Code No: V3201/R07 **Set No: 1**

III B. Tech - II Semester Regular, Examinations, April/May 2011
GEOTECHNICAL ENGINEERING-I
(Civil Engineering)

Time: 3 Hours **Max. Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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(**Ordinary and Semi log Graph Papers are to be supplied in the examination Hall**)

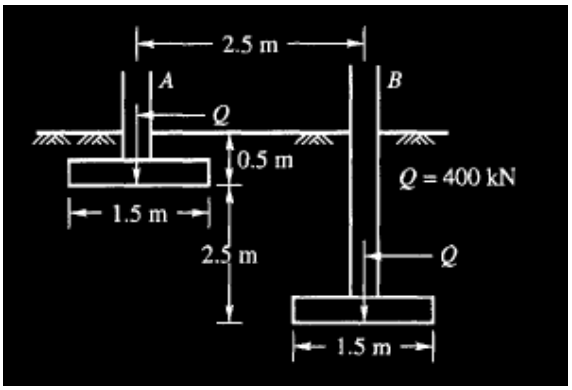
1. (a) What are the common types of minerals available in Clay? Describe them in detail.
   (b) The mass of an empty glass jar, together with its glass cover plate was 478.0 g. When completely filled with water and cover plate fitted the mass was 1508.2 g. An oven dried sample of soil was inserted in the dry glass jar and the total mass, including the cover plate, was 676.6 g. Water was added to the soil and after a suitable period of shaking, was topped up until the glass jar was brim full. The cover plate was fitted and the total mass was found to be 1632.6 g. determine the particle specific gravity of the soil.

2. A 500 g sample of dry soil was used for a combined sieve and hydrometer analysis (152 H type Hydrometer, L =16.3-0.16417R). The soil mass passing through the 75 μ sieve = 120 g. Hydrometer analysis was carried out on a mass of 40 g that passed through the 75 μ sieve. The average temperature recorded during the test was 30°C. Given: G_s = 2.55, *Cm* (meniscus) = 0.50, *Co* = +2.5, η = 8.15 x 10^{-3} poises. The actual hydrometer reading *Ra* = 15.00 after a lapse of 120 min after the start of the test. Determine the particle size *D* and percent finer *P' %* and *P%*.

3. (a) Write in detail about the laboratory permeability test for fine grained soil.
   (b) In a falling head permeability test, the time taken for the head to fall from h_1 to h_2 is t. If the test is repeated with the same initial head h_1. what would be the final head in a time interval *of t/2*.

4. (a) write down the procedure of drawing a flownet for a flow through the foundation of an embankment.
   (b) In order to compute the seepage loss through the foundation of a cofferdam, flownets were constructed. The result of the flownet study gave N_f = 6, N_d = 16. The head of water lost during seepage was 19.68 m. If the hydraulic conductivity of the soil is *k* = 13.12 x 10^{-7} cm/min, compute the seepage loss per meter length of dam per day.

5. (a) Write the construction procedure of Newmark's Influence Chart.
   (b) A and *B* are two footings of size 1.5 x 1.5 m each placed in position as shown in Fig. 1. Each of the footings carries a column load of 400 kN. Determine by the Boussinesq method, the excess load footing *B* carries due to the effect of the load on *A*. Assume the loads at the centers of footings act as point loads.



6. (a) Differentiate: (i) Compaction and consolidation, and (ii) Standard Proctor and modified Proctor tests.
   (b) The fallowing results were obtained from a compaction test using the 2.5 kg rammer.

Mass of mould + wet sample, g	2783	3057	3224	3281	3250	3196
Water content, percentage	8.1	9.9	12.0	14.3	16.1	18.2

   The weight of the compaction mould, less its collar and base was 1130 g. and the soil had a particle specific gravity of 2.70. Plot the curve of dry density against moisture content and determine the optimum moisture content. On your diagram plot the lines for 5 % and 0 % air voids.

7. (a) Explain the logarithmic time fitting method to determine the coefficient of consolidation
   (b) In the consolidation test on a soil the void ratio of the sample decreased 1.25 to 1.10 when the pressure increased from 150 kN/m^2 to 350 kN/m^2. Calculate the coefficient of consolidation if the permeability is 7 x 10^{-7} cm/s.
8. (a) Explain Coulomb's equation for shear strength of a soil. Discuss the factors that affect the shear strength parameters of soil.
   (b) A series of undrained triaxial tests on samples of saturated soil gave the following results

Cell pressure, σ_3 (kN/m^2)	100	200	300
Pore water pressure, u, (kN/m^2)	20	70	136
Deviator stress (σ_1 - σ_3) (kN/m^2)	290	400	534

   Find the values of the parameters *c* and φ (a) with respect to total stress, and (b) with respect to effective stress.

