

# CBCS SCHEME

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## Fourth Semester B.E. Degree Examination, Dec. RAJA' 020 Basic Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 100

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

### Module-1

- 1 a. With the help of 3-phase diagram define: void ratio, porosity, water content and degree of saturation. (08 Marks)
- b. Derive from first principles, the following phase relation:  

$$e = \frac{w}{G} \left( \frac{G}{G_s} \right) \left( \frac{1}{1 - e} \right)$$
(06 Marks)
- c. With the help of particle size distribution curve explain: well graded soil, uniformly graded soil and gap graded soil. (06 Marks)

OR

- 2 a. With a neat sketch, explain the salient features of a plasticity chart. (08 Marks)
- b. The natural dry density of a soil deposit was found to be  $17.5 \text{ kN/m}^3$ . A sample of soil was brought to the laboratory and the minimum and maximum dry densities were found as  $16 \text{ kN/m}^3$  and  $19.01 \text{ kN/m}^3$  respectively. Calculate the density index for the soil deposit. (06 Marks)
- c. How many cubic meters of soil can be formed with a void ratio of 0.5 from 100 cubic meters of soil having void ratio of 0.7. (06 Marks)

### Module-2

- 3 a. List and explain various soil structures. (06 Marks)
- b. What is the effect of compaction on soil properties? (06 Marks)
- c. Following are the results of a standard proctor compaction test on a soil:

Water content, %	8.5	12.2	13.75	15.5	18.20
Weight of wet soil in kgs	1.8	1.94	2.0	2.04	2.03

Plot the compaction curve and get maximum dry density and OMC. Also plot ZAV line. Take  $G = 2.75$  and volume of mould as 995 c.c. (08 Marks)

OR

- 4 a. Describe the three principal clay minerals. (08 Marks)
- b. Explain electrical diffuse double layer and adsorbed water. (06 Marks)
- c. What are the factors which affect compaction? (06 Marks)

### Module-3

- 5 a. Derive an expression to obtain coefficient of permeability under falling head condition. (06 Marks)
- b. Explain with a neat sketch the method of locating the phreatic line in a homogeneous earth dam with horizontal filter. (06 Marks)
- c. Calculate the coefficient of permeability of a soil sample, 6 cms in height and  $50 \text{ cm}^2$  in cross-sectional area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective constant head of 40 cms. On oven drying the test specimen has a mass of 498 gms. Taking the specific gravity of soil solids as 2.65, calculate the seepage velocity of water during the test. (08 Marks)

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**OR**

- 6 a. State the characteristics and uses of flownets. (08 Marks)  
 b. Explain the terms superficial velocity and seepage velocity. Derive the relationship between, them. (06 Marks)  
 c. If during a Variable head permeability test on a soil sample, equal time intervals are noted for drops of head from  $h_1$  to  $h_2$  and again from  $h_2$  to  $h_3$ . Find the relationship between  $h_1$ , and  $h_3$ . (06 Marks)

**Module-4**

- 7 a. Explain mass-spring analogy of consolidation of soils. (06 Marks)  
 b. Explain Casagrande's method of determination of pre consolidation pressure. (06 Marks)  
 c. The time to reach 40% consolidation of a two way drained saturated clay sample of 10mm thick in the laboratory is 40 secs. Determine the time required for 60% consolidation of the same soil 12m thick on an impervious layer subjected to same loading conditions. (08 Marks)

**OR**

- 8 a. Explain square root of time fitting method for determination of coefficient of consolidation. (06 Marks)  
 b. Explain under consolidated, normally consolidated and over consolidated soils. (06 Marks)  
 c. A layer of clay..8m thick underlies a proposed new building. The existing overburden pressure at the centre of clay layer is  $290\text{kN/m}^2$  and the load due to new building increases the pressure by  $100\text{kN/m}^2$ .  $C_c = 0.45$ ,  $W = 50\%$ ,  $G = 2.71$ . Estimate consolidation settlement. (08 Marks)

**Module-5**

- 9 a. Explain Mohr-Coulomb theory of shear strength. (06 Marks)  
 b. Explain the advantages and disadvantages of direct shear test over triaxial shear test. (06 Marks)  
 c. An unconfined compression test was conducted on an undisturbed sample of clay. The sample had a diameter of 38mm and was 80mm long. The load at failure measured as 30N and the axial deformation of the sample of failure was 12mm. Determine the unconfined compressive strength and undrained shear strength of clay. (08 Marks)

**OR**

- 10 a. Explain sensitivity and thixotropy. (06 Marks),  
 b. Explain vane shear test with a neat sketch. (06 Marks)  
 c. The triaxial tests carried'Out on soil samples gave the following results:

Confining pressure,, $\text{kN/m}^2$	50	100	150
Deviator stress, $\text{kN/m}^2$	76	132	186
Pore water pressure . $\text{kN/m}^2$	35	59	83

Plot Mohr's circle and obtain effective shear parameters. (08 Marks)