

**III B.Tech II Semester Supplementary Examinations,  
November/December 2005  
GEOTECHNICAL ENGINEERING  
(Civil Engineering)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

\*\*\*\*\*

1. (a) Distinguish between porosity and void ratio.  
(b) Explain clay mineral structure in detail. [6+10]
2. (a) Explain the difference between compaction and consolidation.  
(b) Proctor compaction test was conducted on a soil sample, and the following observations were made:

Water content, %	7.7	11.5	14.6	17.5	19.5	21.2
Weight of wet soil, kg	1.7	1.89	2.03	1.99	1.96	1.92

If the volume of the mould used was 950 c.c and the specific gravity of soil was 2.65, Make necessary calculations and draw

- i. compaction curve and  
ii. 80% saturation line. [6+10]
3. (a) Does the size and shape of particles reflect the physical properties of cohesion less soils? Discuss.  
(b) What soil characteristics does the slope of grain size curve reveal? What is the difference between a uniform material and one with uniform gradation? [8+8]
4. A permeameter of 8.2 cm diameter contains a sample of soil of length 35 cm. It can be used either for constant head or falling head tests. The stand pipe used for the latter has a diameter of 2.5 cm. In the constant head test the loss of head was 116 cm measured on a length of 25 cm when the rate of flow was 2.73 ml/sec. Find the co-efficient of permeability of the soil.  
If a falling head test were then made on the same soil, how much time would be taken for the head to fall from 150 to 100 cm. [16]
5. (a) What is quick sand? Derive an expression for critical hydraulic gradient.  
(b) The ground water level in a deposit of fine sand is 1.5 m below ground level. Above the water table, the sand is saturated with capillary water. The bulk unit weight of sand is  $21 \text{ kN/m}^3$ . Calculate the total stress, the neutral stress and the effective stress at a depth of 1 m from the ground level. [8+8]
6. (a) How would you determine the stresses at a point due to  
i. Strip load

ii. Circular load.

Compare the zones of influence due to the two types of loads.

- (b) A load of  $16 \text{ kN/m}^2$  is uniformly distributed over a circular area of 6m diameter at the ground surface. Calculate the vertical stress at a point P which is at a depth of 5m directly below the center of the loaded area. [10+6]
7. (a) Distinguish between normally consolidated and over consolidated soils.  
(b) Explain in detail any one method for determining the coefficient of consolidation of soil.  
(c) The void ratio of a clay is 1.56, and its compression index is found to be 0.8 at Pressure of  $180 \text{ kN/m}^2$ . What will be the void ratio if the pressure is increased to  $240 \text{ kN/m}^2$ ? [4+8+4]
8. (a) Explain the factors influencing the angle of shearing resistance of sand  
(b) A soil element is subjected to minor and major principal stress of 20 kPa and 50 kPa respectively. Find the normal and shear stress on a plane making an angle of 30 degrees with respect to major principal plane. Also locate the plane of maximum shear stress and find the magnitude of maximum shear stress. Draw the Mohr's circle corresponding to this condition. [6+10]

\*\*\*\*\*

**III B.Tech II Semester Supplementary Examinations,  
November/December 2005  
GEOTECHNICAL ENGINEERING  
(Civil Engineering)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

★ ★ ★ ★ ★

1. (a) With the help of a phase diagram define: void ratio, water content and degree of saturation.  
(b) Prove that  $S_e = G_w$  with usual notations.  
(c) Determine the Unit Weights in the loosest and densest packings of 2mm dia. Spheres which have a specific gravity of 2.70. [6+5+5]

2. (a) Explain the difference between compaction and consolidation.  
(b) Proctor compaction test was conducted on a soil sample, and the following observations were made:

Water content, %	7.7	11.5	14.6	17.5	19.5	21.2
Weight of wet soil, kg	1.7	1.89	2.03	1.99	1.96	1.92

If the volume of the mould used was 950 c.c and the specific gravity of soil was 2.65, Make necessary calculations and draw

- i. compaction curve and  
ii. 80% saturation line. [6+10]
3. (a) Write a note on the importance of consistency limits and state their importance in soil classification?  
(b) What is Stoke's Law what are its limitations? [8+8]
4. (a) State Darcy's Law. Explain the validity of Darcy's Law.  
(b) Distinguish between discharge velocity and seepage velocity.  
(c) A falling head permeameter accommodates a soil sample 6 cm height and 50 cm<sup>2</sup> in cross-sectional area. The permeability of the sample is expected to be  $1 \times 10^{-4}$  cm/sec. If it is desired that the head in standpipe should fall from 30 cm to 10 cm in 40 minutes, determine the size of the standpipe which should be used. [6+4+6]
5. (a) Derive the Laplace equation for two dimensional flow, mentioning the assumptions made there in.  
(b) Write short notes on flownets. [8+8]
6. (a) How would you determine the stresses at a point due to  
i. Strip load

- ii. Circular load.  
Compare the zones of influence due to the two types of loads.
- (b) A load of  $16\text{KN}/m^2$  is uniformly distributed over a circular area of 6m diameter at the ground surface. Calculate the vertical stress at a point P which is at a depth of 5m directly below the center of the loaded area. [10+6]
7. (a) Describe a suitable procedure for determining pre consolidation pressure.  
(b) Explain 'secondary consolidation'.  
(c) The total anticipated settlement due to consolidation of a clay layer under a certain. Pressure is 150 mm. If 45 mm of settlement has occurred in 9 months, what is the expected settlement in 18 months? [6+6+4]
8. (a) Explain which type of triaxial test you would recommend on soil in the following cases, giving reasons:  
i. Stability of up and downstream slopes of an earth dam  
ii. A raft foundation on clay  
iii. An airport runway.  
(b) In a drained triaxial test on a dense sand, the cell pressure was 150kPa and the deviator stress to cause failure was 540kPa. Calculate the angle of internal friction. Also find the angle made by the failure plane with respect to major principal plane. [8+8]

