from each module.*
2. *Missing data, if any, may be suitably assumed.*

Module-1

1 a. With the help of the phase diagram, define the following:
   (i) Void Ratio   (ii) Porosity
   (iii) Degree of saturation   (iv) Air content   **(06 Marks)**

   b. With usual notation, derive the expression, $e = \dfrac{GW}{S_r}$.   **(06 Marks)**

   c. Explain the procedure to determine in-situ density of soil by core cutter method and sand replacement method.   **(08 Marks)**

OR

2 a. Explain the corrections to be applied to hydrometer readings and give advantages and limitations of sedimentation analysis.   **(06 Marks)**

   b. Soil has been compacted in an embankment at a bulk density of 21.5 kN/m³ and water content of 12%. The value of specific gravity of soil solids is 2.65. The water table is well below the foundation level. Estimate the dry density, void ratio, porosity, degree of saturation, air content and percentage air voids of compacted soil.   **(08 Marks)**

   c. The following data refers to a sample of soil;
   Percentage parsing 4.75 mm IS Sieve = 52
   Percentage parsing 0.75 mm IS Sieve = 7
   Uniformity coefficient = 6.8
   Coefficient of curvature = 3.0
   Liquid limit of fine grained soil = 38%
   Plastic limit of fine grained soil = 12%
   Classify the soil.   **(06 Marks)**

Module-2

3 a. With neat sketches, explain following soil structures:
   (i) Single Grained   (ii) Honey combed
   (iii) Flocculent   (iv) Dispersed   **(08 Marks)**

   b. List the different types of clay minerals commonly found in soils. Explain any two clay minerals with their structure.   **(06 Marks)**

   c. Explain electrical diffuse double layer and adsorbed water.   **(06 Marks)**

OR

4 a. Explain the factors affecting the compaction of soils.   **(06 Marks)**

   b. Distinguish between standard and modified proctor tests.   **(04 Marks)**

   c. Following are the observations of compaction test:

Water content, W (%)	13.5	20.2	25	35	45
Bulk unit weight, γ_b (kN/m³)	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. Take G = 2.65.   **(10 Marks)**

Module-3

5   a. Explain the factors affecting permeability of soil. **(06 Marks)**
    b. The following details refer to a test to determine the permeability of soil, thickness of specimen = 25 mm, diameter of stand pipe = 10 mm, initial head = 1000 mm, final head = 800 mm. Determine the permeability of soil. If the void ratio of sample is 0.75, what is the permeability of same soil at a void ratio of 0.9?
       Take diameter of sample = 75 mm, time = 200 min. **(08 Marks)**
    c. Explain Quick Sand Phenomenon with a sketch. **(06 Marks)**

OR

6   a. Explain total and effective stresses in soil. **(04 Marks)**
    b. State Darcy's law. With a neat sketch, derive an expression for the coefficient of permeability of a soil in a falling head permeability test. **(08 Marks)**
    c. A clay strata of thickness 8m is located at a depth of 6 m below ground surface. It is overlaid by fine sand. The water table is located at a depth of 2 m below the ground surface. For fine sand the submerged unit weight is 10.2 kN/m^3. The moist unit weight of sand located above the water table is 16 kN/m^3. For clay layer, G = 2.76 and water content = 25%. Compute the effective stress at the middle of clay layer. **(08 Marks)**

Module-4

7   a. Explain the determination of pre-consolidation pressure by Casagrande method. **(06 Marks)**
    b. List the different curve fitting methods used in consolidation test. Explain logarithmic time curve fitting method with neat sketch. **(08 Marks)**
    c. An undisturbed sample of a clay stratum 2m thick, was tested in the laboratory and the average value of coefficient of consolidation was found to be 2×10^{-4} cm^2/sec. If a structure is built on clay stratum, how long will it take to attain half the ultimate settlement under the load of the structure? Assume double drainage. **(06 Marks)**

OR

8   a. Explain Terzaghi's spring mass analogy. **(06 Marks)**
    b. What are the assumptions made in Terzaghi's theory of one-dimensional consolidation? **(06 Marks)**
    c. Define the following terms:
       (i) Coefficient of compressibility   (ii) Coefficient of consolidation
       (iii) Primary consolidation   (iv) Over consolidated soil **(08 Marks)**

Module-5

9   a. Classify the shear tests on the basis of drainage conditions. **(04 Marks)**
    b. A cylindrical specimen of dry sand was tested in a tri-axial test. Failure occurred under a cell pressure of 130 kN/m^2 and deviator stress of 420 kN/m^2. Find the following:
       (i)   Angle of shearing resistance
       (ii) Normal and shear stresses on failure plane
       (iii) Inclination of failure plane with major and minor principal stress planes. **(10 Marks)**
    c. List the merits and demerits of tri-axial shear test over direct shear test. **(06 Marks)**

OR

10 a. Explain Mohr-Coulomb's failure theory and draw the failure envelope for different soils. **(08 Marks)**
    b. Following are the details of direct shear test on a soil at failure,

Normal Load (N)	100	200	300	400
Shear Load (N)	90	181	270	362

       Size of box = 6 cm × 6 cm. Determine shear strength parameters. **(08 Marks)**
    c. What are the factors affecting the shear strength of soil? **(04 Marks)**