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

III B.Tech. II Semester Supplementary Examinations, January-2014

**GEOTECHNICAL ENGINEERING-I**

(Civil Engineering)

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

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Explain the formation of soils.
   (b) Define the terms (i) void ratio, (ii) water content, (iii) dry density and (iv)degree of saturation.

2. (a) Explain any one method for determination of liquid limit of a soil.
   (b) Define the terms (i) flow index, (ii) toughness index, (iii) plasticity index and (iv)Liquidity index.

3. (a) State the important factors that affect the permeability of a soil.
   (b) Determine the average coefficient of permeability in the horizontal and vertical directions for a deposit consisting of three layers of thickness 5m, 1m and 2.5m and having the coefficients of permeability of $3 \times 10^{-2}$ mm/sec, $3 \times 10^{-5}$mm/sec and $4 \times 10^{-2}$ mm/sec. Assume the layers are isotropic

4. (a) Explain the total stress, neutral stress and effective stress. What is the role of effective stress in soil mechanics?
   (b) What is the critical hydraulic gradient of a sand deposit of specific gravity 2.65 and void ratio 0.5?

5. (a) What do you understand by geostatic stresses? How are these determined?
   (b) A point load of 3000kN is acting at the ground surface. Determine the vertical stress at a point which is 5m directly below the load. What will be the vertical stress at a point which is at a depth of 5m and at a horizontal distance of 3m from the axis of the load?

6. (a) Differentiate between consolidation and compaction. Give examples.
   (b) An earth embankment is compacted at a water content of 18% to a bulk density of 1.92 g/cm$^3$. If the specific gravity of sand is 2.7, find the void ratio and degree of saturation of compacted embankment.

7. Describe Terzaghi's theory of one dimensional consolidation, stating the various assumptions.

8. (a) What is Mohr Circle? Discuss its important characteristics?
   (b) A sample of dry sand was subjected to triaxial test, with a confining pressure of 250kN/m$^2$. The angle of shearing resistance was found to be $36^0$. At what value of major principal stress, the sample is likely to fail.

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

III B.Tech. II Semester Supplementary Examinations, January-2014

**GEOTECHNICAL ENGINEERING-I**

(Civil Engineering)

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

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Define the terms specific gravity of particles, porosity and submerged density.
   (b) A sample of soil has a volume of 65 ml and weighs 0.96 N. After complete drying, its weight reduces to 0.785N. If the specific gravity of solid particles is 2.65, determine the degree of saturation.

2. (a) What are the uses of consistency limits? What are their limitations?
   (b) Differentiate between dry sieve analysis and wet sieve analysis. Why wet sieve analysis is required?

3. Explain different methods for determination of coefficient of permeability in a laboratory.

4. (a) What is quick sand? How would you calculate the hydraulic gradient required to create quick sand conditions in a sample of sand?
   (b) The water table in a deposit of uniform sand is located at 2m below the ground surface. Assuming the soil above water table is dry, determine the effective stress at a depth of 5m below ground surface. The void ratio is 0.75 and specific gravity of solids is 2.65, If the soil above water table is saturated by capillary action, what is the effective stress at that depth?

5. (a) Explain Westergaard's theory for determination of vertical stress at a point. How is it different from Boussinesq's solution?
   (b) A concentrated load of 30kN acts on the surface of a homogeneous soil mass of large extent. Find the stress intensity at a depth of 8m and (i) directly under the load (ii) at a horizontal distance of 3m.

6. (a) What is a compaction Curve? Give its salient features. What is zero air void line?
   (b) The maximum dry density and optimum moisture content of a soil from standard proctor test are 1.8 $g/cm^3$ and 16% respectively. Compute the degree of saturation of the sample, assuming specific gravity of soil grains as 2.7.

7. (a) Discuss the spring analogy for primary consolidation. What are its uses?
   (b) In a consolidation test the following results have been obtained, when the load was changed for 52 $kN/m^2$ to 100$kN/m^2$, the void ratio changed from 0.7 to 0.65, Determine the coefficient of volume decrease, $m_v$ and compression index, $C_c$.

8. (a) What is coulombs equation of shear strength of soils? Discuss the factors which affect the shear strength parameters of clay soil.
   (b) Briefly discuss the effects of drainage conditions on the shear strength parameters of clay soil.

