Total No. of Questions : 8]

SEAT No. :

P4569

[Total No. of Pages : 2

[4860] - 1028

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

ADVANCED MECHANICS OF SOLIDS

(2013 Credit Pattern)

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) ***Figure 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) With neat sketch, show all the rectangular components on an element in a stress elastic body. Hence obtain differential equation of equilibrium. **[4]**

b) A plane passing through a point (x, y , z) in a stressed elastic body has its normal n with direction cosine cos(n, x), cos (n, y) and cos(n, z). Obtain expression for the resultant stress (T_n) and its direction in terms of the six independent stress components at the points. **[6]**

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

b) State and explain generalised Hook's law. **[3]**

Q3) a) Obtain differential equation of equilibrium of plane elasticity problem in polar co ordinate with usual notation. **[6]**

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

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Q4) a) Derive an expression for radial (σ_r) and tangential (σ_t) stresses for thick cylinder of internal radius (r_i) and external radius (r_0) subjected to internal pressure (p_i). **[5]**

b) Obtain Naviers and Lames equations of equilibrium. **[5]**

Q5) a) Determine the numerical value of the ratio $\sigma_{max}/\sigma_{min}$ for the case of pure bending of a curved beam in elevation having rectangular cross section of 25 mm × 25 mm if the radius of curvature of the centroidal axis is 37.5 mm. **[5]**

b) Analysis the simply supported semicircular beams of radius r curved in Plan, subjected to uniformly distributed load w, supported on three equally spaced columns. **[5]**

Q6) a) Derive an expression, $\sigma = \dfrac{My}{A\bar{y}(r-y)}$ for bending stress of a curved beam in elevation with usual notation. **[5]**

b) Derive an expression for defection at free end for a cantilever quarter circle curved beam of radius r in plan subjected to point load W at the free with usual notation. **[5]**

Q7) a) State and explain in brief St. Venant's theory of torsion. **[4]**

b) Assuming proper stress function for a bar of equilateral triangular cross section subjected to torque T, determine the maximum shear stress and its location. **[6]**

Q8) a) Find differential equation for beam on elastic foundation subjected to downward uniformly varying load (w) per unit distance and to an upward force of ky per unit distance, where k is the stiffness modulus of the elastic foundation. **[5]**

b) An infinite elastic beam is subjected to uniformly distributed load on finite length. Obtain slope, deflection. Moment and shear. **[5]**