Roll No. | | | | | | | | | | | | Total No. of Pages : 03

Total No. of Questions : 09

B.Tech.(ANE) (Sem.–7,8)

THEORY OF ELASTICITY

Subject Code : ANE-414

M.Code : 70496

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.

SECTION–A

1. Write briefly :

a) What is stress-ellipsoid? What do its semi-axes represent?

b) Write down the equilibrium equations for a plane stress problem and explain its various terms.

c) A large plate contains a small circular hole at its centre. What is the maximum tangential stress around the periphery of the hole if the plate is subjected to a uniaxial tensile stress p_0 of the two ends of the plate?

d) State saint-venant's theory of torsion.

e) State and explain stress-optic law.

f) Differentiate between 'Isoclinics' and 'Isochromatics'.

g) What is the relation between maximum shearing stress and principal stresses?

h) Sketch the six components of stress on an element at a point in a three dimensional strained body.

i) Write down the stress-strain relations in polar coordinates.

j) What do you understand by symmetrical stress distribution?

SECTION–B

2. Making suitable assumptions, derive the strain-displacement relations for a two-dimensional problem.

3. Describe the principles of photoelasticity with suitable sketches.

4. Derive the compatability equation for a plane stress problem in the absence of body forces.

5. A bar of a narrow rectangular cross-section and with a circular axis is constrained at the lower end and bent by a force P applied at the upper end in a radial direction as shown in Fig. 1.

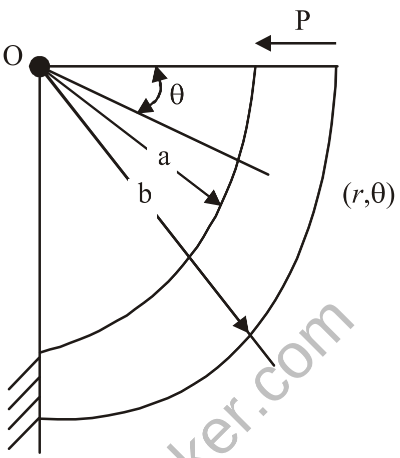

Fig.1

Assuming a stress functions :

$$\phi = \left(Ar^3 + \frac{B}{r} + Cr + Dr \log r\right) \sin\,\theta$$

Determine the stress components, δ_r, δ_0 and $\tau_{r\theta}$.

6. The radial stress in a rotating disc of inner radius a and outer radius b is given by :

$$\delta_r = \left(\frac{3+\nu}{8}\right)\rho\omega^2\left[b^2 + a^2 - \frac{a^2b^2}{r^2} - r^2\right]$$

Where ω = Angular velocity of the disc

ν = Poisson's ratio

ρ = Density of disc material

Determine the maximum value of δ_r.

SECTION–C

7. A prismatical bar is bent in one of its principal planes by two equal and opposite couples M. Making suitable assumptions, derive expressions for the displacements *u, v* and *w*.

8. A cantilever of length L and depth 2*h* is in a state of plane stress. The cantilever is unit of thickness, is rigidly supported at the end x = L and is loaded as shown in Fig. 2.

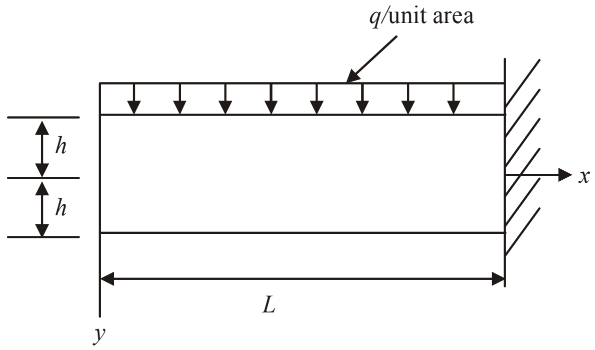

Fig.2

Show that the stress function :

$$\phi = Ax^2 + Bx^2y + cy^3 + D\,(5x^2y^3 - y^5)$$

is valid for the beam and evaluate constants A, B, C and D.

9. Show that the warping function

$\downarrow = kxy$, in which k is an unknown constant, may be used to solve the torsion problem for the elliptical section.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.