Code No: R32011 **R10** **Set No: 1**

III B.Tech. II Semester Regular Examinations, April/May -2013

GEOTECHNICAL ENGINEERING-I

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

Ordinary and Semi-log graph papers are to be supplied

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1. (a) Calculate the void ratio, porosity and degree of saturation of a soil sample, if it has the wet density 2.0 g/cc and dry density 1.8 g/cc. Specific gravity of soil is 2.7.
   (b) List out the minerals available in Clay and describe its properties.

2. (a) Write short notes on following
   i) Sensitivity ii) toughness index iii) thixotropy iv) plasticity index
   (b) Classify the soil having the following properties as per IS Classification. Gravel 10 %, Sand 45 %, Silt 15 % and clay 30 % and LL 35 % and PL 15 %.

3. In a falling head permeameter the sample was 18 cm long and having a cross sectional area of 22 cm^2, calculate the time required for drop of head from 25 to 10 cm, if the cross sectional area of standard pipe was 2 cm^2. the sample of the soil was heterogeneous having a permeability of $3x10^{-4}$ cm/sec for first 6 cm, $4x10^{-4}$ cm/sec for second 6cm and $6x10^{-4}$ cm/sec for the last 6cm thickness. Assume the flow taking place perpendicular to the bedding planes.

4. Derive the Laplace equation for the flow of water through soils and discuss its significance in seepage problems.

5. A concentrate load of 225 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 15 m and (**i**) directly under the load, and (**ii**) at a horizontal distance of 7.5 m away from the point of application of the load. use Boussinesq's equations.

6. (a) From Proctor's compaction test the dry maximum density of a soil was found to be 1.75 g/cc and O.M.C. 16.5%. The specific gravity of the soil grains was 2.6. Find out the degree of saturation and percentage air voids at the optimum state.
   (b) Describe the light compaction test with all giving the specification of the equipments used in the test.

7. a) State the assumptions of Terzaghi's theory of one dimensional consolidation.
   (b) A saturated soil has a compression index of 0.32. Its void ratio at a stress of 10 kN/m^2 is 2.02 and its permeability is 3.4×10^{-7} m/sec. Compute:
   (i) Change in void ratio if the stress is increased to 200 kN/m^2, (ii) Settlement if the soil stratum is 5m thick; and (iii) Time required for 60% consolidation, if drainage is one-way.

8. What are the different tests conducted to measure the shearing strength of soils? Write tri-axial compression test briefly and discuss with example sample results.

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Code No: R32011 **R10** **Set No: 2**

III B.Tech. II Semester Regular Examinations, April/May -2013

GEOTECHNICAL ENGINEERING-I

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
Ordinary and Semi-log graph papers are to be supplied
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1. (a) Write notes on texture and structure of soils.
   (b) A clayey soil has natural moisture content of 15.8% the specific gravity of soil is 2.72. its saturation percentage is 70.8%. the soil is allowed to soak up water. After sometime the saturation increases to 90.8%. Find out the water content of the soil case in latter case.

2. (a) Describe briefly the hydrometer analysis test. What are the corrections to be made to the hydrometer reading and what is the nature of the corrections?
   (b) Tests on a clay sample indicate the following properties of the soil: Natural water content 45.6%, Liquid limit 49.1%; Plastic limit 26.5%. Percentage of soil passing through 75 micron size is 60 %. Classify the Soil and explain the nature of the above soil.

3. With a neat sketch describe the constant head permeability meter and derive an expression for the coefficient of permeability.

4. (a) Distinguish between the following
   i)equipotential lines and flow line **ii**)effective stress and neutral stress . **iii**) discharge velocity and seepage velocity . **iv**) natural water content and optimum moisture content.
   (b) A large open excavation was made in a stratum of stiff clay with a saturated unit weight of 17.3 kN/m^3. When the depth of excavation reached to 8 m, the bottom rose, gradually cracked, and was flooded by a mixture of sand and water. Subsequent boring showed that the clay was underlain by a bed of sand with its surface at a depth of 12 m. Compute the elevation to which the water would have risen above the sandy stratum into a drill hole before the excavation was started.

5. A concentrate load of 300 kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 2 m and (**i**) directly under the load ,and (**ii**) at a horizontal distance of 3.0m away from the point of application of load. Use Boussinesq"s equations.

6. The following observations were noted during Proctor's compaction test with a soil:

Wt.of mould+wet soil in gms	3321.5	3438.0	3578.0	3776.0	3688.3
Moisture content %	5.18	8.45	14.95	16.83	19.70

   If weight of the mould is 1786 gm. and volume 940 cc. find out the maximum dry density and O.M.C of the above soil.

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7. The following results were obtained from an oedometer test carried out on a sample of clay. The data of void ratio (e) and effective stress (σ^1) were determined after equilibrium had been reached for each applied load. Draw a graph and hence calculate the compression index of the soil (C_c), the re-compression index (C_r) and the pre-consolidation stress ((σ^1_{pc}).

e	(σ^1) (kPa)
0.705	18
0.698	36
0.688	72
0.673	144
0.645	288
0.600	576
0.550	1152
0.500	2304
0.508	576
0.518	144
0.532	36
0.540	18

8. (a) What are the advantages and disadvantages of direct shear test over triaxial compression test?
(b) The following are the results of four drained direct shear test on a normally consolidated clay. Diameter of the specimen = 50mm, thickness of the sample is 25 mm.

