Question Paper

Exam Date & Time: 03-May-2019 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
II SEMESTER B.Sc. (APPLIED SCIENCES) IN ENGENEERING
END SEMESTER THEORY EXAMINATION APRIL / MAY 2019
Strength Of Materials [IME 123 - S2]

Marks: 100 **Duration: 180 mins.**

Answer 5 out of 8 questions.

Missing data if any, may be suitably assumed.

1) A) Answer the following: (10)

a. Define: Safe stress
b. Write the equations relating elastic constants
c. Define: Polar section modulus for a hollow circular section
d. Define: Poison's ratio and modulus of rigidity
e. Define: Factor of safety

B) For a simply supported beam of span L, subjected to UDL of magnitude w/unit length acting throughout the span, find the shear force and bending moment at salient points and draw SFD and BMD. (10)

2) A) For a simply supported beam as shown in figure Q-2.A, calculate the shear force and bending moments at salient points and plot the variation of shear force and bending moment along the entire span. Also calculate the maximum bending moment. (10)

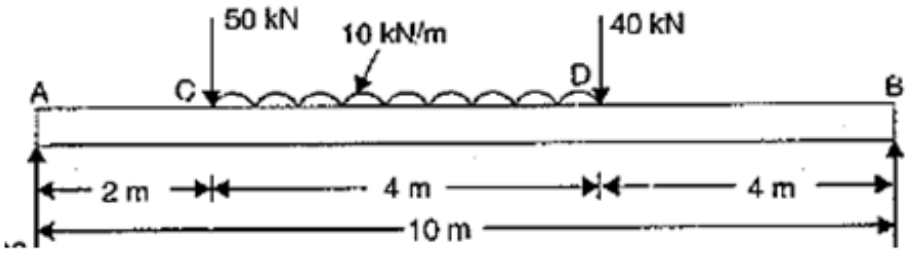

Figure Q-2.A

B) A shaft is required to transmit 245 kW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40 N/mm^2 and the twist 1^0 per meter length. Determine the diameter required if the shaft has a hollow circular cross section. Take OD=2 x ID and G=80 kN/mm^2. (10)

3) With usual notations, derive the bending equation for a beam. (10)

A)

B) Derive the equation for axial deformation of a uniformly tapering circular cross section bar subjected to a load P along the axis. (10)

4) Derive the differential equation for deflection. (10)

A)

B) Draw the SFD and BMD for a simply supported beam of span 7 m and carrying a udl of 10 kN/m for a length of 3 m from the left support and 5 kN/m for a length of 2 m from right support. Also calculate the maximum bending moment on the beam section. (10)

5) A timber beam of rectangular section of length 8 m is simply supported. The beam carries a udl of 12 kN/m run over the entire length and a point load of 10 kN at 3 m from the left support. If the depth is two times width and the stress in timber is not to exceed 8 N/mm^2, find suitable dimensions of the section. (10)

A)

B) A cantilever of length 3 m carries two point loads of 30 kN at the free end and 20 kN at a distance of 1 m from the free end. Find the deflection at free end taking $E=2 \times 10^5$ N/mm^2 and $I=2 \times 10^8$ mm^4. Use double integration method. (10)

6) An I-section as shown in figure Q-6.A is subjected to a shear force of 40 kN. Draw the variation of shear stress diagram across the depth and show the shear stress at all salient points. (10)

A)

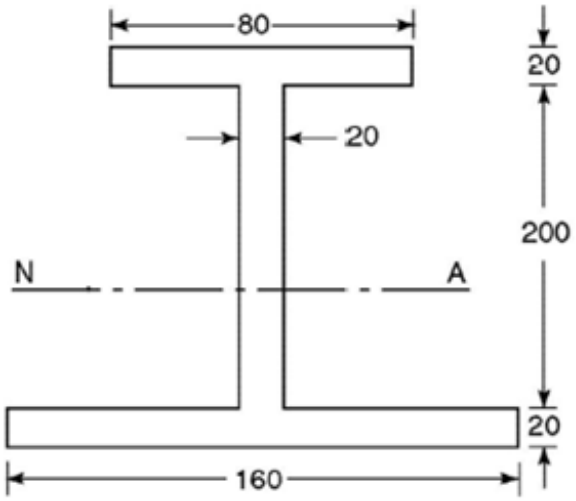

Figure Q-6. A

B) Derive the equation for central deflection and slope at any one end for a simply supported beam subjected to udl of w/unit length on entire span by using double integration method. (10)

7) Determine the buckling load for a short column of T-section. The flange (10)

A) width being 100 mm, overall depth 80 mm, both flange and web 10 mm thick. Assume the column length as 3 m and has both ends hinged. Take E= 200 GN/m^2. Use Euler's formula.

B) Find the maximum deflection and slope for a beam loaded as shown in figure Q-7.B. Take EI=15 x 10^9 kN-mm^2. Use Macaulay's method. (10)

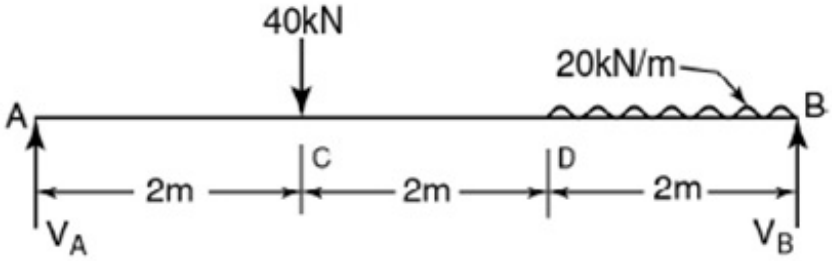

Figure Q-7.B

8) For a beam as shown in figure Q-8.B, find the slope at each of supports and at right end along with the maximum upward deflection between the supports.Take E=2 x 10^5 N/mm^2 and I=5 x 10^8 mm^4. Use Macaulay's method. (10)

A)

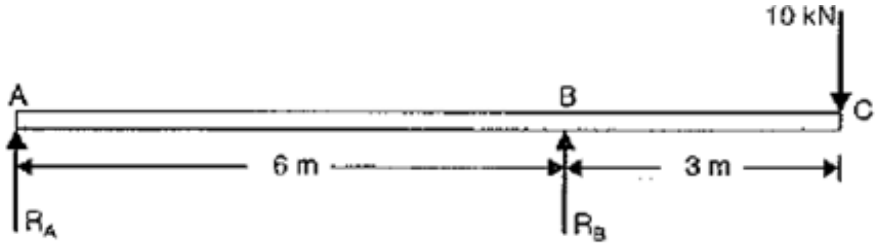

Figure Q-8.B

B) A thick cylindrical pipe with outside diameter 300 mm and internal diameter 180 mm is subjected to an internal fluid pressure of 42 N/mm^2 and external pressure of 6 N/mm^2. Determine the stresses in the material. If the external pressure is doubled, what internal pressure can be maintained without exceeding the previously determined maximum stress? (10)

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