Exam Code: 1015
Sub. Code: 7764

1129

M.E. (Mechanical Engineering)

Second Semester

MME-205(a): Advanced Machines of Materials

Time allowed: 3 Hours **Max. Marks: 50**

***NOTE**: Attempt five questions in all, selecting atleast two questions from each Unit. Assume suitable missing data if any.*

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UNIT- I

Q.1 At a point in the structural member, the 2D stresses are σ_x=80MPa, σ_y=40MPa, and τ_{xy}=30 MPa. Employ Mohr's circle to determine (a) the magnitude and orientation of the principal stresses and (b) the magnitude and orientation of the maximum shearing stresses and associated normal stresses. In each case, show the results on a properly oriented element; represent the stress tensor in matrix form.

Q.2 The displacement field and strain distribution in a member have the form

$$\varepsilon_x = a_0 + a_1 y^2 + y^4$$

$$\varepsilon_y = b_0 + b_1 x^2 + x^4$$

$$\gamma_{xy} = c_0 + c_1 xy\left(x^2 + y^2 + c_2\right)$$

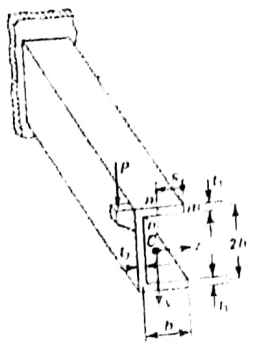
What relationships connecting the constants (a's, b's, and c's) make the foregoing expressions possible?

Q.3 A structural member is subjected to combined loading so that the following stress occur at a critical point:

$$\begin{bmatrix} 120 & 50 & 30 \\ 50 & 80 & 20 \\ 30 & 20 & 10 \end{bmatrix}$$

The tensile yield strength of the material is 300 MPa. Determine the factor of safety n according to (a) maximum shearing stress theory and (b) maximum energy of distortion theory.

Q.4 Locate the shear center of the channel section loaded as a cantilever. Assume that the flange thicknesses are small when compared with the depth and width of the section



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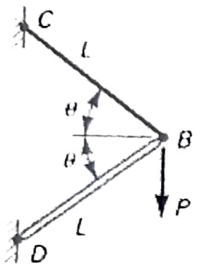
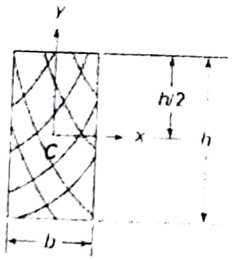
UNIT –II

Q.5 A thick-walled cylinder with 0.3 m and 0.4 m internal and external diameters is fabricated of a material whose ultimate strength is 250 MPa. Let $\nu = 0.3$. Determine (a) for $p_o = 0$, the maximum internal pressure to which the cylinder may be subjected without exceeding the ultimate strength, (b) for $p_i = 0$, the maximum external pressure to which the cylinder can be subjected without exceeding the ultimate strength, and (c) the radial displacement of a point on the inner surface for case (a).

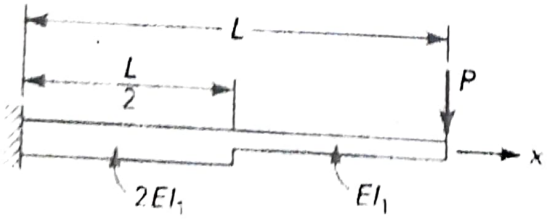
Q.6 A load P is applied at B to two bars of equal length L but different cross-sectional areas and moduli of elasticity. Determine the horizontal displacement δB of point B.



Q.7 A pinned-end wood bar of width b by depth h rectangular cross section and length L is subjected to an axial compressive load. Determine (a) the slenderness ratio; (b) the allowable load, using a factor safety of n. Use $b = 60$ mm, $h = 120$ mm, $L = 1.8$ m, $n = 1.4$, $E = 12$ GPa, and $\sigma_u = 55$ MPa.



Q.8 A force P is applied at the free end of a stepped cantilever beam of length L. Determine the deflection of the free end using the finite difference method, taking $n = 3$. Compare the result with the exact solution $v(L) = 3PL^3/16EI$.



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