B.Tech Odd Semester (CBCS) Exam., December—2018

AGRICULTURAL ENGINEERING

(3rd Semester)

Course No. : AE–CC–02

(Strength of Materials)

Full Marks : 50
Pass Marks : 15

Time : 2 hours

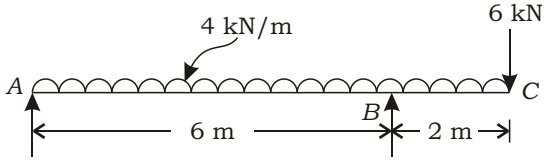
Note : 1. Answer any **five** questions.
2. Begin each answer in a new page.
3. Answer parts of a question at a place.
4. Assume reasonable data wherever required.
5. The figures in the margin indicate full marks for the questions.

1. *(a)* Define the terms, 'modulus of elasticity', 'Poisson's ratio' and 'modulus of rigidity'. A 10 mm diameter rod of the material was subjected to an axial pull of 10 kN and the change in diameter was observed to be 3 10^{3} mm. The modulus of rigidity for a material is 0 51 10^{5} N/mm^{2}. Calculate Poisson's ratio and the modulus of elasticity. 6

(b) A cantilever of length 2·8 m fails when a load of 4·7 kN is applied at the free end. If the section of the beam is 65 mm × 105 mm, find the stress at failure. 4

2. Write the uses of shear force and bending moment diagrams. A cantilever of length 2 m carries a UDL of 2 kN/m over the whole length and a point load of 3 kN at its free end. Draw the shear force and bending moment diagrams for the beam. 10

3. An overhanging beam is shown in figure below. Draw the shear force and bending moment diagrams for the beam. 10



4. A T-beam having flange 210 mm × 20 mm and web 250 20 mm is simply supported over a span of 5 m. It carries a UDL of 8·8 kN/m over its entire span. Calculate the maximum compressive and tensile stresses occurring in the section. What is the magnitude of flexural stress at the junction of flange and web? Draw the variation of stress across the section. 10

5. Derive the expression for the maximum slope and deflection of a simply supported beam subjected to a concentrated load at its mid-span. A simply supported beam of span 3 m is subjected to a central load of 10 kN. Find the maximum slope and deflection of the beam. Take moment of inertia of the section as 12 10^6 mm^4 and E 200 GPa. 10

6. What is torque? Write the torsion formula. A hollow shaft is to transmit 300 kW power at 80 r.p.m. If the shear stress is not to exceed 60 N/mm^2 and the internal diameter is 0·6 times the external diameter, find the internal and external diameters assuming that the maximum torque is 1·4 times the mean torque. 10

7. What is principal stress? At a point in strained material, the principal stresses are 100 N/mm^2 (tensile) and 60 $N\text{-}mm^2$ (compressive). Determine normal stress, shear stress and resultant stress on a plane inclined at 50° to the axis of the major principal stress. Also determine the maximum shear stress at the point. 10

8. Calculate (*a*) change in diameter, (*b*) change in length and (*c*) change in volume of a thin cylindrical shell of 100 cm diameter, 1 cm thick and 5 m long when subjected to internal pressure of 3 N/mm^2. Take the value of E 2 10^5 N/mm^2 and Poisson's ratio 0·3. 10

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