R09

Code No: C2002

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.TECH I - SEMESTER EXAMINATIONS, APRIL/MAY-2012
THEORY OF ELASTICITY AND PLASTICITY
(STRUCTURAL ENGINEERING)

Time: 3hours **Max. Marks: 60**

Answer any five questions
All questions carry equal marks

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1.a) The displacement field in a body is specified as
$u = x^3+3y^2$
$v = 3y^2+4x$
$w = 0$
Determine the stress and strain component at a point whose coordinates are (2, 3) take $E = 2 \times 10^5$, Poisson's ratio = 0.3.

b) Is the following state of stress a possible one?
$\sigma_x = \sigma_y = ky^2/x^2$
$\tau_{xy} = ay/x^2$ assume k is a constant and zero body forces.

2.a) Resolve the given state of stress into spherical and deviator state of stress determine the normal and shearing stresses on a octahedral plane.
$\sigma_x = \sigma_y = \sigma_z = 2$
$\tau_{xy} = \tau_{yz} = \tau_{zx} = 1$

b) Determine the strain components from the displacement field specified as
$u = 5+ x^2+y^2+x^4+y^4$
$v = 6+3x^2+3y^2+x^4+y^4$
$w = 10+ 4xy\ (x^2+y^2+2)$

3.a) Explain hooks law giving strain as a function of stress and also stresses in terms of strain in a plane stress case.

b) Show that the change in volume of a strained cube of unit length is given by $\Delta e = \varepsilon_x+ \varepsilon_y+ \varepsilon_z$

4.a) Obtain the compatibility expression for 2 dimensional problem in polar coordinates.

b) Determine the normal stress, circumferential stress and shear stress of the stress function
$\Phi = A \log r + Br^2 \log r + Cr^2 + D$

5.a) Explain St.Venants principle and its importance?

b) Investigate what problem is solved by the stress function
$\Phi = [-Fx^2/d^3]\ (3d-2y)$ applied to a region in y = 0; y = d, x =0 on the x positive; "d" is the depth of thin rectangular strip of unit thickness, F is the force. Compare this solution with the one obtained from elementary strength of materials.

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6.a) Explain plane stress and plane strain state of stress.

b) A thick cylinder is subjected to internal and external pressures define equations for radial and circumferential stresses at the boundaries.

7.a) Derive an expression for the stress components in a solid bar of elliptical cross section subjected to twisting moment?

b) A hollow thin walled brass tube has an equilateral triangular section the mean length of the side of the triangle is 125mm and thickness of the wall is 3mm the tube is subjected to a twisting moment of $2x10^4$Nmm. Find the maximum shearing stress and the angle of twist per unit length.

8.a) Discuss the yield criteria and the flow rules for perfectly plastic and strain hardening materials.

b) A bolt of 25mm diameter is subjected to an axial force of 50kN. Determine the maximum shear force the bolt can sustain according to various theories of failure. Assume the yield stress of 300MPa and factor of safety = 2.

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