Total No. of Questions : 6]

SEAT No. :

P3969

[Total No. of Pages : 2

[4860] - 35

M.E. (Civil) (Structures) (Semester - I)

ADVANCED SOLID MECHANICS

(2008 Pattern)

Time : 4 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answer any two questions from each section.***
2) ***Answer to the two sections must be written in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

SECTION - I

Q1) a) What is compatibility of strains? Obtain strain compatibility equation for 2D problem in elasticity? **[10]**

b) A plane passing through point (x, y, z) in a stressed elastic body has its normal 'n' with direction cosines cos(n, x), cos(n,y), cos(n,z). Obtain expressions for the stress resultants (Tn) and its direction in terms of six independent components at that point. **[15]**

Q2) a) State and explain the Generalized Hook's Law. Hence obtain the Lame's constants and engineering constants for an elastic isotropic body. **[7]**

b) Define Airy's stress function 'Φ'. Prove that the stress function satisfies the Biharmonic Governing Equation in absence of body forces. **[8]**

c) If Φ is a second degree polynomial function, obtain the stress distribution on the sides of rectangular plate of size L x 2h. Neglect body forces. Also check for static equilibrium of the plate under this stress distribution. **[10]**

P.T.O.

Q3) a) Explain the concept of Stress Invariants. Hence, discuss the state of pure shear and hydrostatic state of stress. **[7]**

b) Obtain the solution for stress distribution σ_r and σ_θ in a hollow cylinder subjected to uniform external pressure 'P_o' and internal pressure P_i? **[8]**

c) Find stress components of a cantilever beam loaded with point load at the free end by using Airy's stress function polynomial? **[10]**

SECTION - II

Q4) a) What is axi-symmetric problem? Write the compatibility equation and corresponding stress components by assuming suitable solution? **[7]**

b) A thick cylinder of internal radius 120mm and external radius 175 mm is subjected to an internal pressure of 10 N/mm^2. Determine variation of radial and hoop stresses in the cylinder wall? **[8]**

c) Using polar co-ordinates, obtain the solution for stress distribution for radial and transverse stresses if there is a circular hole of radius 'a' inside an infinite elastic medium and subjected to internal pressure 'P_i'. **[10]**

Q5) a) Derive Poisson's equation for torsion of prismatic bars of non-circular section in terms of stress function Φ using St. Venants Theory. Neglect body forces. **[15]**

b) A shaft of elliptical c/s having semi major axis 75mm and semi minor axis 25 mm is subjected to a torque of 1 kN-m, determine maximum and minimum shear stress developed in shaft. **[10]**

Q6) a) Derive differential equation for the elastic line of a beam resting on an elastic foundation. **[10]**

b) A semi infinite beam is subjected to a force 'P' and a moment 'M_o' at one end. Starting from the solution for an infinite beam, obtain the solution at a section 'z' from the beam end for **[15]**

i) Deflection 'y'.

ii) Bending moment M_x.