

B.Tech Even Semester (CBCS) Exam., April—2017

AGRICULTURAL ENGINEERING

(6th Semester)

Course No. : AE-603 (C)

(Soil Mechanics)

Full Marks : 75

Pass Marks : 30

Time : 3 hours

- Note :
1. Attempt **one** question from each Unit.
 2. Begin each answer in a new page.
 3. Answer parts of a question at a place.
 4. Assume reasonable data, wherever required.
 5. The figures in the margin indicate full marks for the questions.

UNIT—I

1. (a) Define the air content, air void ratio and water void ratio. 3

- (b) Establish the following relationships : 4×312

(i) $1 - n = \frac{1}{1 + e}$

(ii) $\frac{w}{1 + e} (G - e.S_r)$

(iii) $d_s S_r [\rho_{sat} - \rho_d]$

where, n porosity of soil mass;
 e volume of voids; w moisture content; S_r degree of saturation;
 ρ_d bulk unit weight of soil mass;
 ρ_d dry unit weight of soil mass;
 ρ_{sat} saturated weight of soil mass
 ρ_w unit weight of water;
 G specific gravity.

2. (a) Define specific gravity and write down the test procedure with a neat sketch for determining the specific gravity by a 50 ml density bottle method. 2+6=8
- (b) With the neat sketch, explain the Atterberg limits. 7

UNIT—II

3. (a) Calculate the coefficient of permeability of a soil sample, 6 cm in height and 50 cm² in cross-section area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective

(3)

constant head of 40 cm. On oven drying, the test specimen has mass of 498 g. Taking the specific gravity of soil solids as 2.65, calculate the seepage velocity of water during the test. 8

(b) Define the permeability and discuss the constant head permeability test with neat diagram for the determination of coefficient of permeability. 3+4=7

4. (a) Write short notes on the following : 2×4=8

- (i) Groundwater
- (ii) Capillary water
- (iii) Infiltrated water
- (iv) Adsorbed water

(b) Find the expression of effective pressure at different plane and draw the effective pressure distribution diagram (EPDD) for soil mass with surcharge. 7

UNIT—III

5. (a) What do you understand by the stress tensor? With the help of neat sketch, show that the total number of independent stresses are six for a three-dimensional element. 2+8=10

(4)

(b) Explain in brief the basic assumptions of theory of elasticity. 5

6. Derive equilibrium equations for an elemental volume of size dx , dy and dz . 15

UNIT—IV

7. Define compaction and consolidation. Briefly describe about the factors affecting compaction. 8+7=15

8. Briefly describe about standard and modified Proctor test with schematic diagram. 8+7=15

UNIT—V

9. A clay soil, tested in a consolidometer, showed in a decrease in void ratio from 1.20 to 1.10, when pressure was increased from 0.25 to 0.50 kgf/cm².

(a) Calculate the coefficient of compressibility (a_v)

(b) Calculate the coefficient of volume compressibility (m_v)

(c) If the coefficient of consolidation (c_v) determined in the test for the given stress increment was 10 m²/year, calculate the coefficient of permeability in cm/s.

(5)

(d) If the sample tested at the site was taken from a clay layer 3.0 m in thickness, determine the consolidation settlement resulting from the given stress increment. $3+4+4+4=15$

10. Briefly describe about the essential points of Mohr's strength theory. Draw the Coulomb envelope curve and Mohr envelope curve. $7+8=15$

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