Exam.Code:1015
Sub. Code: 7764

1059

M.E. (Mechanical Engineering) Second Semester

Elective – II

MME-205 (a): Advanced Mechanics of Materials

Time allowed: 3 Hours Max. Marks: 50

NOTE: *Attempt five questions in all, selecting atleast two questions from each Section. Use usual notations and symbols for derivations. Assume suitably missing data, if any.*

x-x-x

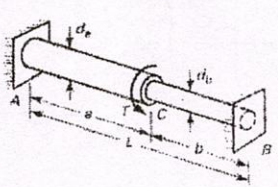
Section A

Q.1 An aluminum alloy bar of circular cross-section area A and length L is subjected to an axial tensile force P. The modulus of elasticity and Poisson's ratio of the material are E and ν, respectively. For the bar, determine **(a)** the axial deformation; **(b)** the change in the diameter d; and **(c)** the change in volume.ΔV. **(d)** Evaluate the numerical values of the quantities obtained in (a) through (c) for the case in which $P = 60$ kN, $d = 25$ mm, $L = 3$ m, $E = 70$ GPa, $\nu = 0.3$, and the yield strength $\sigma_Y = 260$ MPa. [10]

Q.2 Determine the expressions for the stresses acting on the *octahedral* plane. How does this related to the *distortional* strain energy? [10]

Q.3 A wood beam $E_w = 8.75$ GPa, 100 mm wide by 220 mm deep. has an aluminium plate $E_a = 70$ GPa with a net section 80 mm by 20 mm securely fastened to its bottom face. The beam is subjected to a bending moment of 20 kN·m around a horizontal axis. Using transformed section calculate the maximum stresses in the materials. [10]

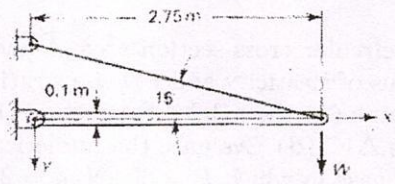
Q.4 A solid circular shaft AB of length $L = 600$ mm is fixed to rigid walls at both ends and is subjected to a torque T at section C. Segment AC has a diamter $d_a = 20$ mm and segment CB has a diameter $d_b = 12$ mm. Determine the lengths a and b of the segments if maximum shearing stress in both the segments is to be the same. [10]



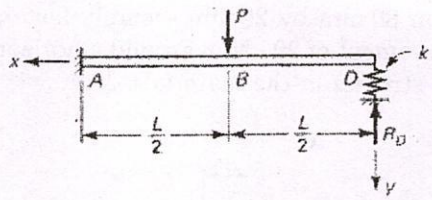
P.T.O.

Section B

Q.5 The boom of a crane is constructed of steel, $E = 210$ GPa; the yield point stress is 210 MPa. The cross section is rectangular with a depth of 100 mm and a thickness of 50 mm. Determine the buckling load of the column. [10]

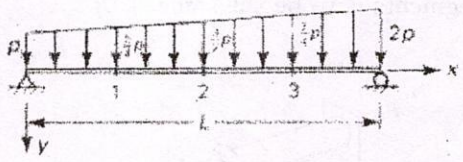


Q.6 A cantilever beam of length L is supported at one end by a spring of constant stiffness k. A concentrated load P is applied at its center. Determine the redundant reaction at the spring support. [10]



Q.7 A concentrated load P is applied at the end of a cantilever beam of length L. Apply the Ritz method to determine the equation of the deflection curve of the beam. Use $v(x) = a_1x^2 + a_2x^3$, where a_1 and a_2 are constants, as the deflected shape of the loaded beam. [10]

Q.8 Use a finite difference approach to determine the deflection and slope at the midspan of the beam shown. [10]



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