R09

Code No: C7603

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I Semester Examinations March/April-2011
CONTINUUM MECHANICS
(AEROSPACE ENGINEERING)

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

Answer any five questions
All questions carry equal marks
- - -

1. Derive the equations of Equilibrium for 3D element subjected to normal and shear stresses causing deformation? Express the conditions of Equilibrium for plane stress. [12]

2. A cantilever beam of length L and depth '2h' is in a state of plane stress subjected to uniformly distributed load, ω having unit thickness. Show that the stress function $\phi = Ax^2 + Bx^2y + cy^3 + D\left(5x^2y^3 - y^5\right)$ is valid for the beam and evaluate the constants A, B, C and D. [12]

3.a) Define Continuum Mechanics and explain its various engineering applications.
b) Explain the strain displacement relations with the help of 3D element under deformation. [12]

4. Derive the equation for stresses on a '2D' inclined plan in a 2D stress system. Also derive the conditions for principal stresses, and Maximum shear stress. [12]

5. Given the following stress field in a body in Equilibrium and referred to spherical coordinate system

$$\sigma_{rr} = -\left(A + \frac{B}{r^3}\right)$$

$$\sigma_{\theta\theta} = \sigma_{\phi\phi} = -\left(A + \frac{C}{r^3}\right)$$

Where A, B, C constants, determine if the stress field satisfies the equilibrium equations when the body forces are zero and all other stresses are zero. [12]

6.a) Explain Reynold's transport theorem.
b) Explain the principle of conservation of linear momentum and angular momentum with illustrations. [12]

7.a) Explain various modes of heat transfer.
b) Explain Fourier's heat conduction law with the help of composite walls. [12]

8.a) Derive the Navier-Stokers Equations for laminar viscous flow.
b) Using Navier-stokes Equation, establish the equation for maximum velocity through a pipe. Also find the head loss due to friction. [12]

--oOo--