Code No: V3201/R07 **Set No: 2**

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1. (a What are the different types of soil structures which can occur in nature? Briefly describe them.
   (b)Define the term Relative Density? Compute the relative density of the sand deposit, if the field void ratio is 0.89. Maximum and minimum void ratios of the sand are 1.20 and 0.60.

2. (a) Discuss about the hydrometer analysis test. What are the corrections to be applied to the hydrometer readings? Why?
   (b) A liquid limit test gave the following results:

Test No	1	2	3	4	5	PL	PL
Wet mass (g)	32.1	30.2	25.5	27.8	35.0	11.83	15.04
Dry mass (g)	28.2	26.5	22.4	23.9	28.6	11.25	14.07
Tin (g)	14.1	14.8	13.9	14.2	13.8	7.04	7.25
Number of blows	42	31	23	16	11	--	--

   Determine the plasticity index and classify the soil.

3. (a) In a falling head permeability test, if the time intervals for the head to fall from h_1 to h_2 and h_2 to h_3 are same. Show that the h_2 is the geometrical mean of h_1 and h_3. ($h_2 = \sqrt{h1*h3}$)
   (b) A falling head permeability test was performed on a sample of silly sand. The time required for the head to fall in the stand pipe from 60 cm to the 30 cm mark was 70 min. The cross sectional area of the stand pipe was 1 .25 cm^2. If the height and diameter of the sample were respectively 10 and 9 cm, determine the value *k* in cm/min.

4. (a) What are the characteristics of the flow nets? What are the uses of flow nets?
   (b) A soil profile consists of a surface layer of sand 6 m thick (γ = 15.8 kN/m^3), an intermediate clay layer 2 m thick (γ_{sat} = 19.75 kN/m^3), and a bottom layer of gravel 4 m thick (γ_{sat} = 21.8 kN/m^3). The water table is at the top of the clay layer. Determine the effective stress at various layers when a surcharge of 100 kN/m^2 is placed at the ground surface.

5. (a) Briefly explain the construction of Newmark's Influence Chart and briefly explain its usage?
   (b) A circular ring foundation for an overhead tank transmits a contact pressure of 300 kN/m^2. Its internal diameter is 6 m and external diameter 10m. Compute the vertical stress on the center line of the footing due to the imposed load at a depth of 6.5 m below the ground level. The footing is founded at a depth of 2.5 m.

6. (a) Draw an ideal 'compaction curve' and discuss the effect of moisture on the dry unit weight of soil.
   (b) The fallowing results are obtained from a standard compaction test:

Mass of compacted sample, g	1920.5	2051.5	2138.5	2147.0	2120.0	2081.5
Water content, percentage	11.0	12.1	12.8	13.6	14.6	16.3

   The specific gravity of the solids is 2.68, and the volume of the compaction mould is 1000 cm^3. Plot the compaction curve and obtain the maximum dry density and optimum moisture content. Plot also the 0 %, 5 % and 10 % air void curves. At the maximum dry density, calculate the void ratio, degree of saturation and air content. If the natural moisture content is 11.8 %, what will be the possible maximum dry density if the soil is compacted with its natural moisture content? What are the values of maximum dry unit weight and the optimum moisture content? Draw 100% saturation line.

7. (a) Obtain the differential equation defining the one dimensional consolidation as given by Terzaghi.
   (b) During a consolidation test, a sample of fully saturated clay 3 cm thick (= h_0) is consolidated under a pressure increment of 200 kN/m^2 . When equilibrium is reached, the sample thickness is reduced to 2.60 cm. The pressure is then removed and the sample is allowed to expand and absorb water. The final thickness is observed as 2.8 cm and the final moisture content is determined as 24.9%.

8. (a) Classify the shear tests based on drainage conditions. Explain how the pore pressure variation and volume change take place during these tests. Enumerate the field conditions which necessitate each of these tests.
   (b) The flowing test results are obtained from the direct shear test. Compute the shear strength parameters. Dimensions of the sample is 6 cm X 6 cm X 2cm.

