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BIMEE-005

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

Term-End Examination

00942 **December, 2017**

BIMEE-005 : EXPERIMENTAL STRESS ANALYSIS

Time : 3 hours *Maximum Marks : 70*

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

1. (a) Explain with a neat sketch, the working of a single pressure output pneumatic strain gauge. 7

(b) What do you mean by multiple strain gauges ? Explain with a neat sketch, the method of switching active gauges individually. 7

2. (a) List the properties of photoelastic model materials and also give a list of materials used in photoelastic models. 7

(b) Using a Wheatstone bridge with a lead resistance, explain the error due to input impedance of the measuring instrument. 7

3. (a) Explain absolute and relative phase difference of polarized light. 7

(b) A rectangular rosette is mounted on a steel plate having modulus of elasticity E = 200 GPa, Poisson's ratio = 0·3. The strains measured are

$$\varepsilon_1 = 500 \times 10^{-6}$$

$$\varepsilon_2 = 400 \times 10^{-6}$$

$$\varepsilon_3 = -100 \times 10^{-6}$$

Calculate the principal strains, stresses, maximum shear stress and the orientation angle for the principal axis of the stress. 7

4. (a) Describe the stress freezing technique for three-dimensional photoelasticity. 7

(b) Describe Tardy's method of compensation technique with a neat sketch. 7

5. (a) Explain with a neat sketch, the phenomenon of scattered light photoelasticity. 7

(b) What is Brittle Coating ? Explain how the brittle coating crack patterns are produced by different states of stress. 7

6. (a) Explain the method of out-of-plane displacement by using Moire. 7

(b) Draw the schematic representation of a holographic set-up. Explain recording and reconstruction process of images in holography. 7

7. Three strain gauges are applied to an area at a point in such a manner that gauge A and gauge C make a positive angle of 45° with gauge B. The strain readings obtained from the gauges are as follows :

Gauge	A	B	C
Strains μ (strains)	– 600	300	400

Calculate the principal strains, principal stress and principal directions. Take E = 200 GPa, Poisson's ratio = 0·3 for the gauge material. *14*

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

(a) Reflection Polariscope

(b) Quarter Wave and Half Wave Plates

(c) Machining of a Photoelastic Casting

(d) Ideal Photoelastic Material