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BTS (C) – IV – 04.12 – 019 – N

B.Tech Degree IV Semester Examination April 2012

ME 403 ADVANCED MECHANICS OF SOLIDS

(2006 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer ***ALL*** questions)

(8 x 5 = 40)

I. (a) Write a brief note on compatibility equation.

(b) State Hooke's law for plane stress and strain condition.

(c) State and explain Caushy's stress formula.

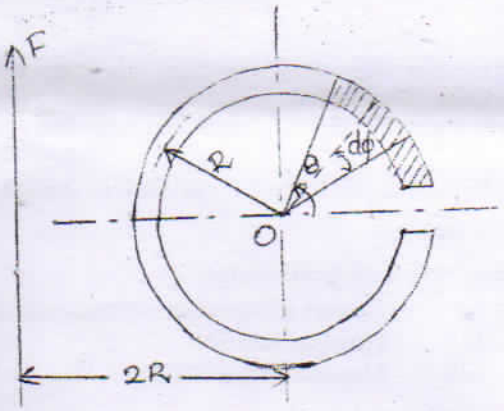
(d) A steel shaft of 10cm diameter is shrink inside a bronze cylinder of 25 cm outer diameter. The shrink allowance is 1 part 1000 (ie. 0.005 cm difference between the radii). Find the circumferential stress in the bronze cylinder at the inside and outer radii and the stress in the shaft.

(e) Write a note on Lame's stress ellipsoid.

(f) Explain the theorem of virtual work.

(g) Describe briefly on the torsion of thin walled tubes.

(h) Determine the shear stress distribution for a circular open section under bending caused by shear force. Locate the shear centre.



PART B

(4 x 15 = 60)

II. (a) In a rectangular strain rosette the strains are measured as $\varepsilon_{0^\circ} = 0.002$ (10)

$\varepsilon_{45^\circ} = 0.001$

$\varepsilon_{90^\circ} = -0.004$

What are the principal strains at the point? Given that Young's modulus of elasticity as 207GPa and Poisson's ratio as 0.3.

(b) At a point P in a body σ_x = 10,000 N/cm^2, σ_y = –5,000 N/cm^2, σ_z = –5,000 N/cm^2 (5)

$\tau_{xy} = \tau_{yz} = \tau_{zx}$ = 10,000 N/cm^2

Determine the normal and shearing stresses on a plane that is equally inclined to all axes.

OR

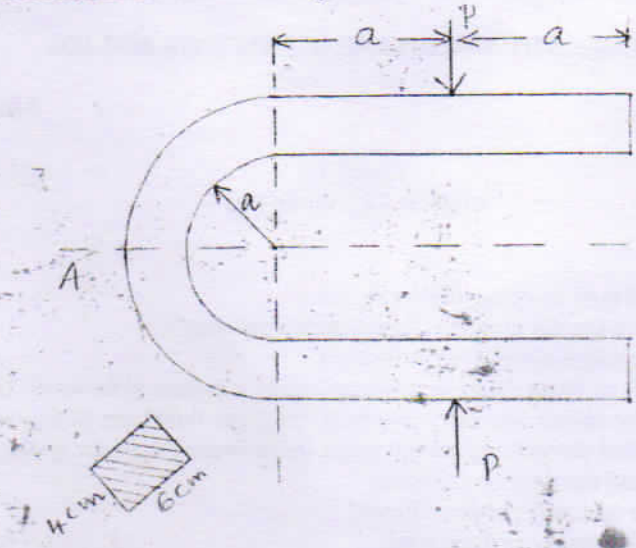
III. (a) Derive the equations in polar co-ordinates related to plane strain condition. (10)

(b) Consider the displacement field $u = \left[y^{2i} + 3yzj + \left(4 + 6x^2\right)k \right] 10^{-2}$ (5)

What are the rectangular strain components at the point $P(1,0,2)$? Use only linear terms.

(P.T.O)

IV. Determine the maximum tensile and maximum compressive stresses across the section AA as shown in the figure. (15)



OR

V. Derive the expression for radial and tangential stresses in solid disc of uniform thickness rotating with an angular velocity ω. (15)

VI. (a) Derive the differential equations of equilibrium for plane stress condition in Cartisian co-ordinates. (10)

(b) Write a note on boundary conditions regarding equations of equilibrium. (5)

OR

VII. An element in plane stress is subjected to stresses $\sigma_x = 15000\,\text{Pa}$, $\sigma_y = 5000\,\text{Pa}$ and $\tau_{xy} = 4000\,\text{Pa}$ (15)

Using Mohr's circle determine

(i) Stresses acting on an element rotated through an angle $\theta = 40^\circ$

(ii) Principal stresses

(iii) Maximum shear stresses

VIII. (a) Explain Membrane Analogy. (10)

(b) Explain Saint Venant's principle of shear centre. (5)

OR

IX. Write a brief note on "Torsion of thin walled tubes" and derive an expression for twist per unit length. (15)

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