

Seat No.: _____

Enrolment No. _____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE SEM-V Examination-Nov/Dec-2011

Subject code: 150604

Date: 29/11/2011

Subject Name: Geotechnical Engineering-I

Time: 2.30 pm -5.00 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) Answer the following: **07**

- 1) The ratio of unit weight of soil solids to that of water is known as _____.
- 2) _____ is defined as the process of decrease in the water content of a saturated soil without replacement of water by air.
- 3) As per I.S. classification the group symbol for poorly graded silty sand with more than 50% of the coarse material smaller than 4.75mm is given as _____.
- 4) On Casagrande's plasticity chart for fine grained soils with medium compressibility, liquid limit should be in the range of _____ and _____.
- 5) For uniformly graded soil coefficient of uniformity is _____.
- 6) _____ is the lowest water content at which a soil is completely saturated.
- 7) _____ and _____ are the structures of composite soils.

(b) A moist sample of soil has a mass of 630g and a volume of 300cm³ at a water content of 10%. Taking $G = 2.7$, determine e , S_r and n_a . Also determine the water content at which the soil gets fully saturated without any increase in the volume. What will be the unit weight at saturation? **07**

Q.2 (a) Explain the factors affecting the permeability of soil. **07**

(b) A soil sample of height 60mm and cross sectional area of 100cm² was subjected to falling head permeability test. In a time interval of 6 minutes, the head dropped from 60cm to 35cm. If the cross sectional area of the Stand Pipe is 2 cm², compute the coefficient of permeability of the soil sample. If the same sample is subjected to a constant head of 20cm, calculate the total quantity of water that will be collected after flowing through the sample. **07**

OR

(b) List out various soil classification systems for engineering purpose. Explain textural classification in detail. **07**

Q.3 (a) Explain Terzaghi's process of consolidation using spring analogy. **07**

(b) The thickness of a saturated specimen of clay under a consolidation pressure of 100k N/m² is 22.25mm and its water content is 15%. On increase of the consolidation pressure to 200kN/m², the specimen thickness decrease by 1.28mm. Determine the compression index for the soil. Take G of the soil as 2.70. **07**

OR

- Q.3 (a)** Write a note on various fields of soil mechanics. **07**
(b) Derive using usual notations $\gamma_d = (G \gamma_w / (1+e))$. **07**

- Q.4 (a)** List out various test to determine shearing resistance of soil in the laboratory. Based on drainage conditions explain types of shear test developed. **07**
(b) Following are the results of a box shear test on a soil: **07**

Normal Stress, kN/m ²	Shear stress at failure, kN/m ²
25	60
75	80
150	105
250	145

Determine the values of c and Φ . If a specimen of the same soil is tested in a triaxial apparatus, estimate the deviator stress at which the sample will fail when the cell pressure is 100kN/m².

OR

- Q.4 (a)** Two identical specimen of a soil were tested in triaxial apparatus. First specimen failed at a deviator stress of 770kN/m² when the cell pressure was 200kN/m², while the second specimen failed at a deviator stress of 1400 kN/m² under a cell pressure of 400kN/m². Determine the shear parameters of the soil. Verify your results graphically. **07**
(b) Show classification of soil water based on phenomenological basis and structural aspect. Explain adsorbed water in detail. **07**

- Q.5 (a)** Explain various factors affecting compaction. **07**
(b) A laboratory compaction test on soil having $G = 2.7$ gave M_{dd} of 1.82g/cc and a water content of 17%. Determine the degree of saturation, air content and percentage air voids at the maximum dry density. What would be theoretical maximum dry density corresponding to zero air voids at the optimum moisture content. **07**

OR

- Q.5 (a)** Write a note on sand boiling. **07**
(b) The Atterberg limits of a soil sample are $\omega_L = 50\%$, $\omega_p = 30\%$ and $\omega_s = 12\%$. If the specimen of this soil shrinks from a volume 10cc at liquid limit to 5.94 cm³ when it is oven dried. Calculate (i) shrinkage ratio and (ii) specific gravity of soil solids **07**
