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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SECOND SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2018

Branch: Mechanical

Stream(s): **Machine Design**

01ME6106: EXPERIMENTAL STRESS ANALYSIS

Answer *any two full* questions from *each* part

(Nine marks for each question in Parts A &B and Twelve marks for each question in Part C)

Limit answers to the required points.

Max. Marks: 60 Duration: 3 hours

PART A

1. a. A two dimensional stress state, $\sigma_{zz} = \tau_{zx} = \tau_{zy} = 0$ exists at a point on the surface of a loaded member. The remaining stress components are $\sigma_{zz} = 90$ MPa, $\sigma_{yy} = 40$ MPa, and $\tau_{zx} = 60$ MPa. Determine the Principal stresses, Principal directions and maximum shear stress at the point.

   b. Graphically illustrate the solution to above problem using Mohr's circle

   c. Explain the necessity of strain compatibility conditions in experimental stress analysis

2. a. Explain briefly working of any one type each of mechanical and optical strain gauge

   b. Explain the characteristics (a) gauge factor (b) gauge sensitivity (b) gauge transverse sensitivity of electrical strain gauges

3. a. Explain the residual stress measurement method using strain gauges

   b. Calculate Principal strains/stresses and maximum shear stress and their directions on a steel plate (E=200 GPa, υ=0.3), if Delta rosette give the following readings: ε_a= -250 μm/m, ε_b=250 μm/m, ε_c= -200 μm/m.

PART B

4. a. Prove that the maximum bridge sensitivity of an unbalanced constant voltage Wheatstone bridge with four active gauges is VF where F=gauge factor and V= voltage applied

   b. Explain the method of achieving temperature compensation using three lead wire system for strain gauge analysis

c. Explain any one transducer application of strain gauges

5. a. Explain Snell Optics law

b. Draw the arrangement of a circular polariscope for dark field

c. Using John's Calculus show that circular polariscope arrangement produces isochromatic fringe pattern only

6. a. Explain Tardy compensation method used in photo elasticity

b. What is meant by stress freezing in photo elasticity?

c. Explain the bi-refringent coating method with suitable sketches

PART C

7. a. Explain how model stresses are evaluated using maximum stress theory under direct loading in brittle coating method

b. What are isostatics and isoentatics patterns in brittle coating analysis?

c. Name any three types of brittle coating methods used

8. a. Explain the procedure of dye penetrant testing and its limitations

b. Explain briefly various techniques used in Radiographic examination

9. a. Explain the following terms associated with UT testing (a) straight beam transducer (b) Angle beam transducer (c) Phased array

b. Explain any two laser testing methods used in Non-Destructive evaluation