Normal stress (kg/cm^2)	0.3	0.4	0.5	0.6	0.7
Shear Load (kg.)	6.75	9.0	11.25	13.50	15.75

Code No: V3201/R07 **Set No: 3**

III B. Tech - II Semester Regular, Examinations, April/May 2011
GEOTECHNICAL ENGINEERING-I
(Civil Engineering)

Time: 3 Hours **Max. Marks: 80**

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1. (a) Write a short note on adsorbed water.
(b) A sample of moist sand was cutout of a natural deposit by means of a sample cylinder. The volume of the cylinder was 478 ml. the weight of the sample alone was 884 g and 830 g after drying. The volume of the dried sample, when rammed tight into a graduated cylinder, was 418 ml and its volume when poured loosely into the same cylinder was 616 ml. if the particle specific gravity was 2.67, compute the relative density and the degree of saturation of the deposit.

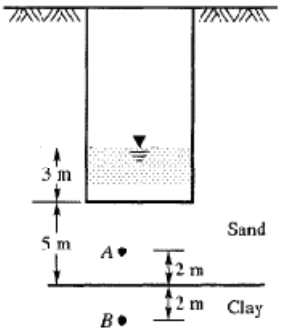
2. The results of particle size analysis and where appropriate, limit test on samples of four soils are given in table 1. Allot group symbols and give main qualifying terms appropriate for each soil.

Table 1

IS Sieve	Particle size	Percentage finer			
		Soil A	Soil B	Soil C	Soil D
40 mm					
20 mm		100			
4.75 mm		94	100		
2.36 mm		69	98		
1.0 mm		54	88		
600 μ		32	67	100	
425 μ		23	55	97	
300 μ		13	47	95	100
150 μ		7	41	85	99
75 μ		2	37	73	98
	20 μ		22	46	88
	6 μ		11	25	71
	2 μ		4	13	58
Liquid limit %				32	78
Plastic limit %				24	31

3. (a) What are the factors affect permeability of soil mass? Discuss them in detail.
(b) In a laboratory falling test, the recorded data are: diameter of the tube = 20 mm, diameter of the cell = 100 mm, length of the sample = 1000mm. The head measured from the top level of the sample dropped from 800 mm to 600 mm within 1 hour and the temperature of the water was 30^0c. Calculate the coefficient of permeability at 20^0C. $\eta = 1.005 \times 10^{-3}$ N.s/m^2 (at 20^0C), $\eta = 1.005 \times 10^{-3}$ N.s/m^2 (at 30^0C).

4. (a) Write short note on flow nets and its uses in the seepage analysis.
   (b) The depth of water in a well is 3 m. Below the bottom of the well lies a layer of sand 5 meters thick overlying a clay deposit. The specific gravity of the solids of sand and clay are respectively 2.64 and 2.70. Their water contents are respectively 25 and 20 percent. Compute the total, intergranular and pore water pressures at points *A* and *B* shown in Fig.



5. (a) Differentiate Boussinesq's and Wester gaurd's Theories.
   (b) Three footings are placed at locations forming an equilateral triangle of 3 m sides. Each of the footings carries a vertical load of 112.4 kN. Estimate the vertical pressures by means of the Boussinesq equation at a depth of 3 m at the following locations :
   (i) Vertically below the centers of the footings,
   (ii) Below the center of the triangle.
6. (a) What are the types of rollers used for compacting different types of soils in the field? How do you decide the compactive effort required for compacting the soil to a desired density in the field?
   (b) Explain: (i) the unit, in which the compaction is measured, (ii) 95 percent of Proctor density, (iii) zero air-voids line, and (iv) effect of compaction on the shear strength of soil.

7. (a) Explain the Square root time fitting method to determine the coefficient of consolidation
   (b) A stratum of normally consolidated clay 7 m thick is located at a depth 12m below ground level. The natural moisture content of the clay is 40.5 per cent and its liquid limit is 48 percent. The specific gravity of the solid particles is 2.76. The water table is located at a depth 5 m below ground surface. The soil is sand above the clay stratum. The submerged unit weight of the sand is 11 kN/m^3 and the same weighs 18 kN/m^3 above the water table. The average increase in pressure at the center of the clay stratum is 120 kN/m^2 due to the weight of a building that will be constructed on the sand above the clay stratum. Estimate the expected settlement of the structure.

