Code No: 07A60101 **R07** **Set No. 2**

III B.Tech II Semester Examinations,APRIL 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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1. (a) Distinguish between mechanical weathering and chemical weathering.
   (b) Derive from fundamentals: $\gamma_{sat} = \frac{(G+e)\gamma_w}{(1+e)}$ [8+8]
2. Explain the Mohr-Coulomb strength envelope. Sketch the stress-strain relationship for dense and loose sand. [16]
3. Write short note on:
   (a) Placement water content
   (b) Compaction Control
   (c) Vibroflotation
   (d) Pre compression. [4×4=16]
4. An undisturbed sample of clay, 24 mm thickness is tested in a consolidometer . The total change in the thickness of the specimen is 4.70mm when the applied pressure is 200 kN/m^2 and 6.13 mm when the applied pressure is 400 kN/m^2. On reducing the pressure to zero, the specimen swells to a thickness of 18.50 mm the final water content of the specimen is 32% and specific gravity is 2.72. The clay stratum 1 m thick, is sandwiched between previous strata, and is subjected to an overburden pressure of 200 kN/m^2. Estimate the probable settlement of a proposed structure. If due to its construction, the effective pressure at the centre of the clay layer is expected to be increased to 400 kN/m^2. [16]
5. (a) A rectangular area 3 m × 1.5 m is uniformly loaded with load intensity 125 kN/m^2 at the ground surface. Calculate the vertical pressure at a point 4.5m below one of its corners.
   (b) Write a short notes on stress isobar or Isobar diagram. [8+8]
6. (a) Define: total stress, effective stress and neutral stress as applied to soils.
   (b) What are the corrections to be made to the phreatic line? And how the same is carried out.
   (c) What is a flow net? State its properties and applications. What is the quantity of seepage between two successive flow lines and equipotential lines? [4+4+8]
7. (a) State Darcy's law. Discuss the assumptions and limitations.

(b) The following data were recorded in a constant head permeability test: Internal diameter of permeameter = 7.5 cm; Head lost over a sample length of 18cm = 24.7 cm; Quantity of water collected in 60 sec = 626 ml; Porosity of the soil sample was 44%. Calculate the coefficient of permeability, discharge velocity, and superficial velocity. Also estimate the permeability of the soil for a porosity of 39%. [6+10]

8. (a) Define coefficient of uniformity and coefficient of curvature. Specify their limits in classification of soils.

(b) A sample of soil with a liquid limit of 72.8% was found to have a liquidity index of 1.21 and water content of 81.3%. What are its plastic limit and plasticity index? In what region would the soil be located on the plasticity chart?[6+10]

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Code No: 07A60101 **R07** **Set No. 4**

III B.Tech II Semester Examinations,APRIL 2011
GEOTECHNICAL ENGINEERING-I
Civil Engineering

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

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1. Describe standard proctor test and modified proctor test. How would you decide the type of the test to be conducted in the laboratory? [16]

2. (a) What are different causes of pre consolidation in soils? What is the effect of pre consolidation on the settlement?
   (b) How would you determine the time-settlement curve in the field? [8+8]

3. (a) Briefly describe the procedure to determine the liquid limit of a soil.
   (b) The sieve analysis and consistency limit tests conducted on a soil sample gave the following results:
   Percent passing 4.75 mm sieve = 82; Percent passing 75 micron sieve = 9; D_{10} = 0.11 mm; D_{30} = 0.45 mm; D_{60} = 1.12 mm; Liquid limit = 22%; Plastic limit =12%.
   Classify the soil by Indian Standard Classification. [10+6]

4. (a) Distinguish between:
      i. discharge velocity and seepage velocity
      ii. coefficient of permeability and coefficient of percolation.
   (b) Explain the phenomenon of capillary rise in soil and develop an expression for the capillary rise.
   (c) Indicate approximate range of values of coefficient of permeability for gravel, sand, silt and clays. [6+6+4]

5. (a) Write a brief note on 'the concept of pressure bulb and its use in soil engineering practice'.
   (b) A 25 KN point load act on the surface of horizontal ground. Find the intensity of vertical pressure at 6m directly below the load. Use Boussinesq's equation. [8+8]

6. (a) What is meant by weathering? Describe its agents, process and effects on rocks.
   (b) A natural soil deposit has a bulk unit weight of 19 kN/m^3 and water content of 5%. Estimate the amount of water required to be added to 1 m^3 of soil to raise the water content to 15%. Assume the void ratio to remain constant. The specific gravity of solids is 2.67. [8+8]

7. (a) Explain the phenomenon of piping.