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

III B.Tech. II Semester Supplementary Examinations, January-2014

**GEOTECHNICAL ENGINEERING-I**

(Civil Engineering)

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

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Describe briefly the different types of soil structures.
   (b) Explain relative density.

2. Describe in detail the Indian soil classification system.

3. (a) What is Darcy's law? What are its limitations?
   (b) Determine the average horizontal and vertical permeabilities of a soil mass made up of three horizontal strata, each 1m thick, if the coefficients of permeability are $1 \times 10^{-1}$mm/s, $3 \times 10^{-1}$mm/s and $8 \times 10^{-2}$mm/s for the three layers.

4. (a) What is effective stress principle?
   (b) A deposit of fine sand has a void ratio of 0.54 and specific gravity of solid particles is 2.67. Compute the safe exit gradient with a factor of safety of 4.

5. (a) Derive an expression for vertical stress at a point due to a point load using Boussinesq theory.
   (b) A load of 50kN is applied at a concentrated unit on a surface. Find the vertical pressure at a point 1.5m below the load and 3m away horizontally.

6. Describe standard proctor test and modified proctor test.

7. (a) Define (i) compression index (ii) Coefficient of consolidation (iii) Coefficient of volume decrease.
   (b) A clay layer, 8m thick, is subjected to a pressure of $70kN/m^2$. If the layer has a double drainage and undergoes 50% consolidation (T=0.196) in one year, determine the coefficient of consolidation. If the coefficient of permeability is 0.4 m/year, determine the settlement in one year. Use $\gamma_\omega$=9.81 $kN/m^3$.

8. (a) Differentiate between unconsolidated undrained test and drained test. Under what conditions are these test results used for design purposes?
   (b) The stress at failure on the failure plane in a cohesion less soil mass were, shear stress =4 $kN/m^2$, normal stress = $10kN/m^2$. Determine the resultant stress on the failure plane, the angle of internal friction of the soil and the angle of inclination of failure plane to the major principal plane.

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

III B.Tech. II Semester Supplementary Examinations, January-2014

**GEOTECHNICAL ENGINEERING-I**

(Civil Engineering)

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

Answer any FIVE Questions

All Questions carry equal marks

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1. (a) Discuss the characteristics and construction of kaolinite, montmorillonite and illite mineral groups.
   (b) A soil specimen has water content of 10% and a wet unit weight of 20 kN/m$^3$. If the specific gravity of solids is 2.7, determine the dry unit weight, void ratio and degree of saturation $\gamma_{\omega=}$ 9.81kN/m$^3$.

2. (a) Explain liquid limit, plastic limit and shrinkage limit.
   (b) A clay sample has a void ratio of 0.5 in dry condition. The grain specific gravity has been determined as 2.72. What will be the shrinkage limit of this clay?

3. (a) How would you determine the average permeability of a soil deposit consisting of number of layers?
   (b) The falling head permeability test was conducted on soil sample of 4 cm diameter and 18cm length. The head fell from 1m to 0.4m in 20min. If the cross sectional area of the stand pipe was 1 cm$^2$, determine the coefficient of permeability.

4. What is flow net? Describe its properties and applications. Describe the methods used to construct the flow net?

5. (a) What are the assumption made in Boussinesq formulas for stress distribution in soils?
   (b) Find the intensity of vertical pressure and horizontal shear stress at a point 4m directly and shear stress at a point 2m horizontally away from the axis of loading but at the same depth of 4m?

6. (a) Explain the factors that affect compaction?
   (b) The maximum dry density of a sample by light compaction test is 1.78g/cm$^3$ at an optimum water content of 15%. Find the air voids and degree of saturation. G=2.67. What would be the corresponding value of dry density on zero air void line at optimum water content?

7. (a) Differentiate between primary consolidation and secondary consolidation.
   (b) A sand fill compacted to a bulk density of 18.84 kN/m$^3$ is to be placed on a compressible saturated marsh deposit 3.5m thick. The height of sand fill is to be 3m. If the volume compressibility $m_v$ of the deposit is 7 x 10$^{-4}$m$^2$/kN, estimate the final settlement of the fill.

8. (a) Sketch stress strain relationship for dense and loose sand.
   (b) A sample of dry cohesionless soil was tested in a triaxial machine. If the angle of shearing resistance was 36$^0$ and the confining pressure 100kN/m$^3$, determine the deviator stress at which the sample failed.

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