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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M-TECH DEGREE EXAMINATION, MAY 2017

Mechanical Engineering

(Machine Design)

01ME6106 EXPERIMENTAL STRESS ANALYSIS

Max marks : 60 Duration : 3 hours

Answer any two full questions from each PART.

PART A

1. (a) Derive the equilibrium equation in terms of displacement. (4)

   (b) At a point in a stressed body, the cartesian components of stress are σ_{xx} =100 MPa σ_{yy} = 50 MPa, σ_{zz} = 30 MPa, τ_{xy} = 30 MPa, τ_{yz} = -30 MPa, τ_{xz} = 60 MPa. Determine the principal stress and direction of maximum principal stress. (5)

2. (a) Describe in detail the principle of working, uses and limitations of an induction strain gauge. (5)

   (b) Mention the steps involved in strain gauge mounting. (4)

3. (a) What is the necessity of temperature compensation? How this can be achieved? (5)

   (b) What is a stress gauge? How a conventional gauge can be used as a stress gauge? (4)

PART B

4. (a) Discuss the different ways in which a Wheatstone bridge can be balanced. (5)

   (b) A three element rectangular rosette stain gauge is mounted on a steel specimen. For a particular state of loading of the structure, the gauge readings are $\epsilon_a = 200\mu$ strain, $\epsilon_b = 900\mu$ strain, $\epsilon_c = 1000\mu$ strain. Determine the principal stresses (4)

5. (a) Derive the equation for out-of-balance voltage in fixed current Wheatstone bridge method of strain measurement. (6)

   (b) Discuss any one method for calibrating a strain gauge. (3)

6. (a) Obtain the sensitivity of any two common Wheatstone bridge arrangement with variable input voltage. (5)

   (b) Explain the working principle of a cathode ray tube. (4)

PART C

7. (a) Discuss the failure theories of coatings (6)

   (b) Explain the different types of magnetic particle inspection. (6)

8. (a) Explain the variables influencing the accuracy of brittle coating application. (5)

   (b) Give examples for brittle coating material. Explain the procedure involved in brittle coating method. (7)

9. (a) Explain the working principle of X-radiography method?Mention the advantages and limitations of the method (6)

   (b) Give the classification of ultrasonic waves? Describe about the flaw detection using these waves. (6)