No. of Printed Pages : 3

BIMEE-005

B.Tech. MECHANICAL ENGINEERING (BTMEVI)

01251

Term-End Examination

December, 2012

BIMEE-005 : EXPERIMENTAL STRESS ANALYSIS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt **any seven** questions. All questions carry **equal** marks. Use of Calculator is **permitted.***

1. A fringe order of 2.5 was observed at a point in a stressed plane stress model with light having a wavelength of 589 nm. Assuming that 'C' remains constant, what fringe order would be observed at the point considered when light with $\lambda = 548$ nm is used ? **10**

2. The maximum shear stress at a point in a model of 0.5 cm thickness is 9 MPa. The fringe order is 4.5 when observed with sodium light. Another model made of the same material and having a thickness 0.7 cm is subjected to a plane state of stress. Observation of this model under mercury light reveals a fringe order of 5.0. **10**

Evaluate the individual principal stresses at the point if one of the stresses, say σ_1 is twice the value of the other principal stress σ_2, *i.e.* $\sigma_1 = 2\ \sigma_2$.

3. Describe with the help of neat diagram any two types of Mechanical strain gauges. **10**

4. Explain in brief any two types of Electrical Strain Gauges with the help of neat diagram **10**

5. Differentiate between unbonded-wire strain gauge and bonded-wire strain gauge. Explain any one with the help of neat diagram. **10**

6. The state of stress at a point with respect to the xyz system is : **10**

$$\begin{bmatrix} 3 & 2 & -2 \\ 2 & 0 & -1 \\ -2 & -1 & 2 \end{bmatrix} \text{kN/m}^2.$$

Determine the Stress tensor relative to the x' y' z' coordinate system obtained by a rotation through 30° about the z-axis.

7. The displacement field in a body is specified as : **10**

$$u_x = (x^3 + 3) \times 10^{-3}$$

$$u_y = 3y^2z \times 10^{-3}$$

$$u_z = (x + 3z) \times 10^{-3}.$$

Determine the strain components at a point whose co-ordinates are (1, 2, 3).

8. The rectangular stress components at a point P inside a Stressed body are : 10

$\sigma_x = 2$, $\sigma_y = 4$, $\sigma_z = 8$, $\tau_{xy} = 4$, $\tau_{yz} = -6$, and $\tau_{zx} = 2$, all in MPa. Find the principal Stresses.

9. The displacement Components are given by : 10

$$u_x = k(x^2 + 2x); \quad u_y = k(4x + 2y^2 + z),$$

$uz = 4kz^2$

where k is a small quantity. Calculate the linear strain at the point (2, 2, 3) in the direction

$$n_x = 0, \qquad n_y = \frac{1}{\sqrt{2}}, \quad n_z = \frac{1}{\sqrt{2}}.$$

10. Compute Lame's coefficients 'γ' and 'G' for steel having $E = 207 \times 10^6$ kPa ; and $\gamma = 0.3$. 10

Where E = Young's modulus, and γ = Poission's ratio.