Total No. of Questions : 8]

SEAT No. :

P3888

[Total No. of Pages : 2

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M.E. (Civil)(Structure Engineering)

ADVANCED MECHANICS OF SOLIDS

(2013 Course) (Semester - I) (Credit)

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 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) A plane passing through a point (x, y, z) in a stress elastic body has its normal n having direction cosines cos (n, x), cos (n, y) and cos (n, z). Obtain expression for the resultant stress and its direction in the form of six independent stress components at the point. **[6]**

b) Obtain the strain-displacement relation for the six independent strain components in an elastic body. **[4]**

Q2) a) Define Airy's stress function ϕ when the body forces are absent. Prove that ϕ satisfies the governing equation $\nabla^4\phi = 0$. **[7]**

b) Explain with suitable example plane stress and a plane strain problem of elasticity. **[3]**

Q3) a) Write the basic equation for a plane stress 2D problems in polar coordinates. **[3]**

b) Obtain differential equation of equilibrium in polar coordinate. **[7]**

Q4) a) A thick wall cylindrical vessel has an inside diameter 300 mm and the outside diameter 400 mm. The vessel is subjected to an internal pressure of 40 MPa. Determine the variation of radial and circumferential stresses in the vessel. **[4]**

b) Obtain stress components when concentrated load acting on the vertex of a wedge (Michell's problem) **[6]**

P.T.O.

Q5) a) A quarter circle beam of radius 2 m curved in plan is fixed at A and free at B. It carries vertical downward load P = 50 kN at free end B, determine the deflection at free end B. **[5]**

b) Determine the reactions at supports for a semicircular beam ABC loaded with uniformly distributed load w kN/m over entire span. The beam is simply supported at end A & C and continuous over support B. **[5]**

Q6) a) Differentiate between beam curve in plan and elevation. **[3]**

b) Show that the neutral axis of curve beam in elevation is below the centroidal axis towards the center of curvature.. **[7]**

Q7) a) Explain St. Venant's theory of torsion for prismatic bars of non circular cross section. **[5]**

b) Explain membrane analogy for thin walled structures. **[5]**

Q8) a) Explain Winklers foundations and obtain differential equation for beams on elastic foundation. **[6]**

b) Explain the following: **[4]**

i) Infinite beam

ii) Semi-infinite beam

iii) Finite beam

iv) Foundation modulus

x x x