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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: CIVIL ENGINEERING **Duration: 3 hrs.**
Course Code: 19CV3PCSOM **Max Marks: 100**
Course: STRENGTH OF MATERIALS **Date: 12.05.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed and mentioned clearly.

UNIT - I

1 a) Briefly explain Saint Venant's principle with the help of a figure. **04**

b) A steel bolt 20 mm diameter is enclosed in a brass tube of 25 mm external diameter and 2 mm thickness. Assume the ratio of E_s / E_b = 2. Initial length of both component is = 400 mm. Determine the stresses in the steel and brass, if the composite section is subjected to an axial compressive force of 50 kN. Assume E_s = 200 GPa. Find also the change in the length of the composite section. Refer Figure 1. **08**

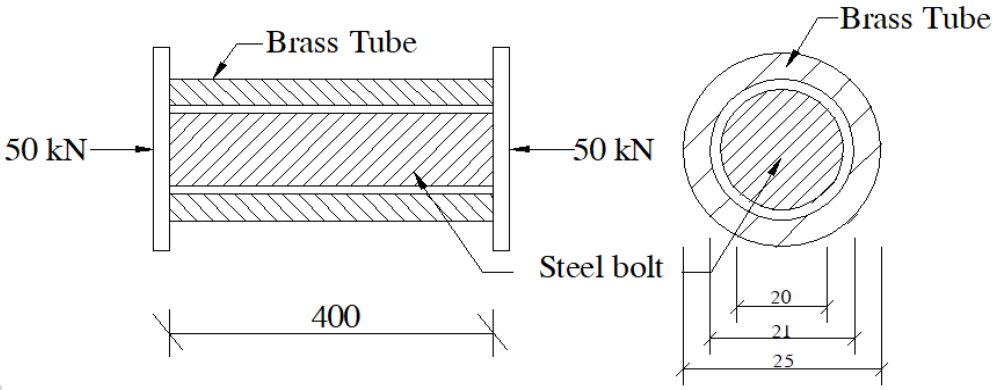

Figure 1

c) A plane element is subjected to stresses as shown in figure 2. Determine principal stresses, maximum shear stress and their planes. Sketch the planes determined. **08**

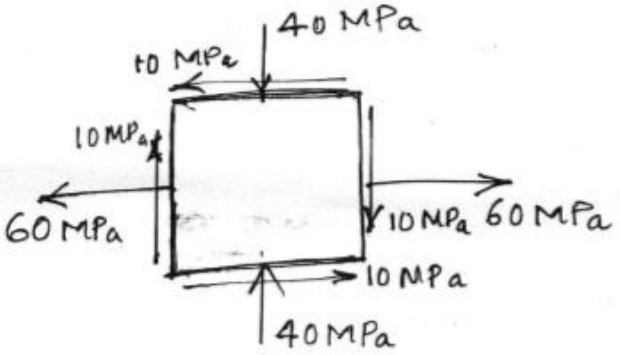

Figure 2

OR

2 a) Differentiate between nominal stress and true stress. **02**

b) A steel bolt of 25 mm diameter passes centrally through a copper tube of internal diameter 40 mm and thickness 8 mm. If the length of the composite section is 500 mm, what stresses will be introduced by 60^0 turn, if the pitch of thread is 4 mm. Assume Es = 200 GPa and Ec = 100 GPa. Refer Figure 3. **10**

