APL 105(Mechanics of Solids and Fluids) MAJOR Test

Part A. Solids Maxm Marks 60

Q1. For the given stress tensor

$$\tau_{ij} = \begin{vmatrix} 300 & 100 & 0 \\ 100 & 200 & 0 \\ 0 & 0 & -100 \end{vmatrix} \quad N/cm^2$$

(a) Find Principal Stresses (9)

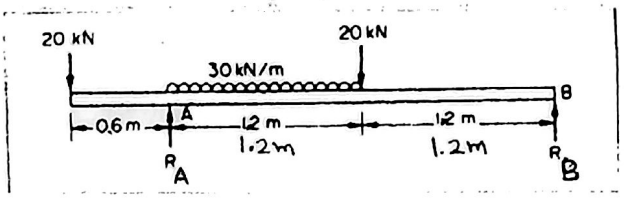
(b) If material yields in uniaxial tension case at 450 N/cm^2. Determine whether yielding occurs due to Tresca and Von-Mises criterion. (6)

Q2.

(a) Derive Torsion equation for circular shafts. State the assumptions made. (6)

(b) A column of length 1000Cm and modulus of elasticity $1x10^7$ N/cm^2 is subjected to compressive Load of $12.33x10^4$ N. The column is hinged at both the ends and having a rectangular X-section with dimensions aXb. If from operational point of view 'a' has to be 10 Cm, find the value of 'b' so that column should not buckle. (9)

Q3. Determine the deflection at a point 1m from the left end of the beam as shown using Macaulay'S method. $EI=0.65$ MNm^2. (15)



Q4.The billboard shown weighs 36 KN and is supported by a structural tube that has a 375mm outer diameter and a 12mm wall thickness. At a time when the resultant of the wind load is 12KN located at the center C of the billboard, determine the normal and shearing stresses at point H. (15)