

Duration: 3 hours

Max Marks: 80

Note: Attempt any 4 questions
 Figures to the right indicate full marks
 Assume data wherever required and mention it clearly

Q1 (i) Show that shear strain ϵ_{yz} is given by $\epsilon_{yz} = \frac{\partial v}{\partial z} + \frac{\partial w}{\partial y}$ **10**

Q1 (ii) The state of stress at a point is given by the following array of terms. **10**

$$\begin{bmatrix} 18 & 12 & 6 \\ 12 & 10 & 4 \\ 6 & 4 & 8 \end{bmatrix} MPa$$

Determine the principal stresses and principal directions

Q2 (i) Given the strains at a point as
 $\epsilon_x = 0.01, \epsilon_y = -0.003, \epsilon_z = 0.004, \tau_{xy} = 0.02, \tau_{yz} = 0.005, \tau_{zx} = -0.07$ **10**
 Determine the principal strains and their directions

(ii) State and derive stress optic law in 2-D **10**

Q3 (i) The state of strain at a point is given by **10**
 $\epsilon_x = 0.001, \epsilon_y = 0.003, \epsilon_z = 0, \tau_{xy} = 0, \tau_{yz} = 0.001, \tau_{zx} = -0.004$

Determine the stress tensor at this point. Take
 $E = 210 \times 10^6 kPa, \text{ and } \nu = 0.28$ Also compute Lamé's constant

(ii) Derive the stress equations of equilibrium **10**

Q4 (i) What is the significance of compatibility equations?
 Prove the compatibility equations **10**

$$\frac{\partial^2 \gamma_{xy}}{\partial x \partial y} = \frac{\partial \epsilon_{xx}}{\partial y^2} + \frac{\partial \epsilon_{yy}}{\partial x^2}$$

(ii) Write short note on construction and use of "CRO" tube for the
 dynamic strain measurement **10**

- Q5**
- (i) Draw a neat sketch of Wheat stone circuit and prove that **10**
- $$\Delta E = \frac{Vr}{(1+r)^2} \left[\frac{\Delta R_1}{R_1} - \frac{\Delta R_2}{R_2} + \frac{\Delta R_3}{R_3} - \frac{\Delta R_4}{R_4} \right]$$
- (ii) What is corrosion? List out the various types of corrosion & explain cavitations corrosion and methods to prevent it **10**

- Q6**
- Write short notes on **(Any Two)**
- (i) Define a strain rosette and explain the different types of strain rosette configurations. **10**
- (ii) What are the types of load consider on an elastic body and explain it? **10**
- (iii) Write short note on a tension load cell **10**
