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**Fifth Semester B.E. Degree Examination, Dec.2016/Jan.2017**  
**Geotechnical Engineering – I**

Time: 3 hrs.

Max. Marks:100

*Note: Answer any FIVE full questions, selecting  
atleast TWO questions from each part.*

**PART – A**

- 1 a. Define the following with the help of three phase diagram. Indicate the units:
- degree of saturation
  - water content
  - specific gravity
  - air content. (08 Marks)
- b. Prove that  $S \times e = w \times G$ . (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 shaving void ratio of 0.7. (06 Marks)

- 2 a. With the help of particle size distribution curve explain :
- Well graded soil
  - Uniformly graded soil
  - Gap graded soil. (06 Marks)
- b. A soil sample, consisting of particles size ranging from 0.5 mm to 0.01 mm, is put on the surface of still water tank 5 meters deep. Calculate the time of settlement of the coarsest and finest particles of the sample to the bottom of the tank. Assume average sp. gravity of soil particles as 2.66 and viscosity of water as 0.01 poise. (06 Marks)
- c. The results of a liquid limit test are given below :

No. of blows	48	38	29	20	14
Water content (%)	32.1	35.9	40.9	46.1	52.8

The plastic limit of the soil is 23%. Plot the flow curve and determine :

- Liquid limit
  - Plasticity index
  - Flow index and
  - Toughness index. (08 Marks)
- 3 a. Explain plasticity chart with a neat sketch and its use in classification of fine grained soil. (08 Marks)
- b. Explain any two clay minerals with the help of neat sketches. (08 Marks)
- c. Explain how to distinguish silt and clay in the field. (04 Marks)
- 4 a. Derive an expression to obtain coefficient of permeability under falling head condition. (06 Marks)
- b. Define permeability. List and explain factors affecting permeability of soil. (06 Marks)
- c. Calculate the co-efficient of permeability of a soil sample, 6 cm in height and 50 cm<sup>2</sup> 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 cm. On oven drying the test specimen has 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)

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.

## PART – B

- 5 a. Explain the types of shear test based on different drainage conditions. (06 Marks)  
 b. What are the advantages and limitations of direct shear test? (06 Marks)  
 c. A consolidated undrained test was conducted on a clay sample and the following results are obtained :

Cell pressure (kN/m <sup>2</sup> )	200	400	600
Deviator stress at failure (kN/m <sup>2</sup> )	118	240	352
Pore water pressure at failure (kN/m <sup>2</sup> )	110	220	320

Determine the shear strength parameters with respect to i) total stresses ii) effective stresses. (08 Marks)

- 6 a. List and explain factors affecting compaction. (05 Marks)  
 b. List the differences between standard and modified proctor compaction test. (05 Marks)  
 c. The following are the results of a compaction test.

Mass of mould + wet soil (gm)	2925	3095	3150	3125	3070
Water content (%)	10.0	12.0	14.3	16.1	18.2

Volume of mould = 1000 ml

Sp. gravity of solids = 2.7

Mass of mould = 1000 gms

- i) Find the compaction curve showing the optimum moisture content (OMC) and maximum dry density  
 ii) Plot the zero air void line  
 iii) Determine the degree of saturation. (10 Marks)

- 7 a. Explain spring analogy theory of consolidation of soil. (07 Marks)  
 b. What is pre consolidation pressure? How it is determined by Casagrande's graphical method? (07 Marks)  
 c. Explain pre consolidated, normally consolidated and under consolidated soil. (06 Marks)

- 8 a. Explain square root of time fitting method for determination of consolidation. (08 Marks)  
 b. Explain vane shear test with neat sketch. (04 Marks)  
 c. An undisturbed sample of clay, 24 mm thick, consolidated 50% in 20 minutes, when tested in laboratory with drainage allowed at top and bottom. The clay layer, from which the sample was obtained, is 4 m thick in the field. How much time will it take to consolidate 50% with double drainage? If the clay stratum has only single drainage, calculate the time to consolidate 50%. Assume uniform distribution of consolidation pressure. (08 Marks)

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