

QP CODE : 27625

(3 Hours)

Marks : 80

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

- Q.No.1 (a)** (i) The principal strains at a point are 10×10^{-3} , 5×10^{-3} , 2.5×10^{-3} . Calculate the maximum shearing strain. (02)
- (ii) Define the Hydrostatic state of stress. (02)
- (iii) Write compatibility condition for a strain field. (02)
- (iv) What are the types of load considered on an elastic body? Give example. (02)
- (v) Write a condition for Crack Propagation. (02)
- (b)** Explain various methods to improve the fatigue strength. (05)
- (c)** Differentiate between the ductile and brittle fracture. (05)

- Q.No.2 (a)** The state of stress at a point is given by the following array of terms: (10)

$$\begin{bmatrix} 30 & -7 & 0 \\ -7 & 20 & 5 \\ 0 & 5 & 5 \end{bmatrix} \text{MPa}$$

Find the resultant stress and resolve parallel and perpendicular to the plane defined by $2\bar{i} + 3\bar{j} + \bar{k} = 1$

- (b)** A strain tensor is given as (10)

$$[e_{ij}] = \begin{bmatrix} 0.002 & 0 & -0.002 \\ 0 & 0.002 & 0.002 \\ -0.002 & 0.002 & 0 \end{bmatrix}$$

Determine the stress tensor, if the values of elastic modulus and shear modulus of 2×10^{11} and 8×10^{10} N/m² respectively.

[TURN OVER

- Q.No.3** (a) For following displacement field, (10)
 $u_x = 0.01xy + 0.02y^2$, $u_y = 0.02x^2 + 0.01z^3y$, $u_z = 0.01xy^2 + 0.05z^2$.
 Determine the strain tensor, rotation tensor and angle of rotation at the point (3, 2, -5).
- (b) What are the desire characteristics of Strain Gauges? List the various (10)
 types strain gauges. Explain the strain mounting procedure for strain measurement in cantilever beam subjected to point load at the free end.
- Q.No.4** (a) Derive the stress equitation of equilibrium. (10)
 (b) Differentiate between fracture toughness and impact toughness. (05)
 (c) What is an Anisotropic material? Give examples. How many (05)
 independent variables (i.e. elastic constants) in their constitutive matrices.
- Q.No.5** (a) For following displacement field (15)
 $u = 2x^2y + 4xyz$, $v = 2yz + z^2 + x$, $w = 5xy + 2yz$.
 (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 above strain tensor find new strain tensor if coordinate system $oxyz$ is sifted to $oxy'z'$ through angle 45° .
 (iv) For the strain tensor at (2,1,1), find the principal strains and their directions.
 (v) Also find octahedral normal and shear strain.
- (b) Define Gauge Factor and Gauge Sensitivity. (05)
- Q.No.6** (a) What is corrosion? List the various types of corrosion. (05)
 (b) Classify Strain Rosette and explain any one type. (05)
 (c) Given $\sigma_x = 100$, $\sigma_y = -60$, $\sigma_z = 40$, $\tau_{xy} = 80\text{MPa}$ and $\tau_{yz} = \tau_{zx} = 0\text{MPa}$. (10)
 Determine the principal normal and shear stresses and the maximum normal and shear stresses using mohr's circle method.