CBCS SCHEME

15CT53
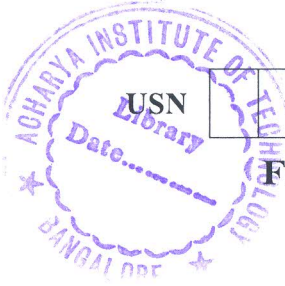
Fifth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Geotechnical Engineering

Time: 3 hrs.   Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Explain the three phase system of soil.   **(05 Marks)**
   b. Define the terms : Bulk Density, Degree of saturation.   **(04 Marks)**
   c. Following results were obtained from liquid limit test on a clay sample whose plastic limit is 20% plot the flow curve and obtain liquid limit, flow index and plasticity index.

No of blows	12	18	22	34
'w' in %	56	52	50	45

                                                                                          (07 Marks)

OR

2 a. Derive : $\gamma_d = \dfrac{G\gamma_w}{1+e}$ **(05 Marks)**
   b. With a neat sketch, explain the salient features of IS soil classification system.   **(05 Marks)**
   c. A soil sample has porosity of 40%. The specific gravity of solids is 2.7 calculate :
      (i) Voids ratio
      (ii) Dry Density
      (iii) Unit weight, if the soil is 50% saturated
      (iv) Unit weight, if the soil is completely saturated.   **(06 Marks)**

Module-2

3 a. Briefly explain the types of clay minerals found in soils.   **(06 Marks)**
   b. Explain Electrical Diffuse Double layer phenomenon.   **(05 Marks)**
   c. Define the terms :
      (i)   Base – exchange capacity
      (ii) Adsorbed water
      (iii) Covalent Bond.   **(05 Marks)**

OR

4 a. Explain any four effects of compaction.   **(04 Marks)**
   b. Distinguish between standard and modified proctor's test.   **(04 Marks)**
   c. Following are the observations of a compaction test. Determine: (i) Draw the compaction curve (ii) Report maximum dry density and OMC.
      If the volume of compaction mould is 950CC. assume G = 2.65.

Water content %	7.7	11.5	14.6	17.5	19.5	21.2
Weight of soil in N	16.67	18.45	19.92	19.52	19.23	18.83

                                                                                          (08 Marks)

Module-3

5 a. Define Darcy's law. Derive an expression to relate discharge velocity and seepage velocity.
                                                                                          (06 Marks)
   b. Explain the following terms :
      i) Total stress   ii) Neutral stress   iii) Effective stress   iv) Quick sand condition. **(06 Marks)**

c. A horizontal stratified soil deposit consists of three uniform layers of thickness 6, 4 and 12m respectively. The permeabilities of these layers are 8×10^{-4} cm/sec, 52×10^{-4} cm/sec, and 6×10^{-4} cm/sec. Find the effective average permeability of the deposit in the horizontal and vertical direction. **(04 Marks)**

OR

6   a. List the properties and use of flownets. **(04 Marks)**
    b. In a falling head permeability test, the initial head (t = 0) is 40cm. The head drops by 5cm in 10mins. Calculate the time required to run the test for the final head to be at 20cm. if the sample is 6cm in height and $50cm^3$ in cross sectional area, calculate the coefficient of permeability, taking area of stand pipe $= 0.5cm^2$. **(08 Marks)**
    c. Write the assumptions of Darcy's law. **(04 Marks)**

Module-4

7   a. With a neat sketch briefly explain Mass spring analogy. **(05 Marks)**
    b. Explain under consolidated, normally consolidated and over consolidated soils. **(05 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 the clay stratum, how long will it take to attain half the ultimate settlement under the load of the structure? Assume double drainage condition. **(06 Marks)**

OR

8   a. Explain square root of time fitting method to determine coefficient of consolidation.
(06 Marks)
    b. Explain Casagrande's method of determining pre consolidation pressure. **(04 Marks)**
    c. A saturated soil has a compression index of 0.28. The void ratio at a stress of $12kN/m^2$ is 2.05. Compute the settlement in soil if the stratum is 6m thick subjected to an increase in stress to $21.6kN/m^2$. **(06 Marks)**

Module-5

9   a. Explain Mohr – Coulomb theory of shear strength. **(05 Marks)**
    b. Explain Direct shear test on soils. **(05 Marks)**
    c. The observations for normal load and maximum shear force for the specimens of sandy clay tested in the shear box, 36cm^2 in area under undrained conditions. Plot the failure envelope for the soil and determine the values of angle of shearing resistance and cohesion.

Normal load (N)	100	200	300	400
Max. Shear force (N)	110	152	193	235

(06 Marks)

OR

10 a. What is Thixotropy and sensitivity of clayey soils? **(05 Marks)**
    b. What are the disadvantages of Direct shear test? **(05 Marks)**
    c. Samples of compacted, clearly sand were tested in a shear box, 6cm × 6cm and the following results were obtained:

Normal Load (N)	100	200	300	400
Peak Shear Load (N)	90	181	270	362
Ultimate shear load (N)	55	152	277	300

Determine the angle of shearing resistance of the sand in i) The Dense state   ii) The loose state. **(06 Marks)**