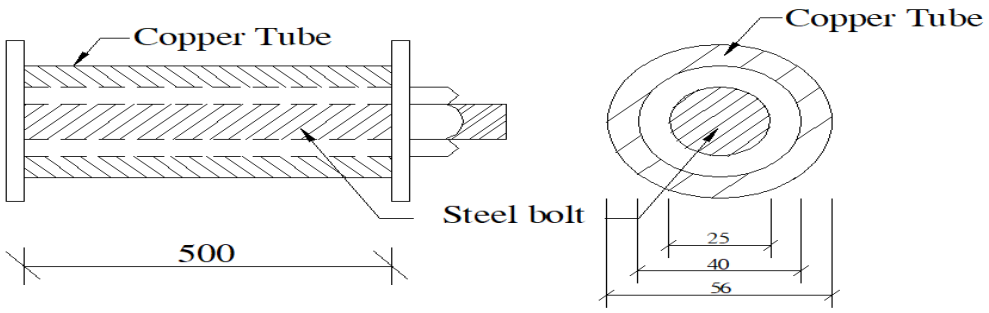

Figure 3

c) A bar of 20 mm diameter is tested in tension. It is observed that when a load of 37.7 kN is applied, the extension measured over a gauge length of 200 mm is 0.12 mm and contraction in diameter is 0.0036mm. Find the poisson's ratio and the three elastic constants. **08**

UNIT - II

3 a) Establish the relations between Load, Shear Force and Bending Moment. **05**

b) The beam is supported and loaded is as shown in the figure 4. Draw the SFD and BMD indicating the salient points. **15**

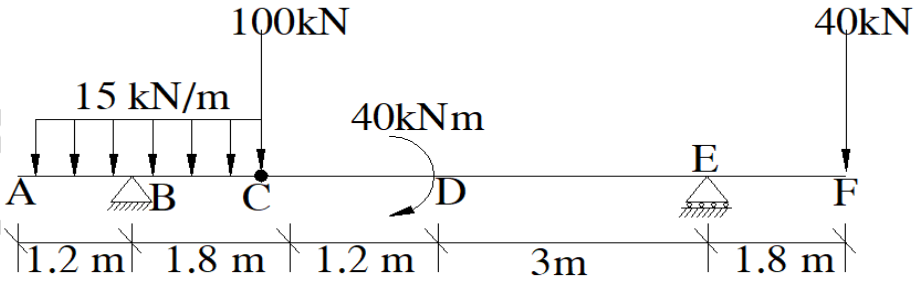

Figure 4

OR

4 a) A beam AB 6.5 m long and supported at A has a simple support of 1 m length between C and D. Assuming a uniformly distributed reaction between C and D, draw the Bending Moment and Shear Force diagrams for the loading shown in figure 5. **12**

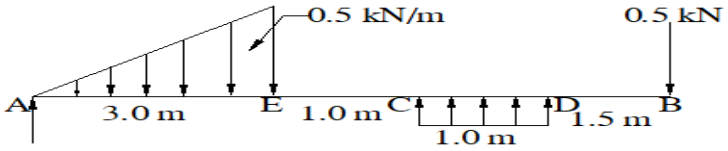

Figure 5

b) A beam ABC is simply supported at A and B. Supports A and B are at 3 m apart. The shear force disgram is as shown in the figure 6. Obtain the load diagram. Assume that there is no couple acting on the beam. **04**

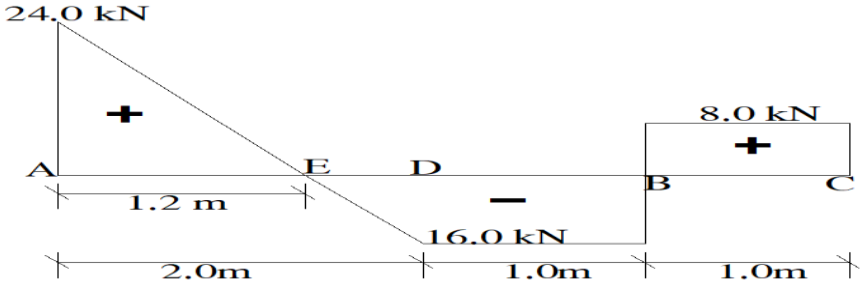

Figure 6

c) A horizontal beam AB of length 4 m is hinged at A and suported on roller at B. The beam carries inclined loads as shown in figure 7. The inclination are in degrees. Draw the thrust diagram only. **04**

