VIT
Vellore Institute of Technology

Final Assessment Test – November 2019

Course: MEE2002 - Strength of Materials
Class NBR(s): 1053 / 1259 / 1827 Slot: C2+TC2+V5
Time: Three Hours Max. Marks: 100

KEEPING MOBILE PHONE/SMART WATCH, EVEN IN 'OFF' POSITION, IS EXAM MALPRACTICE

PART – A (1 X 20 = 20 Marks)
Answer the Question

1. Draw the bending moment and shear force diagram for the beam loaded as shown in Fig. 1. Mark the values at the salient points, determine the point of contraflexure also.

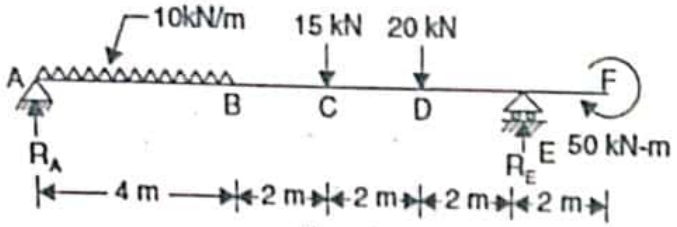

Figure 1.

PART – B (5 X 16 = 80 Marks)
Answer any FIVE Questions

2. A steel bolt of 24 mm diameter passes centrally through a copper tube of internal diameter 28 mm and external diameter 40 mm as shown in Fig. 2. The length of whole assembly is 600 mm. After tight fitting of the assembly, the nut is over tightened by quarter of a turn. What are the stresses introduced in the bolt and tube, if pitch of nut is 2 mm? Take $E_s = 2 \times 10^5$ N/mm^2 and $E_c = 1.2 \times 10^5$ N/mm^2.

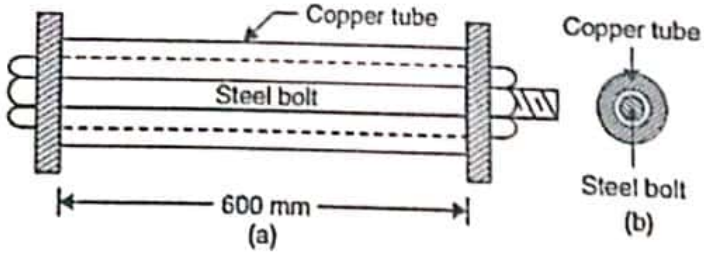

Figure 2.

3. For the state of plane stress shown in Fig. 3, determine (*a*) the principal planes, (*b*) the principal stresses, (*c*) the maximum shearing stress and the corresponding normal stress.

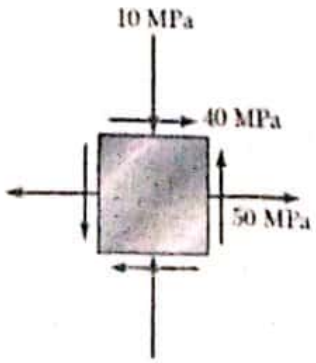

Figure 3

4. A symmetric *I*-section of size 180 mm × 40 mm, 8 mm thick is strengthened with 240 mm × 10 mm rectangular plate on top flange as shown is Fig. 4. If permissible stress in the material is 150 N/mm², determine how much concentrated load the beam of this section can carry at centre of 4 m span. Given ends of beam are simply supported.

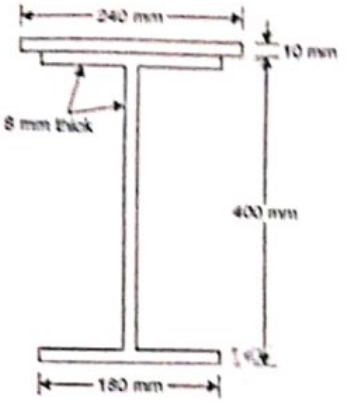

Figure 4.

5. A simply supported wooden beam ABC as shown in figure 5, has a rectangular cross section. Determine the maximum displacement and maximum slope of the beam. Take $E = 12$ GPa. Neglect the weight of the beam. Use double integration method.

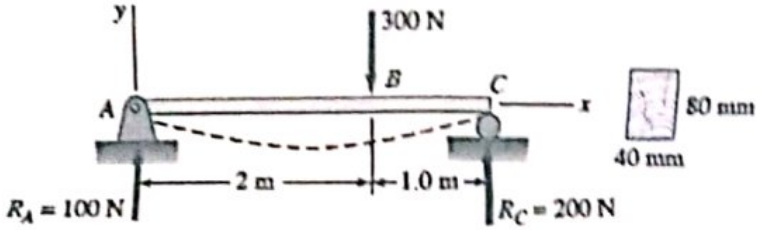

Figure 5.

6. A shaft of solid circular cross section consisting of two segments is shown in the first part of the Fig. 6. The left-hand segment has diameter 80 mm and length 1.2 m; the right-hand segment has diameter 60 mm and length 0.9 m. Shown in the second part of the Fig. 6, is a hollow shaft made of the same material and having the same length. The thickness t of the hollow shaft is $d/10$, where d is the outer diameter. Both shafts are subjected to the same torque. If the hollow shaft is to have the same torsional stiffness as the solid shaft, what should be its outer diameter d?

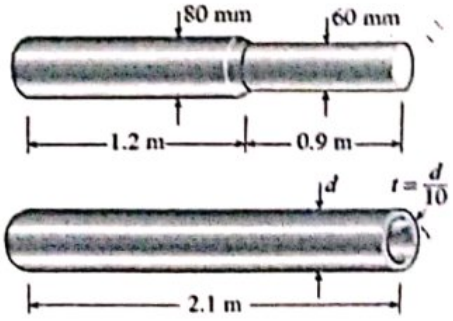

Figure 6.

7. A thin cylindrical shell subjected to internal fluid pressure, the end being closed by
   a) Two water tight pistons attached to the common piston rod
   b) Hemispherical end

   Find the increase in the internal diameter in each case, given that the internal diameter is 200 mm, thickness 5 mm, Poisson's ratio is 0.3, Young's modulus is 200 GN/m², and the internal pressure is 3.5 MN/m².