(b) What is the effect of surcharge and the capillary action on the effective stress?

(c) An excavation is to be done in 9 m thick clay layer under lain by sand. In a trial bore hole, the ground water rises up to an elevation of 3 m below ground level. Find the depth up to which excavation can be safely carried out with quick condition to occur. The void ratio of soil is 0.7 and specific gravity of solids is 2.7. Also, if excavation is to be safely carried out to a depth of 7 m, how much should the water table is lowered near the trench? [4+6+6]

8. (a) A clay stratum of 10m depth, is just sheared due to an adjacent structure leaning against it. The lateral pressure at 10m depth is estimated to be 115 KN/m^2. If the clay is completely saturated and failure might be under undrained condition, what is the shear strength of the clay? The saturated unit weight of the clay is 17.5 kN/m^3.

(b) A soil specimen of fine dry sand, when subjected to a triaxial compression test, failed at a deviator stress of 400 KN/m^2. It failed with a pronounced failure plane with a angle of 25^0 to the axis of the sample. Compute the lateral pressure to which the specimen would have been subjected? [8+8]

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Code No: 07A60101 **R07** **Set No. 1**

III B.Tech II Semester Examinations,APRIL 2011
GEOTECHNICAL ENGINEERING-I
Civil Engineering

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

Answer any FIVE Questions
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1. (a) Describe briefly the origin of soils and bring out the factors which control their formation.
   (b) Define:
      i. porosity,
      ii. degree of saturation,
      iii. air content, and
      iv. submerged density. [10+6]

2. (a) A normally consolidated clay layer of 10m thickness has a unit weight of 20 kN /m^3 and specific gravity 2.72. The liquid limit of the clay is 59%. A structure constructed on the clay increases the overburden pressure by 10%. Estimate the ultimate consolidation settlement. There is no secondary compression.
   (b) The overburden pressure on a normally consolidated 5m thick clay structure is 250 kN/m^2. A laboratory consolidation test followed by a suitable correction gave two points on the field curve
   $e_1 = 1.12$ $p_1 = 150$ kN/m^2
   $e_2 = 1.02$ $p_2 = 450$ kN/m^2
   How much settlement does the clay layer experience due to an additional load intensity of 150 kN/m^2. [8+8]

3. (a) Derive an expression for determining permeability of soil by falling head permeameter.
   (b) It is observed that in 12 minutes 800 ml of water passes through a soil sample of 10 cm high and 75 cm^2 cross section under a head of 60 cm. Determine the discharge velocity and coefficient of permeability. If on oven drying the sample weighs 0.0085 kN, compute the seepage velocity. Assume the specific gravity of solids as 2.70. [8+8]

4. (a) Describe the determination of the vertical stress at a point due to a point load, using Boussinesq's theory.
   (b) Describe the method of calculating the stress at a point below the corner of a rectangular load. How is this method used for finding the stress at points other than that below the corner? [8+8]

5. An earthen embankment of 106m^3 volume is to be constructed with a soil having a void ratio of 0.80 after compaction. There are three borrow pits marked A,B and C, having soils with void ratios of 0.90, 1.50 and 1.80 respectively. The cost

of excavation and transporting the soil is Rs. 0.25, Rs. 0.23, and Rs. 0.18 per m^3 respectively. Calculate the volume of soil to be excavated from each pit. Which borrow bit is the most economical? (G = 2.65) [16]

