3E1210

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3E1210

B.Tech. III Sem. (Main) Examination, April/May - 2022
Automobile Engineering
3AE4-07 Mechanics of Solids
AE, ME

Time : 3 Hours

Maximum Marks : 70

Instructions to Candidates:

Attempt **all ten** *questions from* **Part A**. *All five questions from* **Part B** *and* **three** *questions out of* **Five** *questions from* **Part C**.

Schematic diagrams must be shown wherever necessary. Any **data missing may** *suitably be assumed and stated clearly. Units of quantities* **used/calculated must** *be stated clearly.*

Use of following supporting material is permitted during examination. **(Mentioned** *in form No. 205)*

PART - A (Words limit 25)

(10×2=20)

1. Draw stress-strain diagram (Tensile test diagram).
2. Define the ultimate strength.
3. What is the Poisson's ratio?
4. Explain modulus of rigidity.
5. Write down the maximum shear stress theory.
6. Write down the maximum strain energy theory.
7. Write down the expression for equivalent twisting moment for shaft subjected to torsion and bending forces?
8. Write down the Rankine general formula for Columns.
9. Write the relationship among twisting moment, shear stress and torsional rigidity.
10. Write down the general bending moment equation having modulus of elasticity and moment of inertia.

PART - B (Words limit 100)

(5×4=20)

1. What are the "complimentary shear stresses"? Using Mohr circle, derive expression for normal and tangential stresses on a diagonal plane of a piece of material in pure shear.

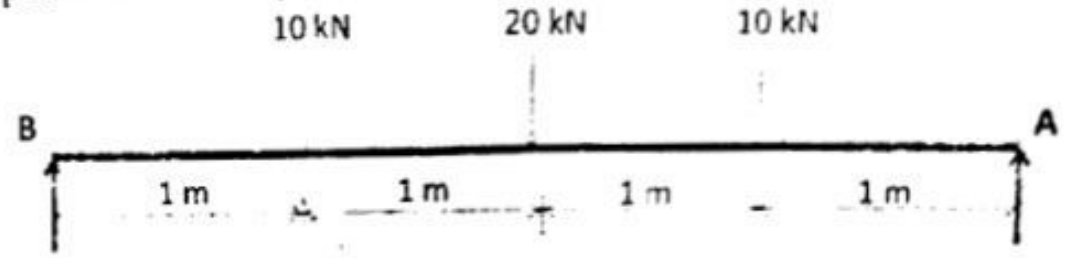
2. At a point in an elastic material under strain, there are normal stresses of 50N/mm² and 13 N/mm² respectively at right angles to each other with a shearing stress of 25 N/mm². Find the principal stresses and position of principal planes if:

i) 50 N/mm² is tensile and 30 N/mm² is also tensile.

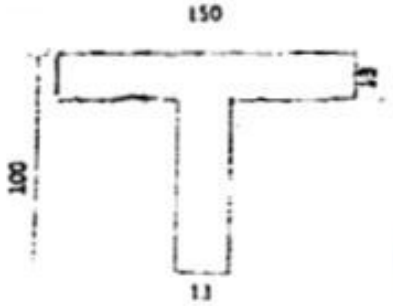
ii) 50 N/mm² is tensile and 30 N/mm² is compressive.

Find also the maximum shear stress and its plane in both the cases using mohr circle method.

3. Draw the shear force diagram and Bending moment diagram for following simply supported beam with point loads.



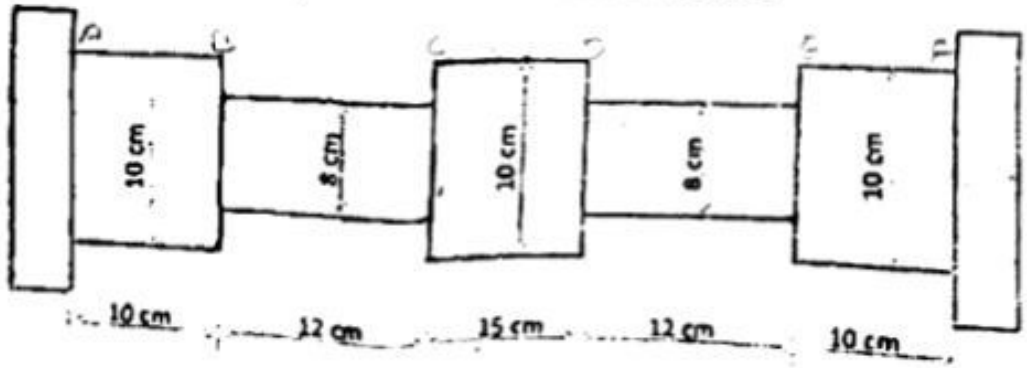
4. The cross section of a joist is a T section 150 mm × 200mm×13 mm with 150 mm side horizontal. Find the maximum intensity of shear stress and sketch the distribution of stress across the section if it has to resist a shear force of 80 kN.



5. A mild steel column is of hollow circular section with 120 mm external diameter and 90 mm internal diameter. The column is 3m long and hinged at both the ends. Calculate the maximum permissible load with an eccentricity of 20 mm if the maximum compressive stress is limited to 80 N/mm². Take E=2.05×10⁵ N/mm²

PART - C (Any three) (3×10=30)

6. A rod shown in the following fig. is subjected to a pull of 500 kN on the ends. Taking E = 205 kN/mm², find the extension of the rod.



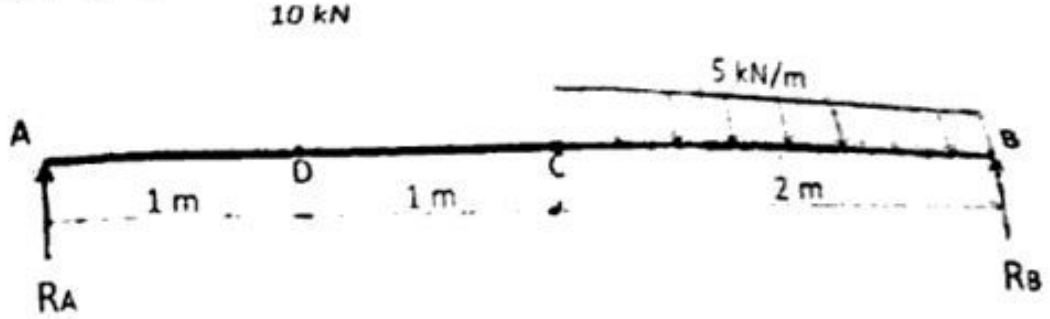
2. A beam AB of 4 metre span is simply supported at the ends and is loaded as shown in the following figure. Determine

i) Deflection at point C.

ii) Maximum deflection and

iii) Slope at the end A.

Take $E = 2\times10^5$ N/mm^2 and $I = 1000$ cm^4



3. A copper tube of 50 mm internal diameter, 1 m long and 1.25 mm thick has closed ends and is filled with the water under pressure. Neglecting any distortion of the end plates, determine the alteration of pressure when an additional volume of 3 cubic centimetres of water is pumped into the tube. https://www.rtuonline.com

4. A hollow steel shaft 4 m long is to transmit 150 kW power at 150 R.P.M. The total angle of twist in this length is not to exceed 2.5 degree and the allowable shear stress is 60 N/mm^2. Determine the inside and outside diameters if $N = 0.082\times10^6$ N/mm^2.

5. Using area moment method, compute

i) Deflection at point C,

ii) Slope at point B for the Beam AB as shown in the following figure.

Take $I = 1000$ cm^4 and is $E = 2\times10^5$ N/mm^2