ME | SemI | Mech | choice Based | May June 2019

1615/19

Paper / Subject Code: 60703 / Advanced Stress Analysis.

(3 Hours) [Total Marks :80]

Note: 1. Attempt any Four Questions.
2. Make suitable assumptions if required

Q.No.1 (a) (i) What is Orthotropic material? Give examples. **(02)**

(ii) Write the stress equations of equilibrium. **(02)**

(iii) Write a condition for Crack Propagation. **(02)**

(iv) Classify Strain Rosette and state the application of it. **(02)**

(v) Write compatibility condition for a strain field. **(02)**

(b) Differentiate between fracture toughness and impact toughness. **(05)**

(c) The principal strains at a point are 0.015, 0.005 and 0.002. Determine maximum shearing strain by drawing the Mohr's Circle. **(05)**

Q.No.2 (a) The stress field at a given points is given by **(15)**

$\sigma_{xx} = 20\ x^2 + 2xy$

$\sigma_{yy} = 10\ x^3 + 300\ y$

$\sigma_{zz} = 50\ xz + 35\ z^3$

$\tau_{xy} = 100\ x + 90\ y^2$

$\tau_{yz} = xz^2 + 40\ xy^2$

$\tau_{xz} = 0$

Find

i) Body force distribution required for equilibrium at a point (2,3,4).

ii) Find stress tensor.

iii) For above stress tensor resolve the stress in to normal and shear.

iv) For the same tensor resolve in to spherical and deviator tensor.

v) For the same tensor find principal stresses and its direction cosines.

(b) Explain various methods to improve the fatigue strength. **(05)**

Q.No.3 (a) Displacement field is given by **(15)**

$u = 2x^2\ y + 4xyz$

$v = 2yz + z^2 + x$

$w = 5\ xy + 2\ yz$

i) Check whether given displacement field is deformable or not at (2,2,-2).

ii) Find strain tensor about displacement field about (2,1,1).

iii) Using the above tensor find new strain tensor if coordinate system axis oxyz is sifted to oxy'z' through 45°.

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iv) For the strain tensor at (2,1,1) find principal strains and their direction cosines. Also find octahedral normal and shear strains.

(b) List the various types of corrosion and explain fretting corrosion and methods to prevent it. **(05)**

Q.No.4 **(a)** Determine maximum shear stress at a point by using the following strain gauge readings of rectangular strain rosette. **(10)**

$\varepsilon 0° = 400 \times 10^{-6}$ Young's Modulus = E = 200 GPa

$\varepsilon 45° = 375 \times 10^{-6}$ Poisson ratio = 0.25

$\varepsilon 90° = 200 \times 10^{-6}$

(b) Define Principal Plane and Principal Stresses. Write the state of stress with respect to principal axis. **(05)**

(c) What is isotropic material? Write stress- strain relationship for isotropic material subjected to pure shear, for instance, a cylindrical bar under torsion in the xy sense. **(05)**

Q.No.5 **(a)** The state of strain at a point in given by **(10)**

$$[e_{ij}] = \begin{bmatrix} 0.001 & 0 & -0.004 \\ 0 & -0.003 & 0.001 \\ -0.004 & 0.001 & 0 \end{bmatrix}$$

Determine the stress at this point. Take E = 210×10^6 kPa and poisson's ratio = 0.28.

(b) Define Gauge Factor and Gauge Sensitivity. **(05)**

(c) State the desire characteristics of Strain Gauges **(05)**

Q.No.6 **(a)** Prove that stress tensor is symmetric. **(10)**

(b) For following displacement field **(10)**

$u_x = 3x^2y + y^2$, $u_y = 3yz + xy$, $u_z = 4xz^2 + 5xy^2$.

(i) What is the deformed position of a point P initially at (2,-1, 3)?

(ii) What is the change in distance between two points after deformation originally at P (1,2,3) and Q (1,-1,2)?