R18

Code No: 153BU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, February -2024

STRENGTH OF MATERIALS - I

(Civil Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

1.a)	Define Poisson's ratio.	[2]
b)	Explain the St. Venant's Principle.	[3]
c)	List out the different types of loads acting on beams	[2]
d)	Derive the relationship between shear force and rate of loading.	[3]
e)	Define section modulus and neutral axis.	[2]
f)	What is the relationship between bending stress and radius of curvature?	[3]
g)	Define conjugate beam.	[2]
h)	Define and highlight the applications of the moment-area method.	[3]
i)	What are the principal stresses?	[2]
j)	Compare the Maximum Principal Stress Theory and Maximum Principal Strain Theory.	[3]

PART – B

(50 Marks)

2. Derive the expression for strain energy when the load is applied suddenly. [10]

OR

3. Two copper rods and one steel rod together support a load 'P' as shown in Figure.1. The cross-sectional area of steel rod is 2500 mm^2 and of each copper rod is 1600 mm^2. If the stresses in the copper and steel are not exceed 50 MPa and 100 MPa, determine the safe load that can support. Take $E_{steel} = 2 \times 10^5$ N/mm^2 and $E_{copper} = 1 \times 10^5$ N/mm^2. [10]

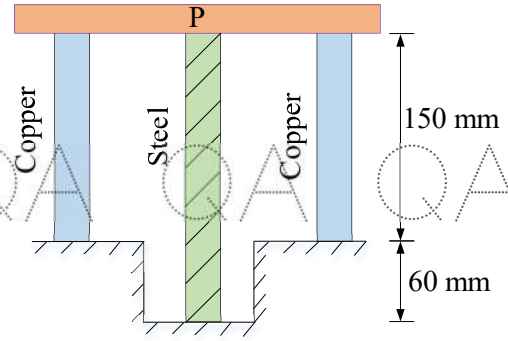

Figure. 1

4. Construct the shear-force and bending moment diagrams for the beam shown in Figure.2. Label all significant points on each diagram and identify the maximum moments along with their respective locations. Clearly differentiate straight-line and curved portions of the diagrams. [10]

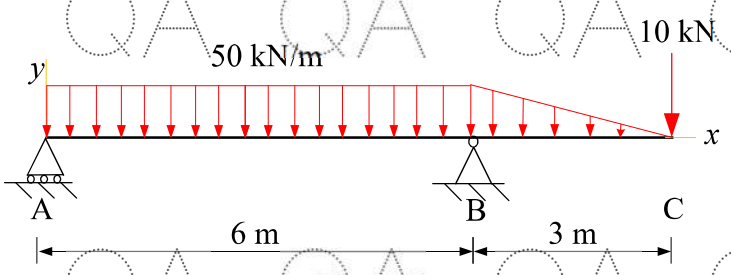

Figure. 2

OR

5. Construct the shear-force and bending moment diagrams for the beam shown in Figure.3. Label all significant points on each diagram and identify the maximum moments along with their respective locations. Clearly differentiate straight-line and curved portions of the diagrams. [10]

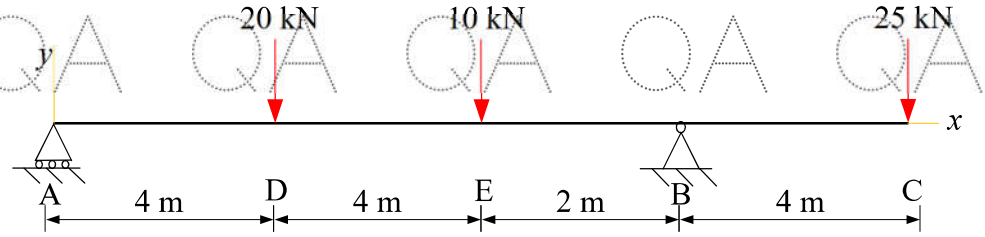

Figure.3

6. A uniformly distributed load of 5 kN/m is applied to a cantilever beam (shown in Figure 4) having the cross-section shown in Figure.5. Determine the maximum tension and compression bending stresses produced in the beam. [10]

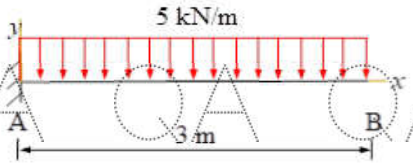

Figure. 4

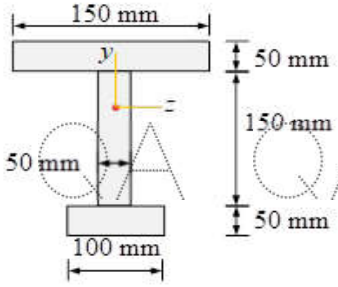

Figure 5

OR

7. A simply supported beam of 5 m carries a uniformly distributed load of 10 kN/m is shown in Figure.6 having the cross-section as shown in Figure 7. At section a-a, determine the magnitude of the shear stress in beam at point D and E. [10]

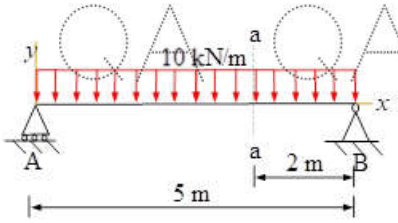

Figure 6

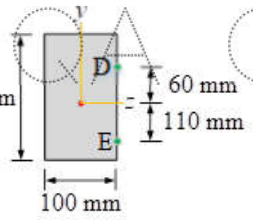

figure 7

8. Determine the deflection at the free end for the cantilever as shown in Figure. 8 using double-integration method. Assume *EI* to be constant. [10]

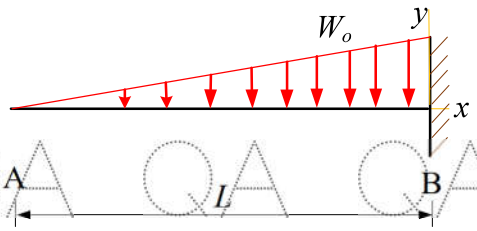

Figure. 8

OR

9. Determine the slope and deflection at point B for the cantilever beam shown in Figure.9 using conjugate beam method. Assume E = 200 GPa and I = 60 × 10^6 mm^4. [10]

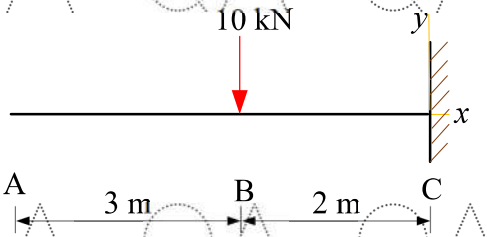

Figure.9

10. Determine the diameter of a bolt subjected to an axial pull of 12 kN and a transverse shear force of 6 kN, using Maximum Principal Stress Theory. Assume the elastic limit in tension as 180 N/mm², a factor of safety of 4, and Poisson's ratio of 0.25. [10]

OR

11. The stresses shown in Figure.10 act at a point on the free surface structural component. Determine the normal stresses σ_x and σ_y the τ_{xy} shear stress at the point. [10]

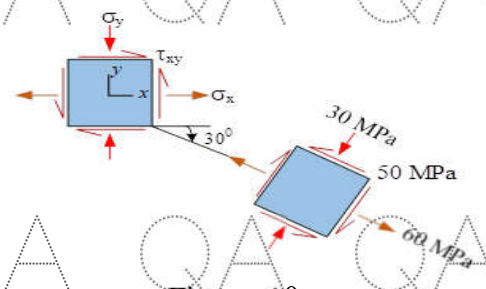

Figure. 10

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