BTS – IV – 04.15 – 0244 Reg. No. 1 5 1 1 3 0 2 5

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B.Tech. Degree IV Semester Examination April 2015

ME 403 ADVANCED MECHANICS OF SOLIDS

(*2006 Scheme*)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 × 5 = 40)

I. (a) State and explain St.Venant's principle.

(b) Explain generalized Hooke's law.

(c) Obtain the stress distribution of the solid disk in rotation with uniform thickness.

(d) Show the variation of σ_r and σ_θ for a cylinder subjected to
(i) External pressure (ii) Internal pressure.

(e) Write short notes on the strain energy methods.

(f) State Castigliano's theorem.

(g) Write short notes on shear flow and shear centre.

(h) Derive an expression for the rotation per unit length of a thin walled tube subjected to torsion.

PART B

(4 × 15 = 60)

II. A material is subjected to two mutually perpendicular strains $\varepsilon_x = 350\times10^{-6}$ units and $\varepsilon_y = 50\times10^{-6}$ units together with an unknown shear strain γ_{xy}. If the principal strain in the material is 420×10^{-6} units, determine the following (15)
(i) Magnitude of the shear strain
(ii) The other principal strain
(iii) The direction of principal strain axes.
(iv) The magnitude of the principal stress. Given $E = 200\ GN/m^2$ and $\upsilon = 0.3$.

OR

III. Show that $\Phi = axy + bxy^2$ can be the Airy's stress function for the problem of the cantilever beam of narrow uniform rectangular section loaded with W at the free end. (15)

IV. A steel shaft of 10 cm diameter is shrunk inside a bronze cylinder of 25 cm outer diameter. The shrink allowance is 1 part per 1000 (i.e., 0.005 cm difference between the radii). Given E of steel is 2.18 x $10^6\ kgf/cm^2$ and E of bronze is 1.09 x 10^6 kgf/cm^2 and $\upsilon = 0.3$ for both metals. (15)
Find (i) the tangential stress in the bronze cylinder at the inside and outer radii.
(ii) Stress in the shaft.

OR

V. Derive the expressions for stress distributions for bending of curved bars. (15)

(P.T.O.)

VI. Given stress matrix of Oxyz plane as $\begin{bmatrix} 7 & 2 & 0 \\ 2 & 6 & 2 \\ 0 & 2 & 5 \end{bmatrix}$ (15)

Find

(i) Matrix on the transformed plane obtained by rotating xz plane through 90°.

(ii) Obtain the stress invariants for the original matrix as well as the transformed matrix.

(iii) Obtain the principal planes and principal stresses.

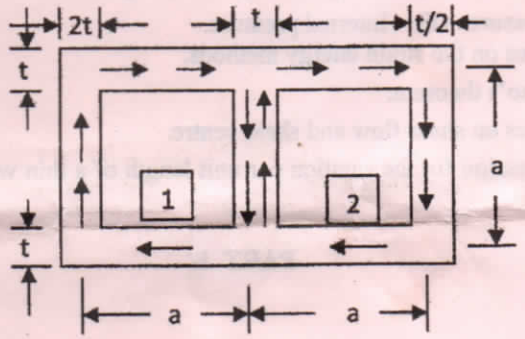
OR

VII. A point load of P acts at the free end of a cantilever been of length L. Using energy method, determine the deflection at its free end. (15)

VIII. Derive an expression for shear centre of a channel section. (15)

OR

IX. Figure shows a two-cell tubular section whose wall thicknesses are as shown. If the member is subjected to a torque T, determine the shear force and angle of twist per unit length of the member. (15)



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