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Fourth Semester B.E. Degree Examination, June/July 2019 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 a three phase diagram, explain
i) Void ratio ii) Porosity iii) Water content iv) Degree of saturation. (08 Marks)
- b. With usual notations, prove that
$$e = \frac{WG}{Sr}$$
 (06 Marks)
- c. Determine the Dry density, Void ratio, Porosity and degree of saturation. Given
 $\gamma_b = 26 \text{ kN/m}^3$, $G = 2.67$ and $W = 16\%$. (06 Marks)

OR

- 2 a. Define Liquid limit, Plastic limit and Shrinkage limit. (06 Marks)
- b. Explain the Indian Standard Soil classification system. (08 Marks)
- c. A fine grained soil has a liquid limit of 54% and a plastic limit of 30%. Classify the soil as per IS classification. (06 Marks)

Module-2

- 3 a. Explain with sketches, the common clay minerals. (08 Marks)
- b. Following are the results of a compaction test.

Weight of soil with mould (N)	29.25	30.95	31.50	31.25	30.70
Water Content (%)	10	12	14.3	16.1	18.2

Plot the compaction curve showing MDD and OMC. Given $G = 2.70$,
Volume of mould = 1000 cm³. Weight of mould = 10N. (12 Marks)

OR

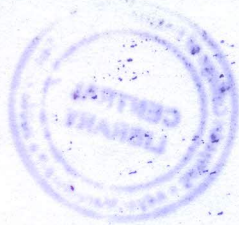
- 4 a. Explain Electrical Diffuse Double Layer. (06 Marks)
- b. Distinguish between Standard proctor and Modified proctor compaction tests. (04 Marks)
- c. For constructing an embankment, the soil is transported from a borrow area using a truck which can carry 6m³ of soil at a time. Determine the number of truck loads of soil required to obtain 100m³ of compacted earth fill and the volume of the borrow pit. Use the following details. (10 Marks)

Property	Borrow area	Truck loose	Field compacted	Soil Type
Bulk density (kN/m ³)	16.6	11.5	18.2	Well graded
Water content (%)	8	6	14%	-

Module-3

- 5 a. What is a Flow net? What are the uses and characteristics of flow nets? (08 Marks)
- b. The porosity of a certain sample of sand was 50% in the loose state and 34% in the dense state. The specific gravity is 2.70. Estimate the critical hydraulic gradients in loose and dense states. (06 Marks)
- c. Compute the quantity of water seeping under a weir per day for which the flow net has been satisfactorily constructed. The coefficient of permeability is 2×10^{-2} mm/s.
 $n_f = 5$ and $n_d = 18$. The difference in water level between upstream and downstream is 3.0m. The length of the weir is 60m. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and/or equations written eg, 42+8 = 50, will be treated as malpractice.



OR

- 6 a. With the help of neat sketches, derive an equation to determine permeability by the following Laboratory method and also state their suitability.
 - i) Constant Head Permeability Test ii) Falling Head Permeability Test. (14 Marks)
- b. What are the factors affecting permeability? Explain them briefly. (06 Marks)

Module-4

- 7 a. Explain with neat sketch, the mass spring analogy. (08 Marks)
- b. Explain normally consolidated soil and over consolidated soil. (06 Marks)
- c. The thickness of a normally consolidated clay layer is 3.0m. The initial void ratio of the sample is 1.0 and its liquid limit is 60%. The overburden pressure at the middle of the clay layer was 154 kN/m². Due to construction of a building the increase in effective stress is 92.4kN/m². Determine the consolidation settlement of the clay layer. (06 Marks)

OR

- 8 a. Explain with a sketch, determination of Pre – consolidation pressure by Casagrande’s method. (06 Marks)
- b. Explain Square root of time fitting method. (06 Marks)
- c. A 20m thick isotropic clay stratum overlies an impervious rock. The coefficient of consolidation of soil is $5 \times 10^{-2} \text{ mm}^2/\text{s}$. Find the time required for 50% and 90% consolidation. Time factors are 0.2 and 0.85 for 50% and 90% consolidations respectively. (08 Marks)

Module-5

- 9 a. Explain Mohr – Coulomb failure theory of soil. (06 Marks)
- b. What are the factors affecting the shear strength of soil? (06 Marks)
- c. In a shear test conducted on a river sand, the following results were obtained.

Normal Force (N)	80	160	240	320	400	480
Shear Force (N)	50	101	149	201	248	302

Determine ‘e’ and ‘φ’. (08 Marks)

OR

- 10 a. With the help of neat sketches, derive an equation to determine shear strength by Vane shear test. (08 Marks)
- b. In a triaxial test on two identical soil samples, the following data was obtained.

Test No.	Cell pressure (KN/m ²)	Maximum deviation stress (KN/m ²)	Maximum principal stress (KN/m ²)
1	50	120	-
2	100	-	332

Compute shear parameters. (12 Marks)
