

Code No: 07A72105

R07**Set No. 2**

IV B.Tech I Semester Examinations, December 2011
EXPERIMENTAL STRESS ANALYSIS
Aeronautical Engineering

Time: 3 hours**Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

1. Write short notes on the following aspects related to the interaction of X-rays or γ -rays with atoms of the medium through which they travel.
 - (a) Photo-electric effect
 - (b) Rayleigh scattering
 - (c) Compton scattering
 - (d) Pair production. [4+4+4+4]
2. (a) Describe a ballast circuit. Find the condition that maximizes its sensitivity.
(b) Describe with neat sketches explain the working principles of Light beam and Pen recorder. [8+8]
3. Write short notes on the following:
 - (a) Brittle coating crack patterns produced by refrigeration techniques
 - (b) Types of brittle coating. [8+8]
4. (a) What is meant by 'Permanent double refraction' and 'Temporary double refraction'?
(b) Discuss the Maxwell proposed 'Stress-optic' law and obtain an expression relating the material fringe value with the stress applied to a photo-elastic model. [6+10]
5. (a) Distinguish the following:
 - i. Accuracy and Precision
 - ii. Resolution and Threshold
 - iii. Reproducibility and Repeatability
 - iv. Dead zone and Hystersis.
(b) A diaphragm type pressure measuring instrument is calibrated for absolute pressures of 600-760mm of Hg. It have an accuracy of $\pm 1\%$ based upon scale span. Calculate the scale span, scale range and maximum static error. [10+6]
6. Describe the working principle of Martens optical strain gauge and scratch strain gauge. [16]

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7. Consider a photo-elastic model of certain thickness is subjected to a plane state of stress. Discuss the differences observed in the fringe pattern in the model when observed in a plane and a circular polariscope with a white light source and explain the procedure to determine the difference in principal stresses. [16]
8. Write short notes on
- (a) Cross sensitivity
 - (b) Torsional strain
 - (c) Delta strain gauge rosette. [4+6+6]

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R07**Set No. 4**

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1. (a) Write about the steps involved in determining the direction of the principal stresses at a desired point of stressed model with the help of isoclinic pattern observed using a plane polariscope and white light source.
(b) Write about the procedure to apply a coating to photo-elastic model. [8+8]
2. How instruments are classified? Discuss different types of instruments. [16]
3. Write short notes on the following:
 - (a) Practical problems in a polariscope.
 - (b) Accurate determination of integral fringe order. [8+8]
4. (a) How a Wheatstone bridge circuit is used for the measurement of strain. Explain the working of a null balance Wheatstone bridge circuit.
(b) A Strain gauge with factor 2 is used to measure the tensile stress. The gauge resistance and the other three resistance of the balanced bridge circuit are having an initial resistance of 300Ω . What strain is to be imposed on the gauge to have a resistance change of 0.44Ω in the variable resistor of the bridge circuit. [8+8]
5. (a) What are the characteristics of a liquid penetrant for its use in inspection of defects in components/structures?
(b) Mention the need for surface preparation and cleaning of the work piece for using liquid penetrant inspection of defects present within it. [10+6]
6. Illustrate the working principle of:
 - (a) Inductance strain gauge
 - (b) Photo elastic Strain gauge. [16]
7. Explain the following with respect to determining the minimum strain that is required to crack the coating under uni-axial state of stress and hence to compute the stress in the specimen:
 - (a) Influence of atmospheric conditions
 - (b) Load time relation and its influence on the threshold strain. [8+8]
8. (a) Explain the measurement of torsional strain.

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(b) Discuss the following:

- i. Grid materials
- ii. Backing Materials
- iii. Bonding Material.

[8+8]

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1. Describe in detail the 'calibration method' generally employed for brittle coatings. How true is that threshold strains can be determined by this method? [10+6]
2. (a) With neat diagram explain the working principle of Pneumatic Strain gauge.
(b) What are the advantages and limitations of electrical extensometers over mechanical extensometers. [8+8]
3. Discuss the null mode of wheat stone bridge circuit used for strain measurement. [16]
4. (a) What are the requirements of a strain gauge.
(b) Derive an expression for gauge factor of resistance strain gauge. [8+8]
5. Give a brief account on non-destructive testing fundamentals providing a clear contrast between the destructive and non-destructive testing philosophies. Discuss various methods available for non-destructive testing of materials and indicate their specific applications. [8+8]
6. Discuss in detail the effect of a stressed model in a circular polariscope employing light field set up. [16]
7. What do you mean by Performance characteristics of an instrument? Explain them in Detail. [16]
8. (a) How does the atmospheric conditions effect the computation of stress in a specimen provided with a suitable photo-elastic coating?
(b) Write a brief note on the procedure adopted in applying a coating to photo-elastic materials. [8+8]

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R07**Set No. 3**

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1. Write a note on the following:
 - (a) 'Oblique-incidence method' to determine magnitude of individual principal stresses when their directions are not known.
 - (b) 'Material fringe constant', and 'Model fringe constant'. [8+8]
2. Describe the concepts of photo-elastic photography and also, explain how it is useful in the determination of fractional fringe order? [16]
3. (a) Define 'Sensitivity of Moire's fringes'.
(b) Differentiate between 'object beam', and 'reference beam'. [6+10]
4. With neat sketches, Explain the various types of optical extensometers. [16]
5. Differentiate the bridge operation under null and deflection modes. [16]
6. (a) Describe the advantages of Semiconductor type Strain gauges over the other types.
(b) Describe the salient features of a semiconductor type strain gauge.
(c) Derive an expression for gauge factor of resistance strain gauge. [4+4+8]
7. Describe radiographic methods for inspecting objects with simpler shapes, curved surfaces, cylindrical surfaces and tubular surfaces. [16]
8. (a) Distinguish between accuracy and Precision. Which of these is more desirable during the act of measurement and why?
(b) What are the different types of dynamic inputs? Explain them with neat sketches. [6+10]
