Total No. of Questions : 8]

MAY2016 (11)

SEAT No. :

P4638

[Total No. of Pages : 2

[4960]-1028

M.E. (Civil - Structures)

ADVANCED MECHANICS OF SOLIDS

(2013 Pattern) (Credit system)

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

Instructions to the candidates:

1) ***Attempt any five questions from the following.***
2) ***Neat diagram must be drawn wherever necessary.***
3) ***Figures to the right indicates 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) Derive the equations of equilibrium for 3D elasticity problems in Cartesian coordinates and show that shear stresses are complimentary. **[6]**

b) The state of strain at a given point in a body is given by the strain tensor. Find the invariants of the strain tensor. **[4]**

$$\varepsilon_{ij} = \begin{bmatrix} 0.002 & 0 & -0.004 \\ 0 & -0.006 & 0.001 \\ -0.004 & 0.001 & 0 \end{bmatrix}$$

Q2) a) What is Airy's stress function? Check whether $\phi = A\,(2y^2 - 6x^2y^2)$ represents the Airy's stress functions. **[5]**

b) Derive the expression for stresses σ_x, σ_y and τ_{xy} in cantilever beam subjected to point load at the free end using Airy's stress function. **[5]**

Q3) a) Derive equations of equilibrium for 2D elasticity problems in polar coordinates. **[5]**

b) Derive the strain displacement relationships for 2D elasticity problems in polar coordinates. **[5]**

P.T.O.

Q4) a) A simply supported circular plate of radius a with circular hole at the center of radius b subjected to uniformly distributed moment at the inner edges i.e. at r = b. Determine maximum deflection of the plate. **[5]**

b) Obtain stress components when concentrated load acting on the free surface of a plate. **[5]**

Q5) a) Explain torsion of thin walled structures by membrane analogy. **[4]**

b) Prove that for the equilateral triangular cross section of side '2a', the torque 'T' is given by approximately, $T = G\theta a \frac{4\sqrt{3}}{5}$. **[6]**

Q6) a) Explain difference between Winkler's foundation and Pasternak's foundations. **[4]**

b) Find the equation for deflection, bending moment and shear force for a semi-infinite long beam resting on elastic foundation subjected to force 'P' at left end. **[6]**

Q7) a) State the difference between beams curved in plan and beams curved in elevation with suitable example. **[5]**

b) Show that the neutral axis of curve beam in elevation is below the centroidal axis towards the center of curvature. **[5]**

Q8) a) A quarter circle beam of radius R curved in plan is fixed at one end and free at other end. It carries a vertical load P at center; determine the deflection at free end. **[5]**

b) Semi-circular beam simply supported on three supports equally spaced carrying uniformly distributed load of intensity *w/m* over entire span. Determine maximum bending moment and twisting moments. **[5]**

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