Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V • EXAMINATION – SUMMER • 2014

Subject Code: 150604 **Date: 01-12-2014**

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)** 1) Distinguish between Silt and Clay **02**

2) Differentiate Flocculated structure and honeycombed structure. **02**

3) Define phase diagram and draw phase diagrams in terms of void ratio 'e' and porosity 'n'. **03**

(b) A Partially saturated soil from an earth fill has a natural water content of 19% and a bulk unit weight of 19.33 kN/m^3. Assuming the Specific gravity of soil solids as 2.7, Compute the degree of saturation and void ratio. If subsequently the soils get saturated, determine the dry density, buoyant unit weight and saturated unit weight. **07**

Q.2 **(a)** 1) Classify the given soil sample:- G = 20 %, S = 78 %, f = 02 %, D_{10}= 1.28 mm, D_{30}= 2.80 mm, D_{60}= 4.99 mm **03**

2) Differentiate between coarse grained soils (CGS) and fine grained soils (FGS). A FGS has liquid limit of 60 % and plastic limit of 18 %. Classify the same. **04**

(b) Define the term 'Soil Structure' and briefly explain the commonly observed soil structures. **07**

OR

(b) 1) Define Toughness Index, Activity, Sensitivity and Thixotropy. **04**

2) In a 8.0 m thick sand deposit, ground water table (GWT) lies at 3.0 m 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 3.0 m and 8.0 m below the GL. **03**

Q.3 **(a)** 1) Explain the factors affecting permeability of soils. **04**

2) Explain 'Quick Sand' condition. **03**

(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)** A Falling Head permeameter accommodates a soil sample 6cm high and 50cm^2 in cross sectional area. The permeability of the sample is expected to be 1 x 10^{-4} cm/sec. If it is desired that the head in the Stand pipe should fall from 30 cm to 10 cm in 40 minutes, determine the size of the standpipe which should be used. If on the same soil sample a constant head of 2 m is maintained for 2 hours then how much quantity of water will flow? **07**

(b) Define Compaction process and how do you control compaction parameters at the site? **07**

Q.4 **(a)** 1) Briefly explain Coulomb's and modified Coulomb's failure theories. **03**

2) Compare the 'Direct Shear Test' with 'Triaxial Compression Test'. **04**

(b) Determine the shearing strength parameters from the Direct Shear Test results given below. The proving ring constant is 0.5 kg/Div. **07**

Sr. No.	Normal Stress (kg/cm^2)	Shear Force (kg)
1.	1.0	100
2.	2.0	150
3.	3.0	220

What would be shearing strength at the normal stress of 15 kg/cm^2?

OR

Q.4 **(a)** 1) Explain importance of 'Unconfined Compression Test' & 'Laboratory Vane Shear Test'. **03**

2) Name and briefly explain the shear tests which may be performed based on the different drainage conditions. **04**

Q.4 **(b)** In a Triaxial compression test a specimen of soil has major and minor principle stresses as 200 kPa and 60 kPa respectively. If the soil is fully saturated clay, find the value of cohesion parameter. **07**

Q.5 **(a)** Define the term 'Consolidation' and 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 the GL. Using the data given below, divide the clay stratum in two 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 : 4.0 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

OR

Q.5 **(a)** Define the terms **06**

i) coefficient of compressibility

ii) coefficient of volume compressibility

iii) compression index

(b) 1) Define the term 'pre-consolidation pressure' and briefly explain the method for determination of the same. **04**

2) During consolidation test, the void ratio is determined to decrease from 0.95 to 0.55 under the stress increment of 1.0 kg/cm^2 to 2.5 kg/cm^2. Compute coefficient of compressibility and coefficient of volume compressibility. **04**

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