Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER - V– • EXAMINATION – SUMMER 2014

Subject Code: 150604 **Date: 17-06-2014**

Subject Name: Geotechnical Engineering - I

Time:10:30 am to 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)** Classify & write symbol for the following soil samples :- **07**
(i) Sandy soil with D_{10} = 1.11 mm, D_{30} = 3.68 mm & D_{60} = 5.08 mm.
(ii) Fine Grained Soil with LL = 60 % & PL = 20 %

(b) A soil deposit 8.0m thick has moist unit weight of 17 kN/m^3 and saturated unit weight of 19 kN/m^3. The ground water table lies at the ground level. Compute effective stress values at 4.00m and 8.00m depths. **07**

OR

(b) 1) Define Toughness Index, Activity, Sensitivity and Thixotropy. **07**
2) In a 10m thick sand deposit, ground water table (GWT) lies at 4.0m depth below the GL. Sand deposit has γ_t = 18 kN/m^3 & γ_{sat} = 20 kN/m^3. Compute effective stress values at the depths of 2.0m, 4.0m and 6.0m below the GL.

Q.3 **(a)** (i) Explain with suitable diagram the use and application of Proctor's needle for field control of compaction. **07**
(ii) how do you find the permeability of stratified soil?

(b) The following data were recorded while performing the compaction test:- **07**
Water content (%): 05 10 14 20 25
Bulk density (kN/m^3): 17.7 19.8 21.0 21.8 21.6
Plot the MDD-OMC curve and obtain the optimum water content and maximum dry density. Calculate the water content necessary to completely saturate the sample at its maximum dry density, assuming no change in the volume. Also plot zero air voids curve. Take G = 2.68

OR

Q.3 **(a)** (i) Briefly explain the factors affecting compaction. **07**
(ii) explain with suitable diagram the methods of finding the coefficient of permeability in the laboratory.

(b) A Falling Head permeameter accommodates a soil sample 10cm high and 50cm^2 in cross sectional area. The permeability of the sample is expected to be 1 x 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 **07**

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?

Q.4 **(a)** Based on drainage conditions, explain the various shear tests that can be performed in the laboratory. How do you select the test type for cohesive soil? **07**

(b) Explain the principle of 'Direct Shear Test'. With a neat sketch give the various advantages and limitations of this test. **07**

OR

Q.4 **(a)** 1) Briefly explain Coulomb's, Mohr's and Mohr-Coulomb's failure theories. **07**
2) State merits and demerits of 'Direct Shear Test' and 'Triaxial Compression Test'.

(b) From the Undrained Triaxial test results given below, determine the shear strength parameters c & φ. **07**

Sr. No.	Cell Pressure (kPa)	Deviator Stress (kPa)
1	200	690
2	400	840
3	600	990

Q.5 **(a)** Define the terms coefficient of compressibility, coefficient of volume compressibility, compression index and coefficient of consolidation. Explain the 'square-root time fitting method' for determination of coefficient of consolidation. **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 the term 'Consolidation'. Explain the same with the help of Terzaghi's Spring Analogy concept. **07**

(b) A 2.0 m x 2.0 m size footing placed at 2.0 m depth below the ground level (GL) is transmitting net pressure intensity of 200 kPa. The ground water table lies at 2.0 m depth below the GL. Using the data given below, divide the clay stratum in three parts and compute the settlement due to consolidation:- **07**

(i) Top layer : 2.0 m thick sand, γ_t = 18 kN/m^3

(ii) Middle layer : 3.0 m thick NC clay, γ_{sat} = 20.1 kN/m^3, γ_d = 16.0 kN/m^3, Liquid Limit = 80 % & G = 2.7

(iii) Bottom layer : sand

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