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BIMEE-005

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

Term-End Examination

June, 2016

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. Describe, with the help of neat diagram, any two types of mechanical strain gauges. *10*

2. Stresses acting at a point P in a body are given as $\sigma_x = 30$ kN/cm^2, $\sigma_y = -10$ kN/cm^2, $\sigma_z = 10$ kN/cm^2 and $\tau_{xy} = \tau_{yz} = \tau_{zx} = 10$ kN/cm^2. Determine the normal and shearing stress on a plane that is equally inclined to all the three axes. *10*

3. Why are Wheatstone bridge circuits preferred over potentiometer circuits in static strain measurements ? Explain. Differentiate between bonded and unbonded gauges. *10*

4. Sketch a circular polariscope. Explain the effects of a stressed model and the fringes obtained in it. *10*

5. What are the various types of optical strain gauges ? Explain with a neat sketch the Tuckerman gauge. *10*

6. Explain the Tardy's compensation method in detail. Why is this method preferred over other methods ? *10*

7. An elastic body under the action of external forces has a displacement field given by $u = (x^2 + y)\hat{i} + (3 + z)\hat{j} + (x^2 + 2y)\hat{k}$. Determine the principal strains at (3, 1, –2) and the direction of the minimum principal strain. *10*

8. (a) Derive the relation for stress-optic law in terms of relative retardation. *6*

   (b) List the photoelastic materials with their specific features. *4*

9. Write short notes on the following : *10*

   (a) Electromagnetic strain gauge

   (b) Calibration of strain gauges

10. Explain the brittle coating method in detail. What are the advantages and limitations of this method ? *10*