

**GUJARAT TECHNOLOGICAL UNIVERSITY**  
**BE - SEMESTER-V • EXAMINATION – WINTER 2013**

**Subject Code: 150604****Date: 02-12-2013****Subject Name: Geotechnical Engineering - I****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** (a) Define: **07**  
 (i) Void ratio, (ii) Porosity, (iii) Degree of saturation, (iv) water content, (v) Dry density, (vi) Bulk density, and (vii) Submerged density.
- (b) (i) Derive the relationship between dry density and bulk density in terms of water content. **07**  
 (ii) In a field density test, the volume and wet weight of soil obtained are 785 cc and 15.8 N respectively. If the water content is found to be 36%, determine the wet and dry unit weights of the soil. If the specific gravity of the soil grains is 2.6, compute the void ratio.
- Q.2** (a) How do you distinguish between Silt and Clay in the field? List any three classification systems and describe one in detail. **07**
- (b) The following data relate to five soil samples:- **07**  
 LL(%) 25 45 50 60 80  
 PL(%) 15 23 25 35 36  
 Plot these on Casagrande's A-line chart and classify the soils.
- OR**
- (b) The following data refer to a sample of soil: **07**  
 Percent passing 4.75 mm IS sieve = 64  
 Percent passing 75 micron IS sieve = 6  
 Uniformity coefficient = 7.5  
 Coefficient of curvature = 2.7  
 Plasticity index = 2.5  
 Classify the soil.
- Q.3** (a) Define the term 'coefficient of permeability' and describe the various factors affecting the same. **07**
- (b) The following data are recorded while performing the standard compaction test:- **07**  
 Water content (%): 06 12 15 20 24  
 Bulk density (kN/m<sup>3</sup>): 17.5 20.0 20.9 21.8 21.7  
 Plot the MDD-OMC curve and obtain the optimum water content and maximum dry density. At MDD find the water content for full saturation. Take  $G = 2.70$

**OR**

- Q.3** (a) A Falling Head permeameter accommodates a soil sample 10cm high and 50cm<sup>2</sup> in cross sectional area. The permeability of the sample is expected to be  $1 \times 10^{-5}$  cm/sec. If it is desired that the head in the Stand pipe should fall from 40 cm to 10 cm in 30 minutes, determine the size of the standpipe which should be used. If on the same soil sample a constant head of 150cm is maintained for 2 hours, then how much quantity of water will flow? **07**
- (b) Briefly explain the factors affecting compaction. **07**  
During field compaction process, how the compacted density and the moisture content can be checked?
- Q.4** (a) Explain the principle of 'Direct Shear Test'. With a neat sketch give the various advantages and limitations of this test. **07**
- (b) Determine the shearing strength parameters from the Direct Shear Test results given below: **07**
- | Sr. No. | Normal Stress (N/mm <sup>2</sup> ) | Shear Force (N) |
|---------|------------------------------------|-----------------|
| 1.      | 0.25                               | 70              |
| 2.      | 0.50                               | 90              |
| 3.      | 0.75                               | 117             |

**OR**

- Q.4** (a) What are the advantages and disadvantages of Triaxial Compression Test? Briefly explain the shear tests which may be performed based on the different drainage conditions. **07**
- Q.4** (b) From the Undrained Triaxial test results given below, determine the shear strength parameters  $c$  &  $\phi$ . **07**

Sr. No.	Cell Pressure (kPa)	Deviator Stress (kPa)
1	200	690
2	400	840
	600	990

- Q.5** (a) Define the term 'Consolidation'. Explain the same with the help of Terzaghi's Spring Analogy concept. **07**
- (b) During consolidation test, the void ratio is found to reduce from 0.90 to 0.50 under the stress increment of 100 kPa to 200 kPa, compute (i) coefficient of compressibility (ii) coefficient of volume compressibility & (iii) compression index. **07**

**OR**

- Q.5** (a) Define 'coefficient of consolidation' and explain any one method of finding it. **07**
- (b) A compressible stratum is 6m thick and its void ratio is 1.70. If the final void ratio after the construction of a building is expected to be 1.61, what will be the probable ultimate settlement of the building? **07**

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