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Fifth Semester B.E. Degree Examination, Dec.2018/Jan.2019 Geotechnical Engineering

Time: 3 hrs.

Max. Marks: 80

- Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.**
2. Involves plotting of graph in semi-log sheet.
3. Missing data, if any, may be suitably assumed.

Module-1

- 1 a. Differentiate between :
- i) Void ratio and porosity (04 Marks)
 - ii) Water content and degree of saturation. (04 Marks)
- b. With the help of phase diagram derive the expression. (04 Marks)
- c. The total unit weight of soil is 18.8 kN/m^3 , the specific gravity of the solid particles of soil is 2.67 and water content of the soil is 12%. Calculate the dry unit weight, void ratio and degree of saturation. (08 Marks)

OR

- 2 a. Briefly explain unified soil classification system. (05 Marks)
- b. State Stokes law and list limitations of the law. (04 Marks)
- c. Following results were obtained from liquid limit test on a clay sample whose plastic limit is 27.8%.

No. of blows (N)	34	23	18	12
Water content (%)	44.6	49.4	51.4	55.6

The natural water content of the sample is 32.8%.

- Determine :
- i) Flow index
 - ii) Plasticity index
 - iii) Liquid limit
 - iv) Liquidity index
 - v) Consistency index. (07 Marks)

Module-2

- 3 a. Explain the following clay structures i) Flocculated soil structure ii) Cohesive matrix/clay matrix iii) Cause grained skeleton iv) Dispered soil structure. (06 Marks)
- b. Explain the effect of compaction on soil properties. (06 Marks)
- c. List out the differences between standard proctor test and modified proctor test. (04 Marks)

OR

- 4 a. Explain the following clay minerals i) Illite ii) Montmorillonite iii) Kaolinite with neat sketches. (06 Marks)
- b. Discuss in detail : i) Diffused double layer ii) Base exchange capacity. (06 Marks)
- c. A laboratory compaction test n soil having specific gravity equal to 2.68 gave a maximum dry density of 1.82 g/cc and a water content of 17%. Determine the degree of maximum dry density. What would be theoretical maximum dry density corresponding to zero air voids of optimum water content. (14 Marks)

Module-3

- 5 a. Derive the expression for seepage velocity and figure out co-efficient of percolation. (07 Marks)
- b. In a falling head permeameter test, the initial head (h_0) 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 the coefficient of permeability, taking area of stand pipe = 0.5cm^2 . (09 Marks)

OR

- 6 a. List out the factors affecting permeability and explain any 3 factors. (06 Marks)
- b. Explain : i) Quick sand ii) Capillary phenomena. (04 Marks)
- c. Water is flowing at the rate of 0.05m/sec in an upward condition through a fine sand whose coefficient of permeability is $2 \times 10^{-3}\text{cm/s}$. The sample thickness is 12cm and cross sectional area is 50cm^2 . Find the effective pressure at the middle and bottom sections of the sample if the saturated unit weight of sand is 19.4kN/m^3 . (06 Marks)

Module-4

- 7 a. Mention the assumptions of Terzaghi's one-dimensional consolidation theory. (05 Marks)
- b. Explain normally consolidated and over-consolidated soil. (04 Marks)
- c. Two clay specimens A and B of thickness 2cm and 3cm have equilibrium void ratios 0.68 and 0.72 respectively under a pressure of 200kN/m^2 . If the equilibrium void ratios of the two soils is reduced to 0.5 and 0.62 respectively, when the pressure was increased to 400kN/m^2 , find the ratio of coefficient of permeability of the two specimens. The time required by specimen A to reach 40% degree of consolidation is $\frac{1}{4}$ of that required by specimen B for reaching 40% degree of consolidation. (07 Marks)

OR

- 8 a. Explain Terzaghi's spring mass analogy. (05 Marks)
- b. With the help of a neat sketch, explain the determination of pre-consolidation pressure by Casagrande's method. (05 Marks)
- c. An undisturbed sample of clay, 24mm thick consolidated 50% in 20 minutes when tested in lab with drainage allowed at top and bottom. The clay layer from which the sample was obtained is 4m thick in field. How much time it will take to consolidate 50% in field.
i) with double drainage ii) with single drainage. (06 Marks)

Module-5

- 9 a. Write a short note on : i) Sensitivity ii) Thixotropy. (04 Marks)
- b. Distinguish between total and effective strength parameters. (06 Marks)
- c. In an unconfined compression test, a sample of clay 100mm long and 50mm is diameter fails under a load of 150kN at 10% strain. Calculate the shearing resistance taking into account the effect of change in cross-section of sample. (06 Marks)

OR

- 10 a. Draw strength envelopes for : i) Coulomb's envelope ii) $C - \phi$ soil iii) Mohr envelope iv) Cohesion less soil v) Cohesive soil. (05 Marks)
- b. In a consolidated drained triaxial test, a specimen of clay fails at a cell pressure of 60kN/m^2 . The effective shear strength parameters are $c' = 15\text{ kN/m}^2$ and $\phi' = 20^\circ$. Determine the compressive strength. (07 Marks)
- c. Classify the of shear tests on the basis of drainage conditions. (04 Marks)
