B. Tech Degree III Semester Examination, November 2008

ME 303 MECHANICS OF SOLIDS

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

*(Answer **ALL** questions)*
*(Each question carries **FIVE** marks)*

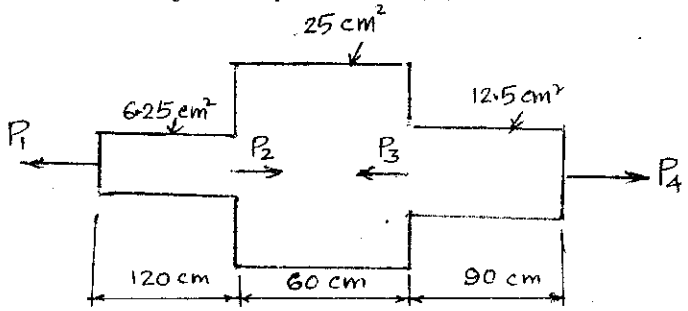
(5 x 8 = 40)

I. a. Define elastic constants. Give relationship between different elastic constants.
b. What is strain energy? How do you compute strain energy in tension?
c. Define Shear Force, Bending Moment and Moment of Resistance.
d. Derive expression for power transmitted through a circular shaft.
e. Show that shear stress varies parabolically for a rectangular beam.
f. Explain Nominal and Actual breaking stress.
g. What are the rules to be followed in Macaulay's method.
h. What is meant by buckling load? What are the method available to calculate it?

PART B

(4 x 15 = 60)

II A member ABCD is subjected to point loads P_1,P_2,P_3 and P_4 as shown in the figure.

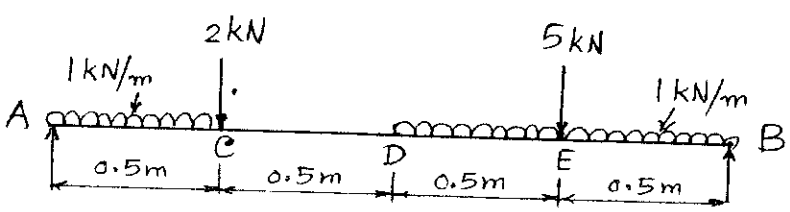


Calculate the force 'P' necessary for equilibrium, if $P_1 = 4500$ kN, $P_3 = 45{,}000$ kN and $P_4 = 13{,}000$ kN. Determine the total elongation of the member assuming E to be 2.1×10^6 kN/cm^2.

OR

III. At a point in a bracket, the stresses on two mutually perpendicular planes are 35 MN/m^2 and 15 MN/m^2 (both tensile). The shear stress across these planes is 9 MN/m^2. Find the magnitude and direction of the resultant stress on a plane making an angle of 40^0 with the plane of first stress. Find also the normal and tangential stresses on the planes.

IV. Draw the Shear Force and Bending Moment Diagram for the beam shown in the Figure.



OR

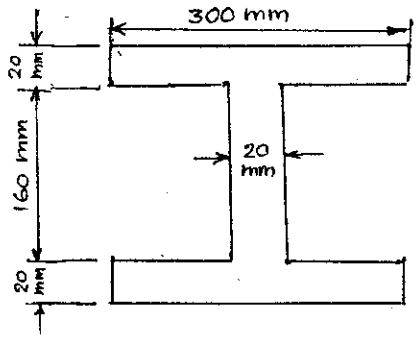
V. A shaft is required to transmit 245 kW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft should not exceed 40 N/mm^2 and the twist 1^0 per meter length. Determine the diameter required if

(i) The shaft is solid

(ii) The shaft is hollow with external diameter twice the internal diameter.

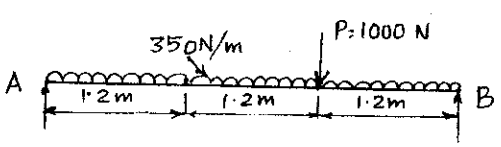
Take modulus of rigidity as 80 kN/mm^2.

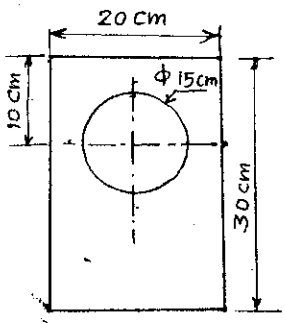
VI. A wide flanged beam section carries a shear force of 200 kN at a section of the beam as shown in the figure. Calculate the maximum shear stress in the material of the beam. Plot the schematic diagram of variation of shear stress through the depth of the beam.



OR

VII. A simply supported beam and its cross section are shown in the figure The beam carries a load P = 1000 N as shown. It's self weight is 350 N/m. Calculate the maximum Normal Stress at a-a.





VIII. A cantilever of length 3 m carries a u.d.l of 2 kN/m over a length of 2m from the fixed end and a point load of 2kN at the free end. Find the deflection at the free end, if I = 14 x 10^7 mm^4 and E = 0.1 x 10^5 N/mm^2.

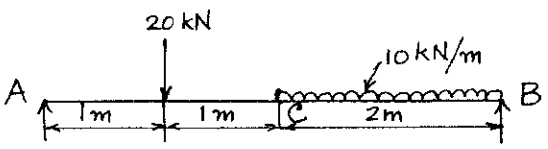
OR

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

(i) deflection at C

(ii) maximum deflection and slope at A

Use Macaulay's method. Given E = 200 x 10^6 kN/m^2 and I = 20 x 10^{-6}m^4.



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