B.Tech Odd Semester (CBCS) Exam., December—2017

AGRICULTURAL ENGINEERING

(3rd Semester)

Course No. : AECC–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. Define Poisson's ratio. A metallic bar 300 mm × 100 mm × 40 mm is subjected to a force of 50 kN (tensile), 6 kN (tensile) and 4 kN (tensile) along x, y and z directions, respectively. Determine the change in volume of the block. Take E 2 10^5 N/mm^2 and Poisson's ratio = 0·25. 10

2. State the principles of a composite bar. A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm as shown in Fig. 1. The composite bar is then subjected to axial pull of 45 kN. If the length of each bar is equal to 15 cm, determine—

(a) the stresses in the rod and tube;

(b) load carried by each bar.

Take E for steel 2 1 10^5 N/mm^2 and copper 1 1 10^5 N/mm^2. 10

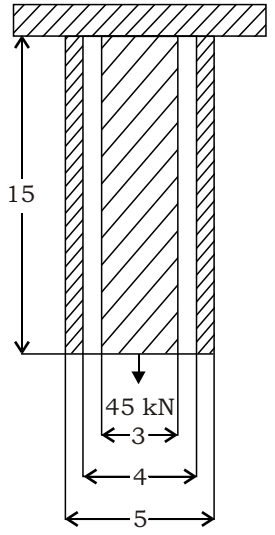

Fig. 1

3. An overhanging beam is shown in Fig. 2. Draw the SF and BM diagrams. 10

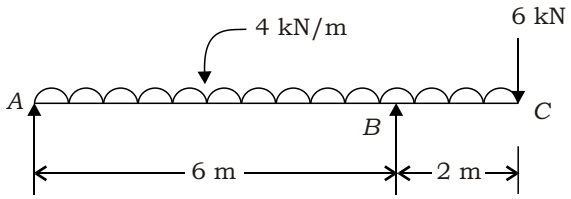

Fig. 2

4. Write flexure formula. A *T*-section of a simply-supported beam has a width of flange = 100 mm, overall depth = 100 mm, thickness of flange and stem = 20 mm. Determine the maximum stress in the beam when the bending moment of 12 kN-m is acting on the section. 10

5. Write the expression for the determination of shear stress on the cross-section of a beam subjected to bending. The cross-section of a beam is *I*-section with flanges of the equal size as shown in Fig. 3. Find the maximum intensity of shear stress and sketch the distribution of stress across the section,

if it has to resist a shear force of 400 kN. Take *I* for the section 6 45 10^8 mm^4. 10

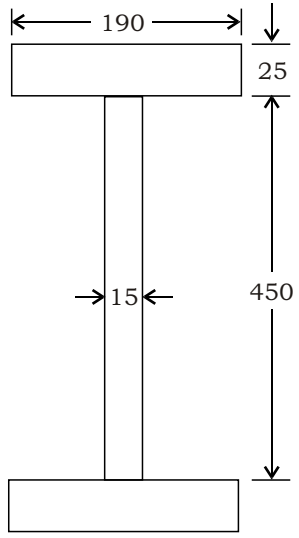

Fig. 3

6. A simply-supported beam of span 5 m, carrying a point load of 5 kN at a distance of 3 m from the left end. Find—

(a) slope at the left support;

(b) deflection under the load;

(c) maximum deflection.

Take E 2 10^5 N/mm^2 and I 1 10^8 mm^4. Use double-integration method. 10

7. Write torsion formula. A hollow shaft of external diameter 120 mm transmits 300 kW power at 200 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/mm^2. 10

8. A simply-supported beam of 6 m length carries two concentrated loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Using Macaulay's method, find—

(a) deflection under each load;

(b) maximum deflection;

(c) the point at which maximum deflection occurs.

Given E 2 10^5 N/mm^2 and I 85 10^6 mm^4. 10

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