[01 – 3113]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Civil Engineering

GEOTECHNICAL ENGINEERING

(Common with Civil Environmental and Dual Degree in Civil Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No.1 is compulsory.

Answer any FOUR from the remaining.

All questions carry equal marks.

1. (a) Derive relation between 'air content', percentage air voids" and 'porosity'.

   (b) A soil has a shrinkage limit of 18% and specific gravity of soil solids as 2.68. Determine its void ratio in dry state.

   (c) Distinguish between "Well Graded" and "Gap graded" soils.

   (d) What is the effect of "grain size" and "Plasticity" of soils on compaction characteristics?

   (e) What is pressure bulb? State its significance.

(f) What is meant by "sensitivity" of soils? Name the tests used for its determination.

(g) What are the corrections to be applied to observed Standard Penetration Resistance?

2. (a) What is unit phase diagram? Derive the following relationship using unit phase diagram. $\gamma = \left(\frac{G + eS_r}{1 + e}\right)\gamma_w$

Where, γ is Bulk Unit weight of soil

γ_w is Unit weight of water

G is specific Gravity of soil

e is Void Ratio of soil

S_r is degree of saturation of soil.

(b) A soil at a void ratio of 0.8 has a volume of 20 cc. What will be its volume if the same soil is compacted to a void ratio of 0.6. Calculate the dry density of soil in compacted soil if G = 2.68. What will be the saturated density of soil if the soil gets saturated subsequently?

3. (a) Distinguish Between 'Atterberg Limits' and 'Consistency Indices'.

(b) In a liquid limit test, specimens of certain clay at water contents of 31.9,27.6,25.5 and 23.3 percent required 5.16, 23 and 42 blows respectively to close the standard groove. The plastic limit of clay is 13%. Natural water content is 18%. Determine liquid limit, liquidity index and relative consistency of the clay.

4. (a) Discuss the effect of compaction on

(i) Soil structure

(ii) Permeability

(iii) Shear Strength and Elastic Modulus

(iv) Shrinkage and Swelling.

(b) A sand stratum is 10 m thick. The water table is 2.5 m below ground level. The bulk and saturated unit weights of sand are 17 kN/m^3 and 19 kN/m^3 respectively, The capillary rise is 1 m. Draw the effective stress, neutral stress and total stress diagrams for the sand stratum.

5. (a) Distinguish between 'Superficial velocity' and 'Seepage Velocity'. Derive relation between them.

(b) A falling head permeability test is to be conducted on a soil whose permeability is 3×10^{-7} cm/s. What diameter standpipe would you use if head had to drop from 27.5 cm to 20 cm in 5 minutes? Take cross sectional area of specimen as 15 cm^2 and length as 5 cm. How much time does it take for head to fall from 20 cm to 12.5 cm?

6. (a) Describe the construction procedure of Newmark's Influence chart. What is its significance?

(b) A continuous strip footing of 3 m width carries a uniformly distributed load of 90 kN/m^2. Calculate vertical stress at a point

(i) directly below centre of load at a depth of 2 m.

(ii) located at 1.5 m depth and away from centre of loading at 2.5 m distance.

7. (a) Explain the theory of one dimensional consolidation using Terzaghi's Spring Analogy.

(b) A normally consolidated saturated clay layer, 8 m thick has a unit weight of 20 kN/m^3 and a specific gravity of 2.70. The liquid limit of the clay is determined to be 54%. If construction of structure on clay increased the overburden pressure by 18%, estimate the ultimate consolidation settlement. Assume that there is no secondary compression.

8. (a) Derive expression for determination of undrained shear strength of soft clay using vane shear apparatus.

(b) A specimen of sand failed at a shear stress of 0.32 kg/cm^2 under a normal stress of 1 kg/cm^2. Determine the shear parameters of sand. If the same sample is tested in triaxial apparatus under a cell pressure of 0.5 kg/cm^2, determine the deviator stress at which the specimen fails.
