Question Paper

Exam Date & Time: 02-Dec-2019 (09:30 AM - 12:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

INTERNATIONAL CENTRE FOR APPLIED SCIENCES
END SEMESTER THEORY EXAMINATION - NOVEMBER/ DECEMBER 2019
II SEMESTER B.Sc.(Applied Sciences)in Engg.
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)
i) Differentiate between normal stress and shear stress
ii) Define Hooke's Law
iii) Define section modulus for a rectangular section
iv) Draw the variation of bending stress across a symmetrical I-section
v) Write the equations for stresses in case of thin cylinders

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 beam as shown in fig 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)

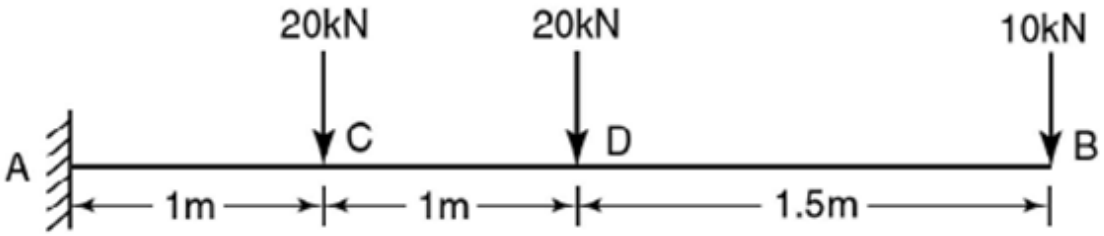


Fig Q-2.A

B) A hollow circular shaft 200 mm OD and metal thickness 25 mm is transmitting power at 200 rpm. The angle of twist over a length of 2 m was found to be 0.5 degrees. Calculate the power transmitted and the maximum shear stress induced in the section. Take G=84 kN/mm^2. (10)

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

B) Taking P_1=45kN, P_3=450kN and P_4=130kN calculate P_2 for equilibrium of the bar (Fig.Q-3.B) and determine its total elongation due to the applied loads assuming (10)

$E=2.1x10^5 N/mm^2$.

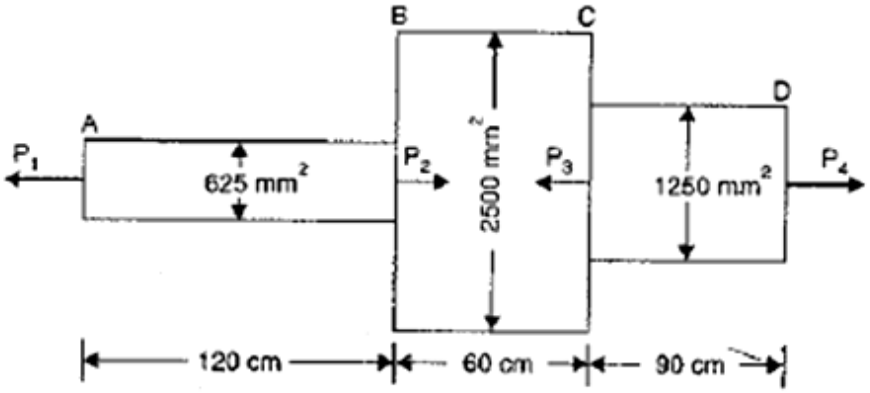


Fig.Q-3.B

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

A)

B) For a beam as shown in Fig.Q-4.B, draw the SFD and BMD. Calculate the values at all salient points.Fig.Q-4.B (10)

