Question Paper

Exam Date & Time: 11-Jun-2019 (09:30 AM - 12:30 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]

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. Differentiate between lateral strain and linear strain for rectangular bar
b. Define Hooke's Law
c. Define section modulus for a hollow rectangular section
d. Draw the variation of shear stress across a circular shaft subjected to torque T (N-mm)
e. Differentiate between thick and thin cylinders

B) For a simply supported beam of span L, subjected to uvl of magnitude w/unit length (zero at left end) 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 moment at salient points and plot the variation of shear force and bending moment along the entire span. (10)

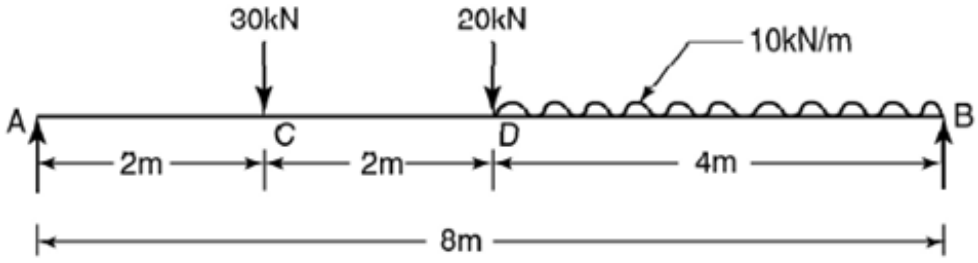

Figure Q-2.A

B) Determine the diameter of a solid shaft which will transmit 440 kW at 280 rpm. The angle of twist should not exceed one degree per meter length and maximum torsional shear stress is to be limited to 40 N/mm^2. Assume G as 84 kN/mm^2. (10)

3) Derive the equation for shear stress if a beam of cross section area 'a' is subjected to shear force of F. (10)

A)

B) A brass bar having cross sectional area of 1000 mm^2, is subjected to axial forces as shown in figure Q-3.B. Find the axial deformation of bar taking $E=1.05 \times 10^5$ N/mm^2. (10)

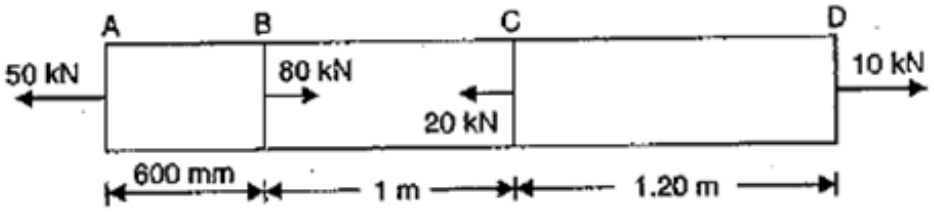

Figure Q-3.B

4) Derive the differential equation for deflection of a beam. (10)

A)

B) Draw the SFD and BMD for a simply supported beam of length 9 m and carrying a udl of 10 kN/m for a distance of 6 m from the left support. Also calculate the maximum bending moment on the beam section. (10)

5) An I-section beam as shown in figure Q-5.A, is simply supported over a span of 12 m. If the maximum permissible bending stress is 80 N/mm^2, what concentrated load W can be carried at a distance of 4 m from right support? (10)

A)

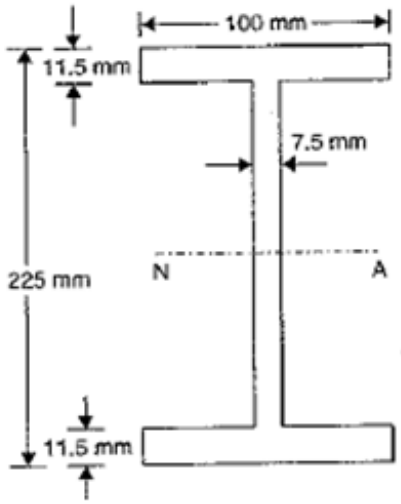

Figure Q-5.A

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) A T-section of a beam has a flange of dimension 100 x 12 mm and web of size 12 x 88 mm. If the cross section is subjected to a shear force of 20 kN, then find the shear stress at salient points and draw shear stress variation diagram. (10)

A)

B) Derive the equation for central deflection and slope at any one end for a simply supported beam subjected to concentrated load W at the mid span by using double integration method. (10)

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

B) Find the deflection at point C for a beam loaded as shown in figure Q-7.B. Take EI=10,000 kN-m^2. Use Macaulay's method. (10)

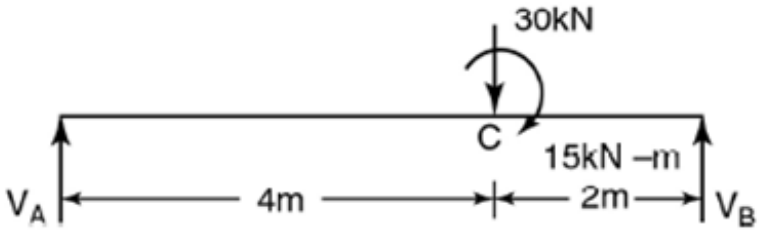

Figure Q-7.B

8) A) Determine the deflection at mid span for a loaded beam as shown in figure Q-8.A. Take E=2 x 10^5 N/mm^2 and I=4.3 x 10^8 mm^4. Use Macaulay's method. (10)

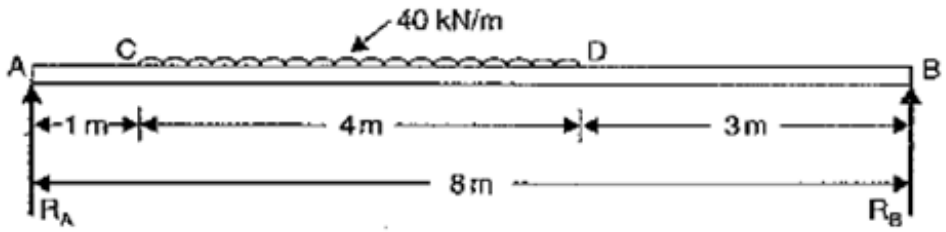

Figure Q-8.B

B) A thick cylindrical pipe with outside diameter 300 mm and internal diameter 200 mm is subjected to an internal fluid pressure of 14 N/mm^2. Determine the maximum hoop stress developed in the cross section. Sketch the variation of hoop stress across the thickness of pipe. (10)

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