Total No. of Questions : 8]

SEAT No. :

P4013

[Total No. of Pages : 2

[5255]-510

M.E. (Civil - Structures)
ADVANCED MECHANICS OF SOLIDS
(2013 Pattern) (Credit Course)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Attempt any five questions from the following.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary and clearly state.***
5) ***Use of cell phone is prohibited in the examination hall.***
6) ***Use of electronic pocket calculator is allowed.***

Q1) a) Obtain Strain compatibility Equation for 2D problem in Elasticity. **[5]**

b) Explain concept of stress at a point and stress on inclined plane. **[5]**

Q2) a) Define Airys stress function. Prove that stress function ϕ satisfying the governing equation $\nabla^4\phi = 0$, when body force is absent. **[6]**

b) State and explain generalised Hooks law. Express the stress strain relation for an elastic and isotropic body in terms of engineering constant E and υ. **[4]**

Q3) a) Derive differential equation of equilibrium of plane elasticity problem in polar co-ordinate with usual notation. **[7]**

b) What is axisymmetric problem. Show that for such a problem, the stress function ϕ =A logr + B r^2logr + Cr^2 + D. **[3]**

Q4) a) Derive an expression for radial (σ_r) and tangential (σ_t) stresses for thick cylinder of internal radious (r_i) and external radious (r_o) subjected to internal pressure (p_i) **[6]**

b) Derive component of stress due to circular hole in a stressed plate (Michell's problem). **[4]**

P.T.O.

Q5) A quarter circle beam of radius 1 m curved in plan is fixed at A and free at B. It carries vertical downward load P = 25 kN at free end B. Determine maximum bending moment, torsional moment and deflection. Also draw shear force, bending moment and torsional moment diagram. **[10]**

Q6) a) Show that the neutral axis of curve beam in elevation is below the centroidal axis towards the center of curvature. **[6]**

b) Differentiate between beam curve in plan and elevation. **[4]**

Q7) Assuming $\phi = m(x^2 / a^2 + y^2 / b^2 - 1)$ as a stress function for a bar of elliptical cross section subjected to pure torque Mt about its longitudinal axis, find moment and shear stress components. **[10]**

Q8) a) Derive differential equation for a beam resting on elastic foundation. **[4]**

b) An infinitely long steel beam of unit width and 250 mm thick is resting on elastic foundation whose modulus of foundation is 10 N/mm^2. A concentrated load of 12 kN is applied at a point. Determine maximum deflection and maximum bending stress assuming E = 200 GPa. **[6]**