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**BIMEE-005**

# B.Tech. – VIEP – MECHANICAL ENGINEERING (BTMEVI)

## Term-End Examination

00734 **June, 2017**

## BIMEE-005 : EXPERIMENTAL STRESS ANALYSIS

*Time : 3 hours* *Maximum Marks : 70*

***Note :*** *Attempt any **five** questions. All questions carry equal marks. Assume any missing data suitably. Use of scientific calculator is permitted.*

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**1.** (a) Explain the method of strain measurement by using mechanical strain gauge. 7

(b) Define gauge factor and derive an expression for gauge factor. 7

**2.** (a) List different types of strain gauge rosettes and explain any one of them briefly with sketch. 7

(b) Explain with a neat sketch, the principle of operation of a plane polariscope. 7

**3.** (a) What do you mean by compensation ? List the methods of compensation. Explain them briefly. 7

(b) A two-element rectangular rosette is used to determine the two principal stresses at a point i, $\varepsilon_1 = 860$ μm/m and $\varepsilon_2 = -390$ μm/m. Find $\sigma_1$ and $\sigma_2$.

Assume

Young's modulus E = 207 GPa,

Poisson's ratio = 0·3. 7

**4.** (a) List the commonly used stress separation techniques. Explain shear-difference method in detail. 7

(b) What is birefringent coating ? Explain the reinforcing effect of birefringent coating. 7

**5.** (a) Explain with a neat sketch, the principle of operation of a reflection polariscope. 7

(b) List the applications and advantages of Moire technique. 7

**6.** (a) Explain with sketches, the geometrical approach to Moire fringe analysis. 7

(b) Derive the relation for stress-optic law in terms of relative retardation. 7

7. A three-element strain rosette is bonded onto the surface of a specimen for strain measurements. Strain gauge 'A' is along the X-axis and strain gauges B and C are oriented along the specimen. The strain gauge yields the following strains.

$\varepsilon_0 = + 500\ \mu m/m$

$\varepsilon_{120} = - 250\ \mu m/m$

$\varepsilon_{240} = 250\ \mu m/m$

Given $K_t = - 0{\cdot}07$, $V_0 = 0{\cdot}285$.

Determine the magnitude and directions of the principal strains at the point where the strain rosette is bonded. *14*

8. Write short notes on any ***two*** of the following : *7+7=14*

(a) Electromagnetic Strain Gauge

(b) Wheatstone Bridge

(c) Isochromatics and Isoclinics

(d) Holography