R18

Code No: 153BU

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year I Semester Examinations, December – 2019

STRENGTH OF MATERIALS – I

(Civil Engineering)

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

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full 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) Define Point of Contraflexure. [2]
c) Draw the shear stress distribution across a triangular section 'Base =B and Height = H' and indicate the location of maximum shear stress if the section is subjected to flexural shear force 'F'. [2]
d) What is a conjugate beam? [2]
e) Define principal stresses. [2]
f) Explain the different types of stresses and strains. [3]
g) Derive the relationship between shear force and bending moment. [3]
h) Explain the assumptions made in the theory of simple bending. [3]
i) State Mohr's theorems. [3]
j) Draw the Mohr's Circle of stress if an element is subjected to only shear stress of 10 MPa. [3]

PART – B

(50 Marks)

2.a) Derive the relation between the various elastic constants.
b) A stepped bar is subjected to axial forces as shown in Figure 1. Determine the safe value of 'P', if normal stresses in steel, brass and copper are limited to 180 MPa, 100 MPa and 120 MPa respectively. Also find the corresponding elongation of the bar. [4+6]

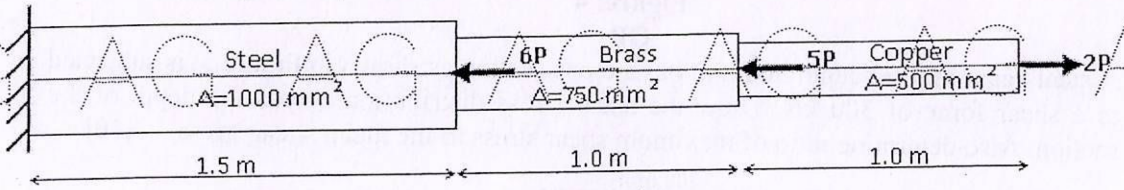

Figure: 1

OR

3.a) Derive an expression for the strain energy stored in a bar (L, A and E) subjected to an axial force 'P'.
b) A composite bar consists of a steel rod 1.8 m long and 25 mm diameter encased in a copper tube of 25 mm internal diameter and 32 mm external diameter. A weight of 10 kN is dropped from a height of 1.0 m on to a collar fixed at the bottom end of the composite bar. Calculate the maximum instantaneous stresses induced in the two components. Assume E = 200 GN/m^2 for steel and 100 GN/m^2 for copper. [5+5]

4. Draw the shear force and bending moment diagrams of a beam supported and loaded as shown in Figure 2. [10]

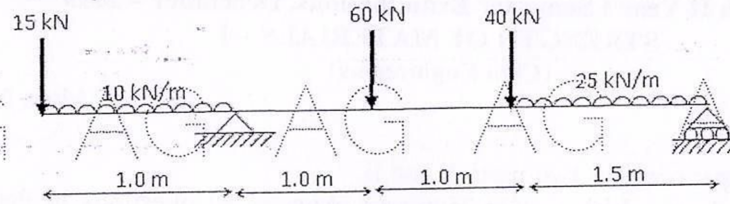

Figure: 2

OR

5. A simply supported beam is subjected to the loading as shown in Figure 3. Draw the shear force and bending moment diagrams. [10]

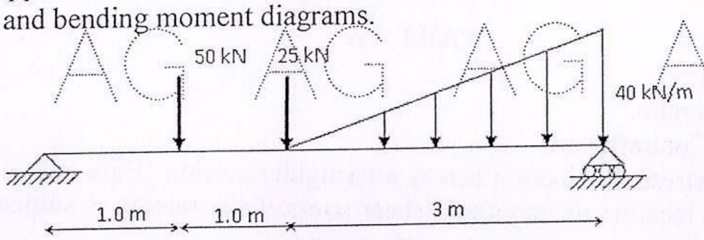

Figure: 3

6. Determine the width of the flange of a T-section, shown in Figure 4, of a simply supported beam if the permissible stresses 75 N/mm^2 in compression and 125 N/mm^2 in tension are reached simultaneously. Also find the moment of resistance of the section. The total depth of the section is 150 mm. [10]

