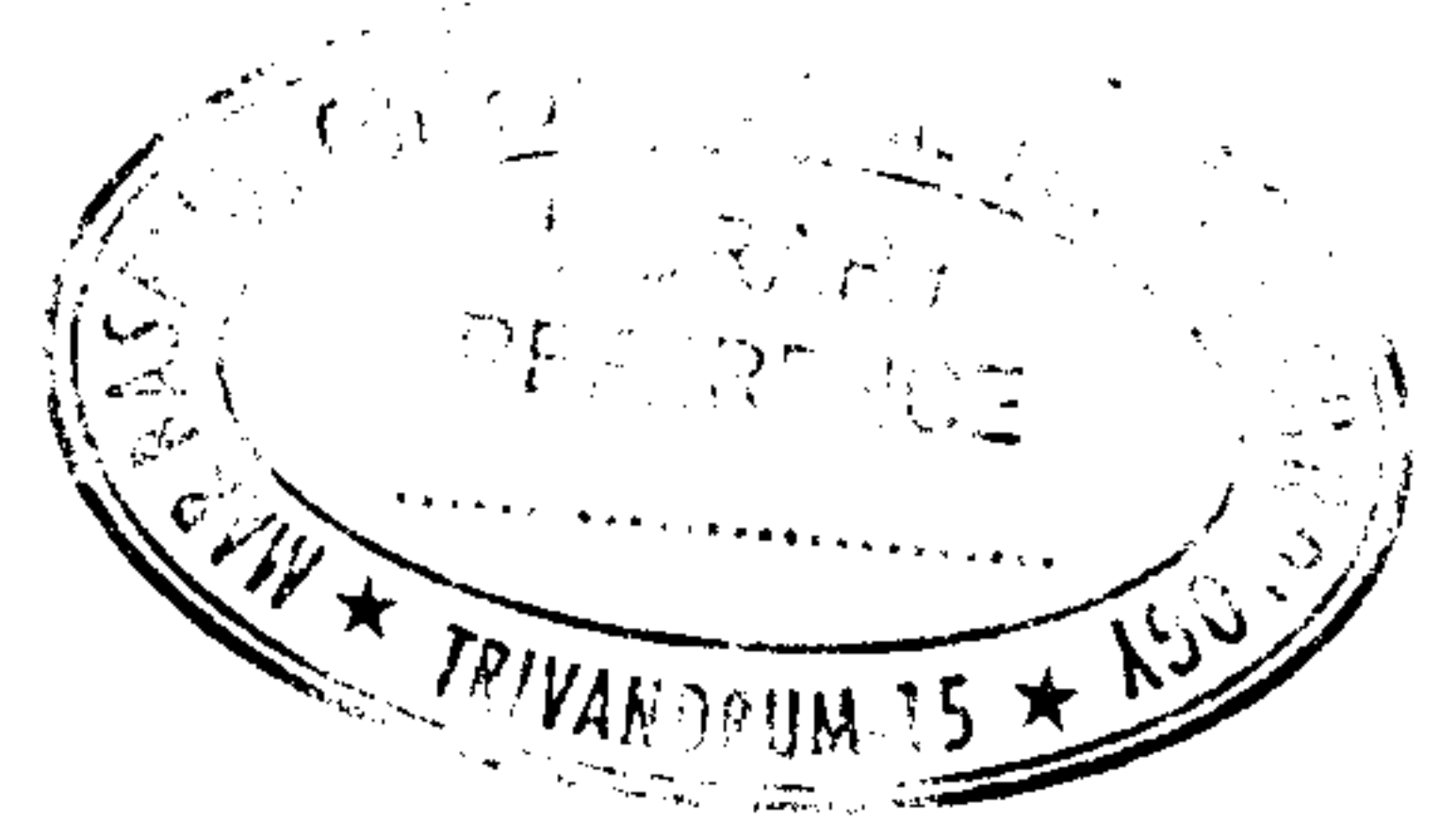


APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY  
SECOND SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2018

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,  $\nu=0.3$ ), if Delta rosette give the following readings:  $\epsilon_a = -250 \mu\text{m/m}$ ,  $\epsilon_b = 250 \mu\text{m/m}$ ,  $\epsilon_c = -200 \mu\text{m/m}$ .

**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-refrangent 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