

# CBCS Scheme



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## Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018 Basic Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 80

Note: Answer FIVE full questions, choosing one full question from each module.

### Module-1

- With the help of the phase diagram, define the following : (03 Marks)  
i) Void ratio ii) Porosity iii) Degree of saturation and iv) Water content.
  - A sample have bulk density of  $26 \text{ kN/m}^3$ , Specific gravity of 2.76 and water content 16%. Determine dry density, void ratio, porosity and degree of saturation. What is the density, if the soil is fully saturated due to rain? (06 Marks)
  - How coarse grained soils are classified as per IS? Explain. If soil have  $C_u = 7$ ,  $C_c = 2$ , % Gravel = 20%, Sand = 75%, classify the soil. (07 Marks)

### OR

- Considering soil as a three phase system, derive the relation  $\gamma_d = \frac{G\gamma_w}{1+e}$ . (05 Marks)
  - Explain Consistency limits of soil. How do you describe the consistency if the soil has liquid limit of 55%, plasticity index of 30% and natural water content of 65%. (05 Marks)
  - At a site the dry density of soil is  $16 \text{ kN/m}^3$ , the weight of soil filled in a container of one liter in its loosest states and densest state are 15N and 17N respectively. Determine maximum and minimum void ratio of this soil. What is the relative density of natural soil at site? Take  $G = 2.67$ . (06 Marks)

### Module-2

- List the different types of clay minerals commonly found in soils. Explain any one with their structure. (04 Marks)
  - Distinguish between standard and modified Proctor tests. (04 Marks)
  - The following data referred to light compaction test as per IS. Take  $\gamma_w = 10 \text{ kN/m}^3$ .

Water content %	8.5	12.2	13.75	15.3	18.2	20.2
Dry unit weight $\text{kN/m}^3$	16.5	17.2	17.5	17.7	17.1	16.4

- If specific gravity of soil is 2.7
- plot compaction curve and find i) OMC and ODD
  - Plot 20% air void line
  - What is the range of water content that can be allowed to achieve dry density of  $16.8 \text{ kN/m}^3$  at site. (08 Marks)

### OR

- Explain electrical diffuse double layer and adsorbed water. (04 Marks)
  - Discuss the effect of compaction and different properties of soil. (06 Marks)
  - During a compaction test a soil attains a maximum dry density of  $18 \text{ kN/m}^3$  at a water content of 12%. Determine the degree of saturation and percent air voids at maximum dry density. Also find the theoretical maximum dry density corresponding to zero air voids at optimum moisture content. Take  $G = 2.77$ . (06 Marks)

### Module-3

- What are the factors affecting permeability? Explain any three. (04 Marks)
  - With a neat sketch, explain the method of locating phreatic line for a homogeneous earth dam with horizontal filter. (06 Marks)
  - A granular soil deposit is 7m deep over an impermeable layer. The ground water table is 4m below the ground surface. The deposit has a zone of capillary rise of 1.2m with a saturation of 50%. Plot the variations of total stress, pore water pressure and effective stress with the depth of deposit. Take  $e = 0.6$  and  $G = 2.65$ . (06 Marks)



OR

- 6 a. Write a note on : i) Characteristics of flow net and ii) Seepage velocity and discharge velocity. (06 Marks)
- b. Calculate the seepage loss in  $m^3/day$  for a hydraulic structure, if the flow net contains 5 flow lines and 9 equipotential lines and the head causing flow is 20m. K of soil is  $2.6 \times 10^{-6}$  cm/sec. (04 Marks)
- c. In a falling head permeameter test, the initial head is 40cm. The head drops by 5cm in 10 minutes, calculate the time required to run the test for the final head to be at 20cm. If the sample is 6cm in height and  $50cm^2$  in cross sectional area, calculate coefficient of permeability taking area of stand pipe as  $0.5cm^2$ . (06 Marks)

Module-4

- 7 a. Define the following terms : i) Coefficient of compressibility ii) Coefficient of consolidation iii) Primary consolidation and iv) Over consolidated soil. (08 Marks)
- b. Explain Mass spring analogy of consolidation of soils. (04 Marks)
- c. An undisturbed sample of clay, 24mm thick consolidated 50% in 20 minutes, when tested in the laboratory with drainage allowed at top and bottom. The clay layer from which the sample was obtained is 4m thick in the field. How much time will it take to consolidate 90% with single drainage subjected to same as lab loading condition? (04 Marks)

OR

- 8 a. Explain Casagrande method of determination of pre consolidation pressure. (06 Marks)
- b. How do you determine coefficient of consolidation by square root time fitting method? (06 Marks)
- c. A layer of soft clay is 6m thick and lies under a newly constructed building. The weight of sand overlying the clay layer produces a pressure of  $260kN/m^2$  and new construction increases the pressure by  $100kN/m^2$ . If the compression index is 0.5, compute the settlement. Water content and specific gravity of clay are 40% and 2.65 respectively. (04 Marks)

Module-5

- 9 a. Explain Mohr – Coulomb theory of shear strength. (04 Marks)
- b. *In an unconfined compression test on soil sample of 100mm long and 50mm in diameter* fails under a load of 150N at 10% strain. The failure plane makes an angle of  $50^\circ$  with the horizontal. Determine shear parameters. (06 Marks)
- c. The results of shear box test are as follows :

Trial No.	1	2	3	4
Normal stress $kN/m^2$	50	100	200	300
Shear stress $kN/m^2$	36	80	154	235

Determine the shear parameters. Would the failure occurs on the plane with in the soil mass when the shear stress is  $122kN/m^2$  and normal stress is  $246kN/m^2$ . (06 Marks)

OR

- 10 a. Explain the classification of shear tests based on drainage condition. (06 Marks)
- b. A cylindrical specimen of dry sand was tested in a triaxial test. Failure occurred under a cell pressure of  $130kN/m^2$  and deviator stress of  $420 kN/m^2$ . Find the following.
- Angle of shearing resistance.
  - Normal and shear stresses on the failure plane.
  - Inclination of failure plane with major and minor principal stress planes. (10 Marks)

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