Test No.	1	2	3	4
Normal Force (N)	250	400	500	550
Shear force at failure (N)	139	222	279	308

Draw a graph for the shear stress at failure against the normal stress and determine the drained shear strength parameters from the graph.

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Code No: R32011 **R10** **Set No: 3**

III B.Tech. II Semester Regular Examinations, April/May -2013

GEOTECHNICAL ENGINEERING-I

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

Ordinary and Semi-log graph papers are to be supplied

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1. (a) What are the different types of soil structures which can occur in nature? Briefly describe them.
   (b) A clayey soil has natural moisture content of 15.8% the specific gravity of soil is 2.72. its saturation percentage is 70.8%. the soil is allowed to soak up water. After sometime the saturation increases to 90.8%. find out the water content of the soil case in latter case.

2. A sample of sand above water table was found to have a natural moisture content of 15% and a unit weight of 18.84 kN/m^3. Laboratory tests on the dried sample indicate values of 0.5 and 0.85 minimum void ratios respectively for densest and coolest states. Calculate the degree of saturation and the relative density, assume G = 2.65.
3. Draw the sketch and describe working of falling head Permeability test. Derive the Governing equation for coefficient of permeability.
4. (a) Distinguish between the following
   i) equipotential lines and flow line **ii**)effective stress and neutral stress . **iii**) discharge velocity and seepage velocity . **iv**) natural water content and optimum moisture content.
   (b) A stratum of sand 2.5 m thick overlies a stratum of saturated clay 3 m thick. The water table is 1 m below the surface. For the sand, G_s = 2.65, e = 0.50 and for the clay G_s = 2.65, e = 1.1. Calculate the total and effective vertical stresses at depths of 1 m, 2.5 m and 5.5 m below the surface assuming that the sand above the water table is completely dry.

5. A line load of 90 kM/m run extends to a long distance. Determine the intensity of vertical stress at a point 1.5 m below the surface (**i**) directly under the line load and (**ii**) at a distance 1 m perpendicular to the line. Use Boussinesq's theory.

6. (a) From proctor"s compaction test the dry maximum density of a soil was found to be 1.75 and O.M.C. 14.5% the specific gravity of the soil grains was 2.6. find out the degree of saturation and percentage air voids at the optimum state.
   (b) List out and discuss the factors affecting the compaction of soil.

7. Write briefly Terzaghi's theory of one-dimensional consolidation. Derive the governing differential equation.

8. The following data were obtained in a direct shear test. Normal pressure=20 kN/m^2, tangential pressure= 16 kN/m^2. Angle of Internal friction= 20^0, cohesion=8 kN/m^2. Represent the data by Mohr's circle and compute the principal stresses and the direction of the principal planes.

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Code No: R32011 **R10** **Set No: 4**

III B.Tech. II Semester Regular Examinations, April/May -2013

GEOTECHNICAL ENGINEERING-I

(Civil Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions
All Questions carry equal marks
Ordinary and Semi-log graph papers are to be supplied

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1. (a) Draw mineral structures of Clay and explain their behavior in brief.
   (b) Calculate the void ratio, porosity and degree of saturation of a soil sample if it is having wet density 2.0 g/cc and dry density 1.8 g/cc. specific gravity of soil is 2.7

2. (a) Define Consistency Limits? Why they are required to find in geotechnical Engineering? What are they?
   (b) Sieve analysis test is conducted on a soil sample weighing 500 g. The results are given below.

Sieve size (mm)	10	4.75	2.0	1.0	600μ	425μ	300μ	150μ	75μ	Pan
Soil retained (g)	29	42	40	45	89	110	68	32	35	10

   Plot the grain size analysis curve and compute C_u and C_c and classify the soil.

3. (a) What are the factors that affect permeability?
   (b) A sand deposit of 12 m thickness overlies a clay layer. The water table is 3m below the ground surface. In a field permeability pumping out test, at a rate of 540 lt/min, when steady state condition is reached. Two observation wells are located at 18 m and 36 m from the center of the test well. The depths of the draw down curve are 1.8 m and 1.5 m respectively for these two wells. Determine the coefficient of permeability.

4. Derive the Laplace equation for flow of water through soils from the fundamentals and discuss its significance in seepage problems.

5. Explain Westergaard's theory for the determination of the vertical stress at a point. How is it different from Boussinesq's solution?

6. (a) What are the different type of rollers that are used for compaction work in the field?
   (b) How you will control the quality of compaction in the field?

7. a) State the assumptions of Terzaghi"s theory of one dimensional consolidation.
   b) Explain what meant by
   (**i**) a normally consolidated clay stratum (**ii**) an over consolidated clay stratum.
8. A cylindrical specimen of saturated soil fails under a axial stress 150 kN/m^2 in an unconfined compression test. The failure plane makes an angle of 52^0 with the horizontal. Calculate the cohesion and angle of internal friction of the soil.

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