6. A sample of dense sand is tested in the following tests:
   (a) Direct shear with a normal stress of 150KN/m^2.
   (b) Triaxial shear with a confining pressure of 150 KN/m^2.
   Find the maximum shear stress at failure in both the cases if the angle of internal fiction of the sand is 36^0. Explain your results with the Mohr-coulomb envelope. [16]

7. (a) Differentiate between flow lines and equipotential lines.
   (b) Prove that the discharge per unit length of an earth dam with a horizontal filter at its toe is equal to the coefficient of permeability times the focal length.
   (c) What is a boiling sand condition? Discuss the situation and type of soil in which such condition is developed. [5+5+6]

8. (a) Draw plasticity chart with equation of A - line and mark position of a CH - soil on it.
   (b) A saturated clay sample had a volume of 90 cc and weight 22 grams. When completely oven dried, its volume was measured as 80 cc and weight was found to be 18.5 grams. Calculate the shrinkage limit of the soil and specific gravity of the solid particles. [6+10]

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Code No: 07A60101 **R07** **Set No. 3**

III B.Tech II Semester Examinations,APRIL 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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1. (a) State Stoke's law and explain its limitations as applicable to the sedimentation analysis.

   (b) The following results were obtained from the liquid limit test;

Number of blows	55	46	32	22	15
Water content (%)	24	30	35	41	49

   Find the liquid limit. Also determine plasticity index, liquidity index, and constituency index if plastic limit and natural water content of soil were 24% and 32% respectively. [6+10]

2. A 2m thick saturated clay layer is sandwiched between two highly pervious layers of coarse sand. When a building is constructed on the ground surface, it starts settling due to the consolidation of the clay layer. If the overage coefficient of consolidation of clay is 4.5 $\times 10^{-4} cm^2/S$, in how many days will the building reach half of its final settlement. [16]

3. (a) Explain the phenomena of formation and transportation of soils.

   (b) A sample of sand with the specific gravity of solids of 2.65 has a porosity of 40 percent. Find the dry unit weight, saturated unit weight, submerged unit weight and bulk unit weight when degree of saturation is 50%. [8+8]

4. (a) State various methods used to construct the flow net and describe any one method.

   (b) The water table in a certain area is at a depth of 2 m below the ground surface level. The soil of 10m depth consists of very fine sand having an average porosity of 0.40 and G = 2.67. Above the water table, the sand is saturated by capillary water for 1 m thickness. Calculate and show the total, effective and neutral stress diagrams at a depth of 0m, 0.30m and 5m from the surface.

   [8+8]

5. A very long embankment is to be built with a top width of 10m and side slopes of 1: 1 $^1/2$. The height of the embankment is 10m. Compute the vertical stresses at a depth of 5m from the base at the following points.

   (a) Below the toe

   (b) Below the central line

(c) Below a point midway on the slope.
Assume, $\gamma = 21$ KN/m^3. [16]

6. (a) Explain Darcy?s law and demonstrate that the coefficient of permeability has the dimensions of velocity.

(b) Find the average horizontal and vertical permeabilities of a soil mass made up of three horizontal layers. The first and second layers have the same thickness of 0.6 m each. The third layer is 0.7 m thick. The coefficient of permeability of first, second and third layers are 1×10^{-3} cm/sec, 2.5×10^{-2} cm/sec and 4.5×10^{-3}cm/sec respectively. [6+10]

7. In the construction of a levee, the compaction specification required was 95% of proctor maximum dry density at a field moisture content within 2% of the optimum moisture content. The maximum dry density and optimum moisture content obtained in the laboratory from the proctor test were 1.94 gm/cm^3 and 13.5% respectively. A field supervisor conducted sand-cone tests at two locations and obtained the results presented below. The sand in the sand bottle was found to have a density of 1.87 gm/cm^3. Check whether the specification was satisfied. [16]

Location No	Mass of soil removed (g)		Mass of sand used (g)
	wet	Dry	
1	42.86	38.46	39.61
2	37.18	32.12	32.19

8. (a) Define critical void ratio. Explain the shear behavior of a soil whose void ratio is less than the critical void ratio.

(b) Explain how a negative pore water pressure develops in a consolidated - undrained test on a over-consolidated clay. [8+8]

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