Code No: I8701/R16

M. Tech. I Semester Regular/Supple Examinations, Jan/Feb-2018
THEORY OF ELASTICITY
(Common to Structural Engineering (87), Structural Design (85)
and Computer Aided Structural Engineering (35)

Time: 3 Hours **Max. Marks: 60**

Answer any FIVE Questions
All Questions Carry Equal Marks

1. Show that the line elements at the point x, y that have the maximum and minimum rotation are those in the two perpendicular directions θ determined by 12

$$\text{Tan}2\theta = \frac{\partial v/\partial y - \partial u/\partial x}{\partial v/\partial x + \partial u/\partial y}$$

2. a Derive expressions for compatibility for a two dimensional problems. 6
   b Derive expressions for strain at a point in terms of stress components. 6

3 . Show that $\phi = -\frac{F}{d}3\ xy^2(3d-2y)$ 12
Applied to the region included in y = 0, y = d, x = 0, on the side x positive.

4. a Explain Saint-Venant's principle. 4
   b Determine the stress components and sketch their variation in a region included in Z=0, Z=d, x=0 on the side x positive for the problem if plane stress satisfied by the stress function 8

$$\phi = -\frac{3F}{4d}\left[xz - \frac{xz^3}{3d^2}\right] + \frac{pz^2}{2}$$

5. Derive general equations in polar coordinates. 12

6. Show that 12
$€_x = k(x^2+y^2)$, $€_y = k(y^{2+} z^2)$, $\Upsilon_{xy} = k'xyz$, $€_z = \Upsilon_{xz} = \Upsilon_{yz} = 0$

Where k, k' are small constants, is not a possible state of strain.

7. The stresses in a rotating disk (of unit thickness) can be regarded as due to centrifugal force as body force in a stationary disk. Show that this body force is derivable from the potential v = -1/2 $p\ \omega^2(x^2 + y^2)$, where p is the density and ω the angular velocity of rotation (about the origin) 12

8. Write short notes on following
   i Homogenous deformations. 4
   ii Stress invariants. 4
   iii Reciprocal theorem 4

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