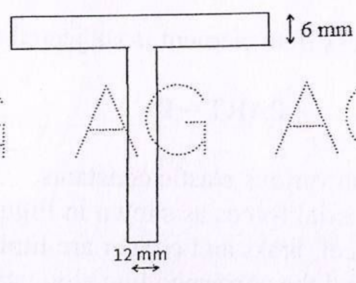

Figure: 4

OR

7. A steel beam of total depth 300 mm has a cross-section as shown in Figure 5, is subjected to a shear force of 300 kN. Draw the shear stress distribution across the depth of the section. Also determine ratio of maximum shear stress to the mean shear stress. [10]

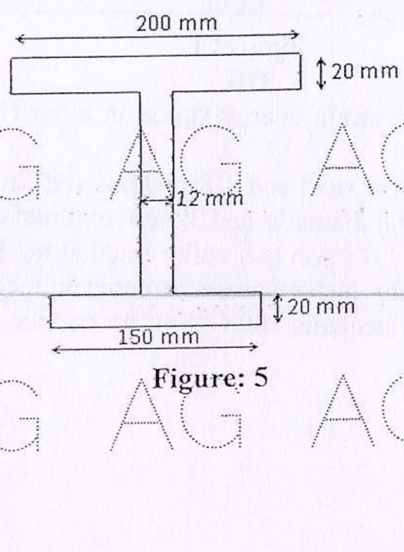

Figure: 5

8. A cantilever beam of span 2.4 m is subjected to the loading as shown in Figure 6, find the deflection and slope under the concentrated loads. [10]

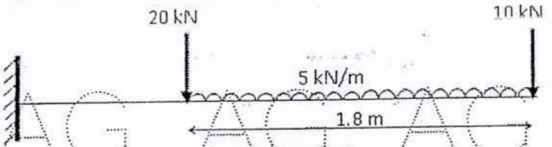

Figure: 6

OR

9. Using conjugate beam method, determine the deflection at the mid-span and slopes at the supports of a beam due to the action of a concentrated load at its mid-span as shown in Figure 7. [10]

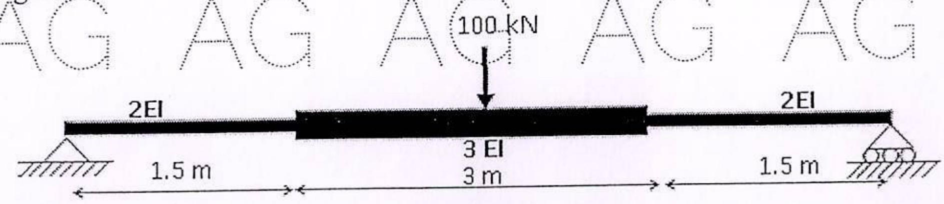

Figure: 7

10. The state of stress at a point in a loaded member is shown in Figure 8, using the Mohr's circle of stresses, determine (a) the plane of action and the magnitude of the principal stresses, (b) the magnitude and plane of maximum shear stress and (c) the stresses acting on a plane making 60^0 in clockwise direction with respect to x-axis. [10]

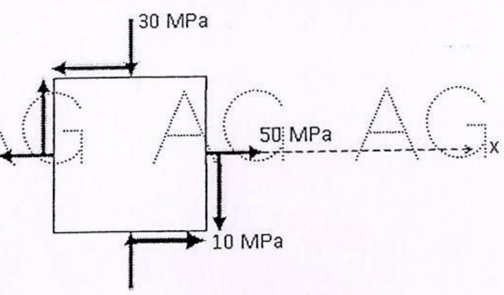

Figure: 8

OR

11. Explain the following theories of failure and obtain the failure criterion:
a) Von Mises theory
b) Maximum shear stress theory. [5+5]

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