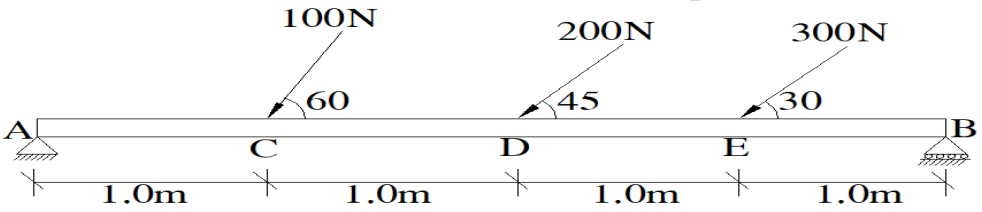

Figure 7

UNIT - III

5 a) List out the assumptions made in simple bending theory. **04**

b) Prove that in case of a beam of a rectangular cross section, the maximum shear stress developed is 1.5 times the average shear stress. **04**

c) An I section has flanges of size 180 mm x 10 mm and its overall depth is 500 mm. Thickness of the web is 8 mm. it is strengthend with a plate of size 240 mm x 12 mm on compression side. Refer figure 8. Find the moment of resistance of the section if permissible stress is 150 N/mm^2 in bending tension. What uniformly distributed load it can carry if it is used as a cantilever of span 3 m? **12**

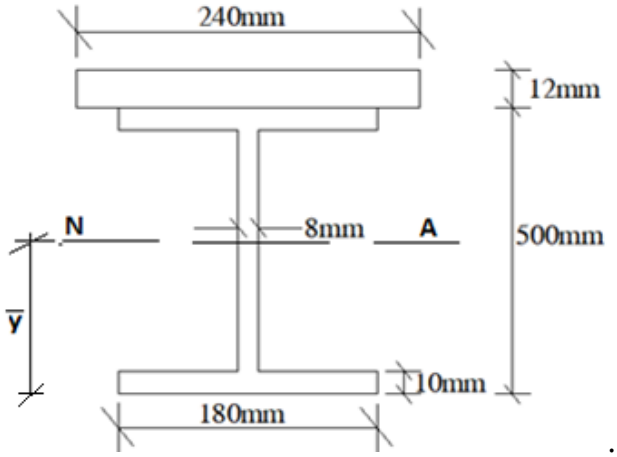

Figure 8

UNIT - IV

6 a) Discuss the limitations of Euler's formula. **04**

b) A built up column consists of two channels with two plates each 8 mm thick connected symmetrically as shown in the figure 9. The actual length of the column is 7 m and it is fixed at one end and hinged at the other. Find the safe axial compressive load taking the factor of safety as 2. **16**

Use Rankine's formula. The properties of the individual channel section are as under:

$I_{xx} = 1.8193 \times 10^7$ mm^4, $I_{yy} = 1.404 \times 10^6$ mm^4, A= 2821 mm^2, Distance of CG = Cy=21.7mm, Rankine's constants: fy = 300 MPa, $\alpha = 1 / 7500$.

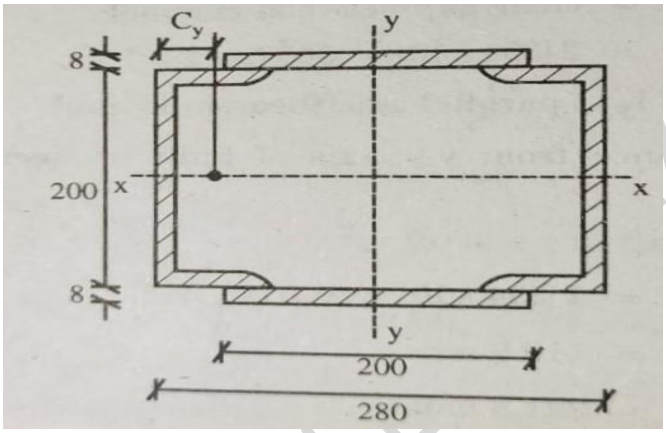

Figure 9

UNIT - V

7 a) Determine the diameter of solid shaft which will transmit 440 kW at 280 rpm. The angle of twist must not exceed one degree per metre length and the maximum torsional shear stress is to be limited to 40 N/mm^2. Assume G = 84 kN/mm^2. **13**

b) The diameter of a city water supply pipe is 750 mm. It has to withstand a water head of 60 m. Find the thickness of the seamless pipe, if the permissible stress is 20 N/mm^2. Take the unit weight of water as 9810 N/mm^3. **07**

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