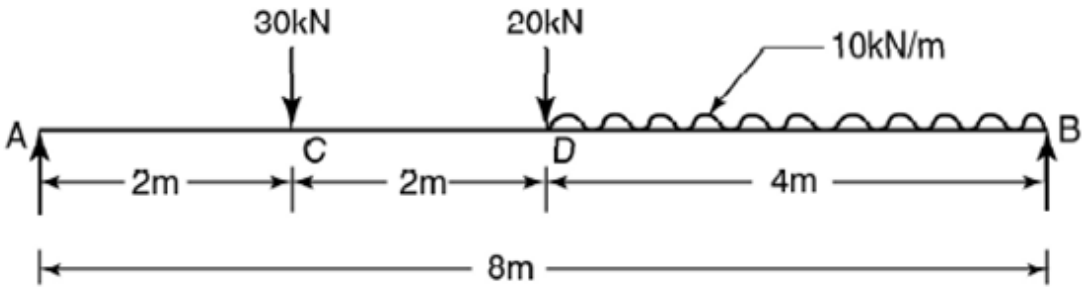
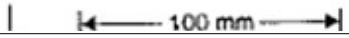


Fig.Q-4.B

5) An I-section beam as shown in fig 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)



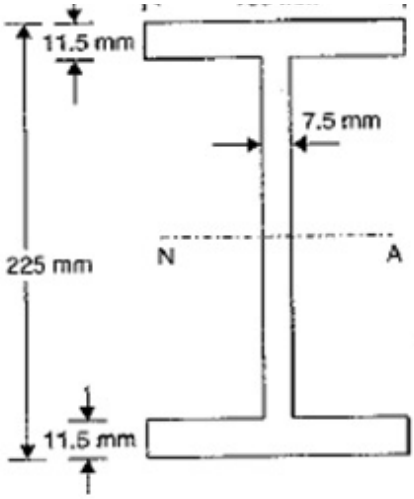


Fig Q-5.A

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) A I-section of a beam has upper flange of dimension 80 x 20 mm, web of size 20 x 200 mm and lower flange 160 x 20 mm. If the cross section is subjected to a shear force of 40 kN, then find the shear stress at salient points and draw shear stress variation diagram. (10)

B) Derive the equation for central deflection and slope at any one end for a simply supported beam subjected to udl on entire 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) For a beam as shown in fig. Q-7.B, find the position and value of maximum deflection, slope at mid span and deflection at the point C. Take E= 200 GPa and $I=15 \times 10^6$ mm^4. (10)

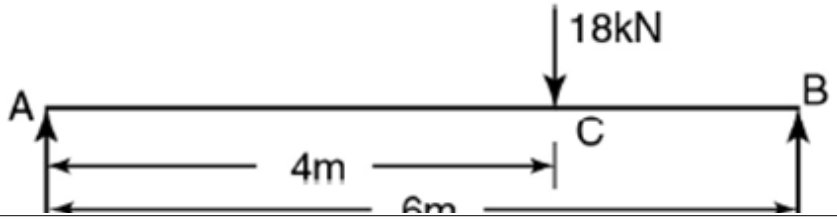


Fig.Q-7.B

8) A) Determine the maximum deflection and maximum slope for a loaded beam as shown in fig Q-8.A. Take EI=15 x 10^9 kN-mm^2. Use Macaulay's method. (10)

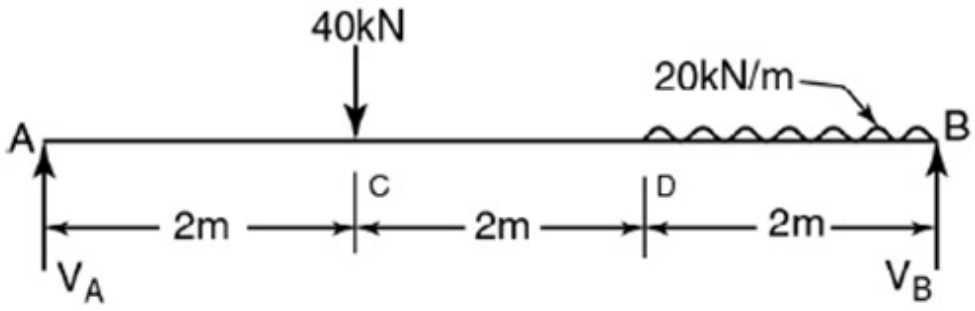


Fig Q-8A

B) A thick cylinder of internal diameter 160 mm is subjected to an internal pressure 40 N/mm^2. If the allowable stress in the material is 120 N/mm^2, find the thickness required. (10)

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