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BAS-008

B.Tech. (AEROSPACE ENGINEERING) (BTAE)

Term-End Examination

December, 2015

BAS-008 : STRENGTH OF MATERIALS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. Define bulk modulus, modulus of elasticity and modulus of rigidity. Derive the relationship between these three moduli. *10*

2. A steel rod of 60 mm diameter and 1 m long is encased by a cast iron sleeve 8 mm thick and of internal diameter 60 mm. This assembly of composite section is under a load of 40 kN (tensile). Find the stresses in two materials and elongation of the composite assembly. Take E for steel = 200 GPa and E for cast-iron = 100 GPa. Give a neat sketch of the assembly. *10*

3. A steel rod, 20 mm diameter and 1·5 m long, is constrained between supports A and B as shown in Figure 1. The material is stress-free at 27°C. Determine the stress in the material when the temperature increases to 50°C for the following conditions :

(a) If the supports are unyielding.

(b) If the support B yields by 0·1 mm outwards.

Take E for steel = 200 GPa and α for steel = 12×10^{-6}/°C. *10*

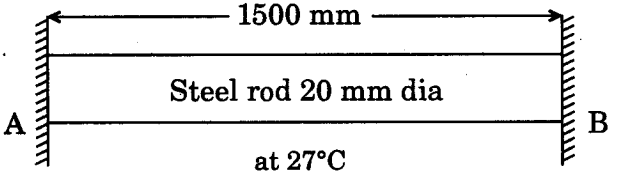


Figure 1

4. Draw the BMD and SFD for the beam shown in Figure 2. *10*

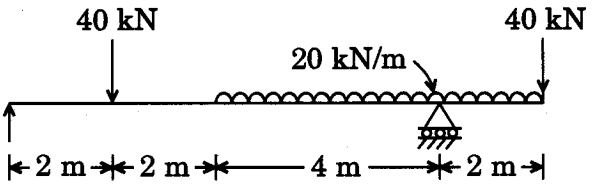


Figure 2

5. (a) Define the terms section modulus and flexural rigidity. *4*

(b) A rectangular section, 200 mm wide and 400 mm deep, is used as a beam. Find the maximum moment carrying capacity of this beam so that the permissible stress of 50 MPa is not exceeded in the material. *6*

6. A short bar of rectangular section 25 mm × 50 mm is subjected to an axial compressive force of 50 kN. Find the stresses (normal and shear) on the plane AB shown in Figure 3. *10*

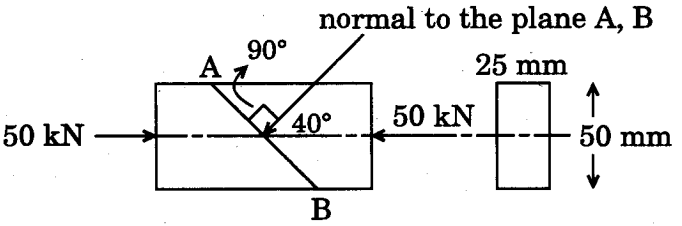


Figure 3

7. For the composite beam section shown in Figure 4, determine the maximum central concentrated load, if this section is used as a beam of 800 mm span (simply supported).

Take permissible stresses in steel and brass as 120 MN/m^2 and 80 MN/m^2 respectively and modulus of elasticity for steel E_s = 200 GN/m^2 and for brass E_b = 100 GN/m^2. *10*

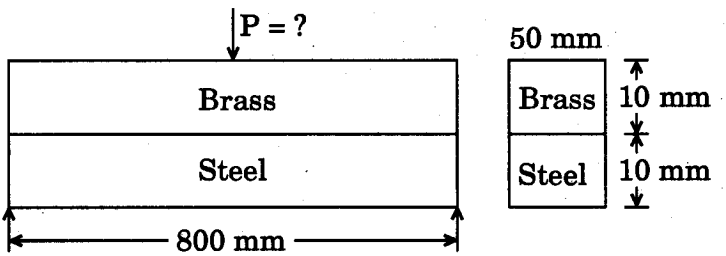
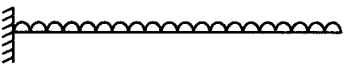


Figure 4

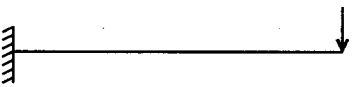
8. (a) Describe the Castigliano's first and second theorems. *5*

(b) A solid circular shaft is 4 m long and has a diameter of 80 mm. Find the torsional strain energy stored in it when it is subjected to a torque of 200 Nm. Take modulus of rigidity, G = 80 GPa. *5*

9. (a) Draw the typical shapes of BMD and SFD for the following : *5*

(i) 

Cantilever beam subjected to UDL

(ii) 

Cantilever beam subjected to point load at free end

(b) What are the assumptions made in the theory of simple bending ? *5*

10. (a) Define any ***two*** of the following : *2×3=6*

(i) Limit of proportionality and Elastic limit

(ii) Brittle material and Ductile material

(iii) Principal plane and Principal stress

(b) Describe the 'shear centre'. *4*