Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. Sem. - V - Examination – June- 2011

Subject code: 150604

Subject Name: Geotechnical Engineering - I

Date:27/06/2011 **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) Differentiate Physical weathering and Chemical weathering. **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) An undisturbed soil sample has total weight of 2060 gm, volume of 1200cc, water content = 11 % and specific gravity G = 2.68. Compute (i) void ratio (ii) porosity (iii) degree of saturation (iv) water content to make sample fully saturated & (v) effective unit weight of the soil sample. **07**

Q.2 **(a)** 1) Classify the given soil sample:- **03**

G = 20 %	% N :	10	20	30	60	90	100
S = 78 %							
f = 02 %	(Dmm):	1.28	2.98	3.07	4.80	4.92	5.25

2) Differentiate between coarse grained soils (CGS) and fine grained soils (FGS). A FGS has liquid limit of 65 % and plastic limit of 23 %. Classify the same. **04**

(b) 1) Define the term 'Soil Structure' and briefly explain the commonly observed soil structures. **05**

2) Describe any one field identification test. **02**

OR

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

2) In a 10m thick sand deposit, ground water table (GWT) lies at 4.0m depth below the GL. Sand deposit has $\gamma_t = 18$ kN/m^3 & $\gamma_{sat} = 20$ kN/m^3. Compute effective stress values at the depths of 2.0m, 4.0m and 6.0m below the GL. **03**

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

2) Define 'Critical Hydraulic Gradient' and briefly 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 200cm is maintained for 2 hours then how much quantity of water will flow? **07**

(b) 1) Briefly explain the factors affecting compaction. **04**

2) During field compaction process, how the compacted density and the moisture content can be checked? **03**

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

2) State merits and demerits of 'Direct Shear Test' and '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)** From the Undrained Triaxial test results given below, determine the total shear strength parameters c & φ by plotting conventional failure envelope or modified failure envelope**.** Also state that at normal stress of 500 kPa, what would be the shear strength? **07**

Sr. No.	Cell Pressure (kPa)	Deviator Stress (kPa)
1	100	180
2	200	320
3	300	500

Q.5 **(a)** Define the term 'Consolidation' and explain the same with the help of Terzaghi's Spring Analogy concept. State the assumptions used in Terzaghi's one dimensional consolidation theory. **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

OR

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) 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, coefficient of volume compressibility & compression index. **03**

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