\*\*\*\*\*

**III B.Tech II Semester Supplementary Examinations,  
November/December 2005  
GEOTECHNICAL ENGINEERING  
(Civil Engineering)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

\*\*\*\*\*

1. (a) What is meant by cation exchange capacity of clays? List the cations in the order of their increasing replacing power. Explain the significance of cation exchange. Give typical values of cation exchange capacities of kaolinite, illite and montmorillonite clay minerals.  
(b) The maximum and minimum dry unit weights of sand, determined in the laboratory, are  $2\text{g/cc}$  ( $20\text{kN/m}^3$ ) and  $1.5\text{g/cc}$  ( $15\text{kN/m}^3$ ) respectively. If the relative density of sand is 74%, determine the insitu porosity of sand deposit. Assume  $G=2.6$ . [8+8]
2. (a) Describe the Proctor 'Compaction Test' and give its use for construction of earth embankments.  
(b) The maximum dry density and optimum moisture content of a soil from Standard Proctor's test are  $1.8\text{ g/cm}^3$  and 16% respectively. Compute the degree of saturation of the sample, assuming the specific gravity of soil grains as 2.70. [8+8]
3. Describe the complete procedure for determining all the Atterberg's limits in the laboratory. [16]
4. (a) Mention two different methods of determining the permeability coefficient of a soil. Explain when you prefer each of them.  
(b) Write a note on factors affecting permeability. [8+8]
5. (a) Why do you prefer field testing of permeability of soils to Laboratory testing. Explain pumping in tests.  
(b) Derive an expression to determine the coefficient of permeability of soil by conducting pumping out test in the case of confined aquifer. [8+8]
6. (a) How would you determine the stresses at a point due to
  - i. Strip load
  - ii. Circular load.Compare the zones of influence due to the two types of loads.  
(b) A load of  $16\text{KN/m}^2$  is uniformly distributed over a circular area of 6m diameter at the ground surface. Calculate the vertical stress at a point P which is at a depth of 5m directly below the center of the loaded area. [10+6]

7. (a) The water table in a lake has been lowered by 20m below the bed, will this cause a settlement of a clay layer 5m thick, lying 25m below bed level? Explain.
- (b) An oedometer test is performed on a 2cm thick clay sample. After 5 minutes, 50% consolidation is reached. After how long a time would the same degree of consolidation be achieved in the field where the clay layer is 3.7m thick? Assume the sample and the clay layer have the same drainage boundary conditions (double drainage). [8+8]
8. (a) Draw and explain the typical stress- strain curve and volume change-axial strain curve for
- i. loose sand
  - ii. dense sand
- (b) The effective shear strength parameters of a soils are 25 kPa and  $30^\circ$ . Find the shearing resistance on a plane within a submerged soil mass where the total normal stress is 328 kPa and the pore water pressure is 114 kPa. [8+8]

★ ★ ★ ★ ★

**III B.Tech II Semester Supplementary Examinations,  
November/December 2005  
GEOTECHNICAL ENGINEERING  
(Civil Engineering)**

**Time: 3 hours****Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

★ ★ ★ ★ ★

1. (a) A soil sample has a bulk unit weight of 21kN/cu.m and the degree of saturation is 80 %. Determine the void ratio and water content if the specific gravity of solids is 2.65.

(b) Describe the method of obtaining field density of core cutter method. [8+8]

2. (a) Explain the difference between compaction and consolidation.

(b) Proctor compaction test was conducted on a soil sample, and the following observations were made:

Water content, %	7.7	11.5	14.6	17.5	19.5	21.2
Weight of wet soil, kg	1.7	1.89	2.03	1.99	1.96	1.92

If the volume of the mould used was 950c.c and the specific gravity of soil was 2.65, Make necessary calculations and draw

i. compaction curve and

ii. 80% saturation line. [6+10]

3. (a) Sketch the grain size distribution curve for uniformly graded, well graded and gap graded soils and discuss their characteristics.

(b) Briefly discuss the salient features based on which BIS classification of soils is done. [6+10]

4. (a) Explain the Phenomena of capillarity in detail.

(b) In a falling head test the head fell from 300 mm to 100 mm in 800 seconds for a sample whose diameter was ten times that of stand pipe and whose length was 100mm. Find the coefficient of permeability. (Soil sample has a void ratio of 0.52). What would be your answer if void ratio is increased to 0.62. [8+8]

5. (a) Distinguish between discharge velocity and seepage velocity .

(b) Derive the relation to determine the seepage loss from the flownet. [8+8]

6. (a) Write westergaard's formula for the determination of stresses due to point load and discuss the assumptions.

(b) A load of 1000 KN acts as point load at the surface of a soil mass. Estimate stress at a point 3m below and 4m away from the point of action of load by Boussinesq theory. Compare the value with the result from westergaard's theory assume Poisson's ratio as zero. [8+8]

7. (a) State the assumptions made in Terzaghi's theory of one-dimensional consolidation. Explain limitations, if any.
- (b) A laboratory sample of clay 2cm thick took 15 minutes to attain 60 percent consolidation under double drainage condition. What time will be required to attain the same degree of consolidation for a clay layer of 3m which under the foundation of a building for a similar loading drainage condition? What is the value of coefficient of consolidation? [8+8]
8. The results of consolidated undrained triaxial test conducted on a soil sample are given below:

Cell Pressure(kPa) 1800	1000	1800
Additional stress at failure(kPa)	1600	2200
Pore pressure at failure(kPa)	400	800

Find the shear strength parameters with respect to

- (a) total stress
- (b) effective stress

[16]

★ ★ ★ ★ ★