Final Assessment Test – November 2019

VIT
Vellore Institute of Technology

Course: MEE2002 - Strength of Materials
Class NBR(s): 1149 / 1828 Slot: A1+TA1+V1
Time: Three Hours Max. Marks: 100

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

Answer any FIVE Questions
(5 X 20 = 100 Marks)

18BME0665

1. a) A steel bolt of 20 mm diameter passes centrally through a copper tube of internal diameter 28 mm and external diameter 40 mm as shown in Fig.1. 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. [10]

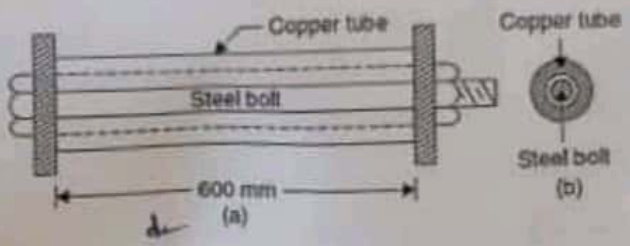

Fig. 1

b) A steel rod of 20 mm diameter passes centrally through a copper tube of 50 mm external diameter and 40 mm internal diameter. The tube is closed at each end by rigid plates of negligible thickness. The nuts are tightened lightly home on the projecting parts of the rod. If the temperature of the assembly is raised by 50°C, calculate the stress developed in copper and steel. Take E for steel and copper as 200 GN/m^2 and 100 GN/m^2 respectively. The value of co-efficient of linear expansion (α) for steel and copper is given as 12×10^{-6} per °C and 18×10^{-6} per °C respectively. [10]

2. An elemental cube is subjected to tensile stress of 60 N/mm^2 and 20 N/mm^2 acting on two mutually perpendicular planes and a shear stress of 20 N/mm^2 on these planes. Draw the Mohr's circle of stresses and determine the magnitude and direction of principal stresses and also the maximum shear stress. [20]

3. Draw the S.F. and B.M. diagrams indicating values at salient point for the beam shown in Fig.2 and also find the point of contraflexure. [20]

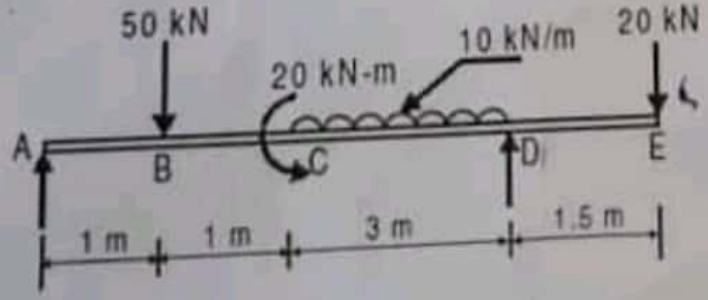

Fig. 2

4. A beam ABC of length 9 m has one support of the left end and the other support at a distance of 6 m from the left end. The beam carries a point load of 12 kN at right end and also carries a uniformly distributed load of 4 kN/m over a length of 3 m as shown in Fig.3. Determine the slope and deflection at point C. [20]

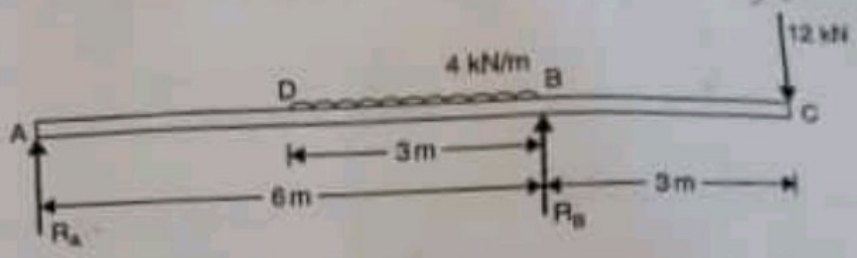

Fig. 3

5. a) What do you understand by neutral axis and moment of resistance? Explain. [5]

b) A hollow shaft, having an internal diameter 40% of its external diameter, transmits 562.5 kW power at 100 rpm. Determine the external diameter of the shaft if the shear stress is not to exceed 60 N/mm^2 and the twist in a length of 2.5 m should not exceed 1.3^0. Assume maximum torque = 1.25 × mean torque and modulus of rigidity = 9×10^4 N/mm^2. [15]

6. a) Discuss the stability of long and short column in brief. [5]

b) Find the Euler crushing load for a hollow cylindrical cast iron column 15 cm external diameter and 25 mm thick if it is 6 m long and is hinged at both ends. Take $E = 8 \times 10^4$ N/mm^2. Compare the load with the crushing load as given by Rankine's formula, taking $f_c = 550$ N/mm^2 and $\alpha = \frac{1}{1600}$; for what length of the column would these two formulae give the same crushing load? [15]