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(2063)

820

B.Tech 4th Semester Examination

Soil Mechanics

CE-4004

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/ continuation sheet will be issued.

Note : Attempt five questions, selecting one question from each section A, B, C and D. Question 9 is compulsory. All questions carry equal marks. Non-programmable calculator is allowed.

SECTION - A

1. (a) By three phase soil system, show that the bulk unit weight γ in terms of specific gravity G, void ratio e and degree of saturation S, is given by the expression:

   $\gamma = (G + Se)\ \gamma_w/(1+e)$.

   (b) The Atterberg limits of a soil sample are w_L = 50%, w_P = 30% and w_S = 15%. If this soil sample shrinks from a volume of 10 cm^3 at liquid limit to 5.94 cm^3 when it is oven-dried; calculate shrinkage ratio and specific gravity of soil solids. **(10,10)**

OR

2. (a) Sketch the plasticity chart for classifying fine grained soil in IS soil classification system and give the group symbol for the following soil:

   liquid limit = 20% and plastic limit = 14%.

(b) For soil classification, test results obtained on soil sample are: w_L = 54%, w_P = 21%

Size (mm)	1.0	0.075	0.060	0.005	0.002
Percent finer	98	71	69	31	19

Determine the percentage of sand, silt & clay and classify the soil as per I.S. 1498. **(10,10)**

SECTION - B

3. (a) Discuss various factors affecting the coefficient of permeability of a soil.

(b) A horizontal stratified soil deposit consists of three layers, each uniform in itself. Permeability coefficients of the layers are: 8×10^{-4}, 50×10^{-4} and 15×10^{-4} cm/sec; and their thicknesses are: 6, 3 and 12 m respectively. Find the effective average permeability of the deposit in horizontal and vertical directions. **(10,10)**

OR

4. (a) Define and explain critical hydraulic gradient. Derive an expression for it.

(b) Discuss various factors affecting compaction of soils.

(c) An earth dam is built on an impervious foundation with a horizontal filter under the down stream slope. The horizontal and vertical permeabilities of the .soil in the earth dam are 4×10^{-3} and 1×10^{-3} cm/sec. The full reservoir level is 15 metres above the down stream filter. A flow net, constructed for transformed section of the dam, consists of 4 flow channels and 15 equipotential drops. Estimate seepage-loss per metre length of the dam. **(8,6,6)**

SECTION - C

5. (a) Derive an expression for vertical pressure under a uniformly loaded circular area.

(b) A rectangular area 2 × 1 m is uniformly loaded with load intensity of 100 kN/m^2 at ground surface. Calculate vertical pressure at a point 4 m below one of its corners. **(10,10)**

OR

6. (a) Discuss logarithm of time fitting method for determining consolidation coefficient.

(b) Two clay layers A and B are respectively 4 m and 5 m thick. The time taken by the layer A to reach 50% consolidation is 6 months. Calculate the time taken by the layer B to reach the same degree of consolidation. The coefficient of consolidation for layer B is half the coefficient of consolidation for layer A. Both the layers have double drainage. **(10,10)**

SECTION - D

7. (a) Describe Coulomb's wedge theory for determining the earth pressure behind a retaining wall.

(b) A vertical excavation was made in a clay deposit having unit weight of 20 kN/m^3. It caved in after the depth of excavation reached 4 meters. Calculate the value of Cohesion, assuming ϕ to be zero. If the same clay is used as a backfill against a retaining wall upto a height of 8 m. calculate (i) total active earth pressure (ii) total passive earth pressure. Assume that the wall yields far enough to allow Rankine deformation conditions to establish. **(10,10)**

OR

8. (a) List various methods of finding shear strength of soils. Discuss their relative merits and demerits.

(b) Two identical specimens 4 cm in diameter and 8 cm high of partly saturated soil are tested in a triaxial cell under undrained conditions. The first specimen failed at a deviator load of 720 N under a cell pressure of 100 kN/m^2. The second specimen failed at a deviator load of 915 N under a cell pressure of 200 kN/m^2. The increase in the volume of first specimen at failure is 1.2 ml and it shortens by 0.6 cm at the failure. The increase in the volume of the second specimen at failure is 1.6 ml and it shortens by 0.8 cm at failure. Determine the value of apparent cohesion and the angle of shearing resistance. **(10,10)**

SECTION - E (Compulsory)

9. (a) The specific gravity of a soil sample is 2.7 and its void ratio is 0.945. If the sample is fully saturated, determine its moisture.

(b) A soil has liquid limit of 45% and lies above A - line when plotted on the plasticity chart. Give the group symbol of the soil as per IS Soil classification.

(c) Explain what is a flow net?

(d) Define and explain coefficient of compressibility.

(e) For a sandy soil, the angle of internal friction is 30º. If the major principal stress is 50 kN/m^2 at failure, determine the minor principal stress.

(f) Discuss flocculated soil structure.

(g) Explain earth pressure at rest.

(h) Differentiate between discharge velocity and seepage velocity.

(i) Define and explain zero air void line.

(j) Explain the term ‘pressure bulb’. **(10×2=20)**