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B.Tech Even Semester (CBCS) Exam., May—2019

AGRICULTURAL ENGINEERING

(6th Semester)

Course No. : AECC–29

(Soil Mechanics)

Full Marks : 50
Pass Marks : 15

Time : 2 hours

Note : 1. Attempt *any* **five** questions.

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 right margin indicate full marks for the questions.

1. *(a)* Establish the following relationships : 2+2=4

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

(ii) $\gamma_d = S_r[\gamma_{sat} - \gamma_d]$

Where, $n =$ porosity of soil mass, $e =$ volume of voids; $w =$ moisture content;

$S_r =$ degree of saturation; $\gamma =$ bulk unit weight of soil mass; $\gamma_d =$ dry unit weight of soil mass; $\gamma_{sat} =$ saturated weight of soil.

(b) It is required to prepare a compacted cylindrical specimen/soil sample of 40 mm diameter and 80 mm length from oven dry soil. The specimen is required to have water content of 16% and percent air voids of 18%.

Taking $G = 270$, determine the mass of soil and mass of water, required for preparation of the above specimen/soil sample. 6

2. *(a)* What is specific gravity? Describe the procedure to determine the specific gravity of a soil mass. 2+4=6

(b) Write short notes on the following : 1×4=4

(i) Dry density

(ii) Plasticity index

(iii) Liquidity index

(iv) Shrinkage limit

3. *(a)* Write short notes on the following : 1×4=4

(i) Groundwater

(ii) Capillary rise

(iii) Capillary tension

(iv) Adsorbed water

(b) Find the expression of effective pressure at different planes and draw the effective pressure distribution diagram (EPDD) for soil mass with surcharge. 4+2=6

4. (a) Define permeability and discuss the constant head permeability test with neat diagram for the determination of coefficient of permeability. 2+3=5

(b) Calculate the coefficient of permeability of a soil sample, 6 cm in height and 50 cm^2 in cross-section area, if a quantity of water equal to 430 ml passed down in 10 minutes, under an effective 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. 2+3=5

5. (a) What do you mean by body forces and surface forces? 2+2=4

(b) What is stress tensor? With the help of neat sketch, show that the total numbers of independent stresses are six for a three-dimensional element. 2+4=6

6. Derive equilibrium equations for an elemental volume of sizes dx, dy, dz with nine stress components acting at the centre of elements. 10

7. (a) Define compaction and consolidation. Briefly describe about the factors affecting compaction. 1+1+3=5

(b) Describe the standard proctor test with schematic diagram. 5

8. Briefly describe about the essential points of Mohr's strength theory. Draw the Coulomb envelope curve and Mohr's envelope curve. 4+3+3=10

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