8. (a) Explain the method of drawing a Mohr circle for a cylindrical sample in a triaxial test. Establish the geometrical relationships between the stresses on the failure plane and externally applied principal stresses.
   (b) A sample of dry sand was tested in a direct shear device under a vertical pressure of 137.9 kN/m^2. Compute the angle of internal friction of the sand. Assume shearing resistance = 96.56 kN/m^2.

Code No: V3201/R07 **Set No: 4**

III B. Tech - II Semester Regular, Examinations, April/May 2011
GEOTECHNICAL ENGINEERING-I
(Civil Engineering)

Time: 3 Hours **Max. Marks: 80**

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1. (a) Write a short note on Soil formation.
(b) In a bulk density determination a sample of clay with a mass of 683 g was coated with paraffin wax. The combined mass of the clay and the wax was 690.6g. the volume of the clay and the was found by immersion on water to be 350 ml. The sample was then broken open and moisture content and particle specific gravity tests gave respectively 17 % and 2.73. The specific gravity of the was 0.89. Determine the bulk density, dry density, porosity, void ratio and degree of saturation

2. (a) Write briefly about the procedure of the Shrinkage limit test conducted in the laboratory.
(b) A shrinkage limit test on a clay soil gave the following data. Compute the shrinkage limit. Assuming that the total volume of dry soil cake is equal to its total volume at the shrinkage limit, what is the degree of shrinkage? Comment on the nature of soil
Mass of shrinkage dish and saturated soil M_1 = 38.78 g
Mass of shrinkage dish and oven dry soil M_2 = 30.46 g
Mass of shrinkage dish M_3 = 10.65 g
Volume of shrinkage dish V_0 16.29 cm^3
Total volume of oven dry soil cake V_d - 10.00 cm^3

3. (a) Derive the relation between the superficial velocity of flow to the seepage velocity of the flow.
(b) In a falling head permeameter, the sample used is 20 cm long having a cross-sectional area of 24 cm^2 . Calculate the time required for a drop of head from 25 to 12 cm if the cross sectional area of the stand pipe is 2 cm^2. The sample of soil is made of three layers. The thickness of the first layer from the top is 8 cm and has a value of $k_1 = 2 \times 10^{-4}$ cm/sec, the second layer of thickness 8 cm has $k_2 = 5 \times 10^{-4}$ cm/sec and the bottom layer of thickness 4 cm has $k_3 = 7 \times 10^{-4}$ cm/sec. Assume that the flow is taking place perpendicular to the layers.

4. (a) Write short note on Quick sand condition
(b) From the flow net diagram drawn for a seepage flow through an earth dam the flowing data is obtained. Compute the seepage through the body of the dam per unit length. Number of flow lines = N_f = 3.5. Number of equi-potential drops = 10. coefficient of permeability = 1.25 X 10^{-5} cm/sec. head causing seepage flow, h = 12.5 m.

5. (a) Derive the stress under the center of the circular footing at a depth 'z' from the ground level.
(b) Three point loads, 10000, 7500 and 9000 kN, act in line 5m apart near the surface of a soil mass. Calculate the vertical stress at a depth of 4m vertically below the centre (7500 kN) load.

6. (a) What are the methods adopted for measuring the density of the compacted soil? Briefly describe the one which will suit all types of soils.

   (b) A soil having a specific gravity of solids G = 2.75, is subjected to Proctor compaction test in a mold of volume V = 945 cm3. The observations recorded are as follows:

Observation number	1	2	3	4	5
Mass of wet sample, g	1389	1767	1824	1784	1701
Water content, percentage	7.5	12.1	17.5	21.0	25.1

7. (a) Define: (i) compression index (ii) coefficient of consolidation (iii) coefficient of volume decrease (iv) percent consolidation.
   (b) In a oedometer test, a clay specimen initially 25 mm thick attains 90 % consolidation in 10 minutes. In the field the clay stratum from which the specimen was obtained has a thickness of 6 m and is sand witched between two sand layers. A structure constructed on this clay experienced an ultimate settlement of 200 mm. Estimate the settlement at the end of 100 days after construction.

8. (a) What are the advantages and disadvantages of a triaxial compression test in comparison with a direct shear test?
   (b) A specimen of sandy silt, when subjected to a drained triaxial test failed at major and minor principal stresses of 120 kN/m^2 and 50 kN/m^2 respectively. At what value of deviator stress would another sample of the same soil fail, if it were subjected to a confining pressure of 75 kN/m^2?