



B. Tech Degree V Semester (Special Supplementary) Examination, July 2005

CE 501 A/B GEOTECHNICAL ENGINEERING I (2002 Admissions)

Time : 3 Hours

Maximum Marks : 100

- I. (a) Explain the following terms in connection with soil :
- | | |
|------------------------|-----------------------|
| (i) Three phase system | (ii) Void ratio |
| (iii) Porosity | (iv) Specific gravity |
| (v) dry density. | |
- (10)
- (b) A soil has a mass specific gravity of 1.90, specific gravity of solids 2.70 and moisture content of 30%. Find the values of voids ratio, porosity and degree of saturation. Assume the volume of solids = 100 c.c. (10)
- OR**
- II. (a) Explain the Pipette Analysis for grain size distribution of soils. (6)
- (b) Define the terms :
- | | |
|-----------------------|--------------------|
| (i) Liquid limit | (ii) Plastic limit |
| (iii) Shrinkage limit | |
- (6)
- (c) For a soil sample, the liquid limit is 52%, plastic limit is 30% and shrinkage limit is 18%. If the specimen of the soil shrinks from a volume of 39.5 cm³ at the liquid limit to a volume of 24.2 cm³ at the shrinkage limit, calculate the true specific gravity. (8)
- III. (a) State Darcy's law for flow of water through soil. What are the assumptions made in this law? (6)
- (b) State the factors on which the permeability of a soil depends. (4)
- (c) Clay was tested in a variable head permeameter having the diameter of the sample to be 0.1 m. The initial head of water in the stand pipe was 0.75 m and the level of the water is dropped to 0.50 m in 2.5 minutes. If the soil sample is 0.15 m high and the diameter of the stand pipe is 0.015 m, determine the coefficient of permeability of the clay in metre per day. (10)
- OR**
- IV. (a) Explain the concept of flow net diagrams in connection with an isotropic soil sample. What are the properties of a flow net? (10)
- (b) For a homogeneous earth dam 52 m high and 2 m free board, a flow net was constructed and the following results were obtained : Number of potential drops = 25, Number of flow channels = 4. The dam has a horizontal filter of 40 m length at its downstream end. Calculate the discharge per metre length of the dam if the coefficient of permeability of the dam material is 3×10^{-3} cm/sec. (10)
- V. (a) Differentiate between consolidation and compaction. (4)
- (b) Define the terms : Coefficient of compressibility, Coefficient of volume change and Compression index. (6)
- (c) On a soft glacial clay layer 2 m thick with liquid limit as 45%, the pressure was increased from 100 kN/m² to 200 kN/m². If the original voids ratio was found to be 0.67, calculate the settlement caused by the pressure increment. (10)

OR

(Turn Over)

- VI. (a) Explain Terzaghi's theory of one-dimensional consolidation stating clearly the assumptions made. Derive the basic differential equation of consolidation and an expression for coefficient of consolidation. (10)
- (b) An undisturbed sample of clay, 24 mm thick, consolidated 50% in 20 minutes, when tested in the laboratory with drainage allowed at top and bottom. The clay layer, from which the sample was obtained, is 4 m thick in the field. How much time will it take to consolidate 50%, with double drainage? If the clay stratum has only single drainage, calculate the time to consolidate 50%. Assume uniform distribution of consolidation pressure. (10)
- VII. (a) Explain the Mohr-Coulomb Failure theory with figures of strength envelop. (10)
- (b) A cylinder of soil fails under an axial vertical stress of 160 kN/m^2 , when it is laterally unconfined. The failure plane makes an angle of 50° with the horizontal. Calculate the values of cohesion and angle of internal friction of the soil. (10)
- OR
- VIII. (a) Explain *any two* methods for determining the shear strength of soil. Write their relative advantages and disadvantages. (10)
- (b) Two similar specimens, 3.75 cm in diameter and 7.5 cm high, of partially saturated, compacted soil were tested in triaxial cell under undrained conditions. The first specimen failed at a deviator load of 680 N under an all around pressure of 150 kN/m^2 . The second specimen failed at a deviator load of 940 N under an all around pressure of 250 kN/m^2 . The increase in volume of the first specimen at failure is 1.4 ml and it shortens by 0.5 cm. The increase in volume of the second specimen at failure is 1.8 ml and it shortens by 0.6 cm. Calculate the values of apparent cohesion and angle of shearing resistance. (10)
- IX. (a) Describe the standard Proctor Compaction Test. (10)
- (b) A compaction test in the laboratory gave a maximum dry density of 18.5 kN/m^3 at water content of 15%. The specific gravity of soil is 2.70. Find out the degree of saturation, air content and percentage air voids at the maximum dry density. Find out the theoretical maximum dry density at zero voids at the optimum moisture content. (10)
- OR
- X. (a) Describe any method for c I analysis of soil. (10)
- (b) Calculate the height for an embankment rising 60° , to the horizontal and to be constructed with soil having unit weight of 20.5 kN/m^3 , I 20° and cohesion of 15 kN/m^2 . Stability factor N corresponding to slope angle i 62° and I 20° is 0.10 (from Taylor's curve). Factor of safety can be assumed as 3.0. (10)
