Code No: RR412104 **Set No.1**

IV B.Tech. I Semester Regular Examinations, November -2005
EXPERIMENTAL STRESS ANALYSIS
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Differentiate between 'analytical stress analysis' and 'experimental stress analysis'. Explain how experimental stress analysis is advantageous than the analytical approach.
   (b) Explain different types of errors that can occur in strain measurement and also discuss how to eliminate the same. [8+8]

2. Explain different methods in which magnification can be obtained in mechanical strain gauges. [16]

3. (a) Derive an expression for Gauge factor of an electrical resistance gauge.
   (b) The value of transverse sensitivity factor obtained for a strain gauge is 0.03 by assuming the Poisson's ratio as 0.30. If the true value of Poisson's ratio is 0.29, determine the percentage error introduced in the determination of transverse sensitivity factor. [8+8]

4. Derive an expression for the output voltage of an unbalanced Wheatstone bridge. Show how this expression can be used for measuring strain. [16]

5. (a) What is a Strain rosette. List out different strain rosettes.
   (b) Derive the relationship between the auxiliary gauge factor and transverse sensitivity factor for a rectangular rosette. [6+10]

6. Calculate the material fringe value and the stress optic coefficient of a photoelastic material from the following data obtained from a calibration test using a flexural beam model.
   Depth of beam = 30 mm. Breadth of beam = 5 mm.
   Distance between two supports = 200 mm
   Distance between two symmetrically placed loads = 120 mm
   Magnitude of each load = 220 Newton.
   Number of fringes for whole depth = 10.2; Wave length of light = 5900 A^0. [16]

7. (a) Explain principles of non-destructive testing.
   (b) Explain briefly the principles of radiography. [8+8]

8. (a) Differentiate between linear and rotational mismatch.
   (b) Explain in detail the Moire's gap effect. How this helps in increasing the sensitivity of Moire's method. [4+12]

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Code No: RR412104 **Set No.2**

IV B.Tech. I Semester Regular Examinations, November -2005
EXPERIMENTAL STRESS ANALYSIS
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the optimum characteristics commonly used to judge the adequacy of a strain measurement system for a particular application.
   (b) Explain different methods of simplifying a 3-D stress analysis problem and also suggest suitable experimental method for each case. [8+8]

2. With the help of neat sketches, explain two different methods of magnification used in optical strain gauges. [16]

3. (a) What are the desirable properties of an ideal base material for electrical gauge.
   (b) The value of transverse sensitivity factor obtained for a strain gauge is 0.04 by assuming the Poisson's ratio as 0.28. If the true value of Poisson's ratio is 0.29, determine the percentage error introduced in the determination of transverse sensitivity factor. [8+8]

4. What are the essential requirements of a balancing technique? Discuss different ways in which the Wheatstone bridge can be balanced. [16]

5. Define the term 'T-Delta strain rosette' and show its configuration. Derive expressions for computing principal stresses and for location of principal planes from the strain measurements of T-Delta strain rosette. [16]

6. (a) Explain practical problems in a polariscope.
   (b) A circular disc is of 70 mm diameter and 5 mm thick. Determine the material fringe value if a load of 3 kN produces a fringe order of 8 at the center of the disc. [6+10]

7. Explain in detail the methodology adopted for non-destructive testing of structural models by 'Radiography'. Discuss its advantages and limitations. [16]

8. (a) What do you mean by the mismatch technique.
   (b) Explain in detail the technique used for Moire's fringe sharpening and fringe multiplication. [6+10]

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IV B.Tech. I Semester Regular Examinations, November -2005
EXPERIMENTAL STRESS ANALYSIS
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. Differentiate between 'range' and 'accuracy'. Explain the various factors that should be considered in selecting a gauge for a particular application. [16]

2. (a) With the help of a neat sketch, explain the principle and working of Porter-Lip mechanical strain gauge.
   (b) Describe the working principle of Whittemore mechanical strain gauge with the help of a neat sketch. [10+6]

3. (a) Define 'transverse sensitivity' and explain its importance.
   (b) Two gauges are mounted on a tensile test piece, one in the direction of the stress and the other at right angles to this. The gauge in the direction of the stress field indicates a strain of 400 μm/m. Calculate the reading shown by the transverse gauge. Assume the Poissons ratio as 0.30 and transverse sensitivity factor as 0.032. Calculate the maximum stress in the specimen if Young's modulus is 200 GPa. [6+10]

4. Explain why a null-balance bridge is preferred over the out-of-balance type. Derive an expression for the sensitivity of a null-balance Wheatstone bridge. [16]

5. (a) Explain in detail, the effect of transverse sensitivity errors in strain rosettes.
   (b) Present a point-by-point comparison of different rosette configurations. [10+6]

6. Calculate the material fringe value and the stress optic coefficient of a photoelastic material from the following data obtained from a calibration test using a flexural beam model.
   Depth of beam = 40 mm. Breadth of beam = 5 mm.
   Distance between two supports = 220 mm
   Distance between two symmetrically placed loads = 140 mm
   Magnitude of each load = 250 Newton.
   Number of fringes for whole depth = 16.2; Wave length of light = 5900 A^0. [16]

7. (a) What is acoustic emission technique. How do you evaluate stress system in a structure with this technique.
   (b) Discuss the merits and limitations of acoustic emission technique. [10+6]

8. (a) When a fringe order is said to be positive or negative.
   (b) Discuss the shadow Moire's method in detail and give its uses. [6+10]

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Code No: RR412104 **Set No.4**

IV B.Tech. I Semester Regular Examinations, November -2005
EXPERIMENTAL STRESS ANALYSIS
(Aeronautical Engineering)

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

Answer any FIVE Questions
All Questions carry equal marks

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1. What are the basic characteristics of a strain gauge? Which factors should be considered while selecting a strain gauge for a particular case? [16]

2. (a) Compare the basic principle of magnification of mechanical strain gauge with that of an optical gauge.
   (b) Explain the optical principle of Sharpe Interferometer with the help of a neat sketch and describe the method of strain measurement with this gauge. [6+10]

3. (a) Name a few bonding cements suitable for room temperature applications.
   (b) Two gauges are mounted on a tensile test piece, one in the direction of the stress and the other at right angles to this. The gauge in the direction of the stress field indicates a strain of 450 μm/m. Calculate the reading shown by the transverse gauge. Assume the Poisson's ratio as 0.26 and transverse sensitivity factor as 0.035. Calculate the maximum stress in the specimen if Young's modulus is 210 GPa. [6+10]

4. Define the term 'Circuit sensitivity' of a Wheatstone bridge and make analysis for circuit sensitivity of bridge bringing out clearly the important conclusions. [16]

5. (a) Explain in which situation a Two-Gauge strain rosette can be used. For this case derive the expressions for computing principal stresses.
   (b) Draw the configuration of T-delta rosette and write the expressions for the magnitude and direction of principal stresses for this rosette. [10+6]

6. (a) Describe the basic elements of a circular polariscope with a sketch.
   (b) A circular disc is of 75 mm diameter and 6 mm thick. Determine the material fringe value if a load of 2 kN produces a fringe order of 6 at the center of the disc. [6+10]

7. (a) Briefly explain ultrasonic magnetic approach as a potential non-destructive testing method.
   (b) Discuss the merits and limitations of ultrasonic magnetic approach. [10+6]

8. (a) Differentiate between additive and subtractive Moire's patterns.
   (b) Discuss the fundamental properties of Moire's fringes and explain how the strain analysis is carried out with this method. [6+10]

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