Code No: 153BU

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JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, September/October - 2023
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) If the linear strain in a steel specimen is 0.001 and the lateral strain is 0.0003, find the Poisson's ratio. [2]
b) Draw stress-strain diagram for mild steel, brittle material and a ductile material and indicate salient points. [3]
c) Define beam and point of contra flexure. [2]
d) Explain the following terms:
i) Shear force, ii) Shear force diagram iii) bending moment diagram. [3]
e) Draw the bending stress distribution for a symmetrical I section. [2]
f) A beam subjected to a bending stress of $5N/mm^2$ and the section modulus is 3530 cm^3. What is the moment of resistance of the beam? [3]
g) What are the important points in finding slope and deflection by Macaulay's Method? [2]
h) State Mohr's theorems I and II [3]
i) Define principal plane and principal stress. [2]
j) Write about maximum principal stress theory. [3]

PART – B

(50 Marks)

2. A steel tube 50mm external diameter 5mm thick encloses centrally a copper bar of 30 mm diameter. The bar and tube are rigidly connected together at the end at a temperature of 30^0C.The composite bar is subjected to an axial compressive load of 60kN and the temperature is raised to 150^0C. Determine the stresses in the steel tube and copper rod. Take $\alpha_s = 12x10^{-6}/^0C$, $\alpha_{copp} = 18 \times 10^{-6}/^oC$, $E_s = 200$ GPa, $E_{copp} = 100$ GPa. [10]

OR

3.a) A straight circular rod tapering from diameter 'D' at one end to a diameter 'd' at the other end is subjected to an axial load 'P'. Obtain an expression for the elongation of the rod.
b) Define Elasticity and plasticity. [5+5]

4.a) A cantilever 2 m long is loaded with a uniformly distributed load of 2 kN/ m run over a length of 1m from the free end. It also carries a point load of 4 kN at a distance of 0.5 m from the free end. Draw the Shear force Diagrams and Bending Moment diagrams.
b) Give the relationship between B.M. & S.F. and rate of loading in a beam. [5+5]

OR

5. Analyse the beam loaded as shown in figure 1. Draw the SFD and BMD. [10]

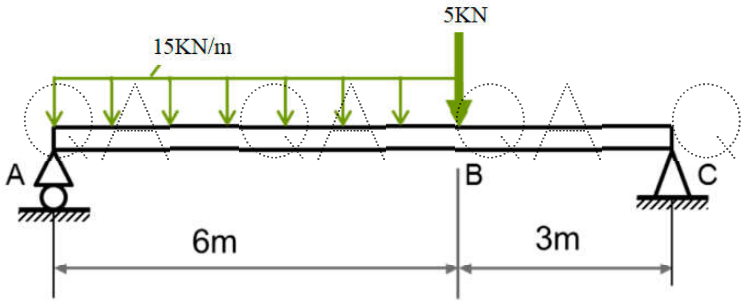

Figure 1

6. A T- section of a beam has the following dimensions width of the flange 100mm, overall depth 80mm, thickness of the web 10mm, thickness of flange 10mm. Determine the maximum bending stress in the beam, when the bending moment of 20 kN-m is acting one of the section. [10]

OR

7. Derive the pure bending equation. [10]

8. Obtain the deflection under the greater load for the beam shown in figure 2, using the conjugate beam method. Take EI is constant. [10]

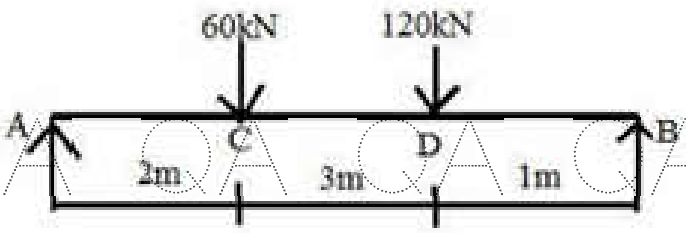

Figure 2

OR

9. A cantilever of length 3 m carries a uniformly distributed load of 15kN/m over a length of 2 m from the free end. If I =10^8 mm^4 and E=2 × 10^5 N/mm^2, find: (i) Slope at the free end and (ii) Deflection at the free end. [10]

10. The principal stresses at a point across two perpendicular planes are 75 MN/m^2 (Ten) and 35 MN/m^2(Comp) . Find the normal, tangential stresses and the resultant stress and its obliquity on a plane at 200 with the major principal plane. Use Analytical and Mohr's circle method. [10]

OR

11.a) Determine the normal, shear and resultant stress in magnitude and direction in a plane, the normal of which makes an angle of 30^0 with the direction of 40MN/m^2 stress (Ten) The value of other tensile stress is 20MN/m^2.

b) A mild steel shaft is subjected to a maximum torque of 10kNm and a maximum bending moment of 7.5 kN-m, at a particular section. If the allowable equivalent stress in simple tension is 160MN/m^2 find the diameter of the shaft according to the maximum shear stress theory. [5+5]

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