INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
M.Tech II Semester End Examinations (Regular) - May, 2019
Regulation: IARE–R18
EXPERIMENTAL STRESS ANALYSIS
Time: 3 Hours   **(CAD/CAM)**   **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Specify two methods for measure of an unknown force. How to measure the temperature changes? Distinguish between the "static characteristics" and "static calibration" in measurements. What is accuracy? **[7M]**

   (b) Define the static sensitivity and the relative limiting error. Differentiate environmental and systematic errors. What is the frequency range in measurements? **[7M]**

2. (a) Give the advantages of scratch gauge and the disadvantages of a simple mechanical lever magnification. Classify the extensometers depending on the magnification systems. **[7M]**

   (b) What are the standards for the measurement of an angle? What is known as foil strain gauges? Give the classifications of electrical strain gauges. How to measure strain by using the electrical strain gauges? **[7M]**

UNIT – II

3. (a) What is known as strain gage rosettes? Give quantities required for a good gauge material? Highlight the advantages of strain gage rosette analysis. **[7M]**

   (b) $\varepsilon_a(i = 1, 2, 3)$, are three strain readings from three gauges cemented to the surface angles $\theta_i(i = 1, 2, 3)$ from the x-direction. The transformation law of normal strains is:
   $\varepsilon_a = 1/2\{(\varepsilon_x + \varepsilon_y) + (\varepsilon_x - \varepsilon_y)cos2\theta_i \_ \gamma_{xy} \sin 2\theta_i\}$. How to determine the principal strain direction, principal stresses and the maximum shear stress? Which properties of the material required in the stress evaluation? **[7M]**

4. (a) What are the types of electrical resistance train guages and their uses. **[7M]**

   (b) A delta strain rosette bonded onto the surface of a structural member under load gives readings $\varepsilon_{\theta_1=o^o} = 400\mu$; $\varepsilon_{\theta_2=120^o} = 200\mu$; and $\varepsilon_{\theta_3=120^o} = 200\mu$ (here the μ symbol indicates micrometers per meter). Determine the principal strain directions and principal strains. **[7M]**

UNIT – III

5. (a) What is the plane of polarization? What is refractive index? Give four different possible set ups in circular polariscope. How to determine fractional fringe order? **[7M]**

   (b) What is meant by compensation in photo elasticity and explain any two fringe compensation method in detail with its advantages over other methods. **[7M]**

6. (a) What are the disadvantages in Nichol prism to obtain plane polarized light? What is known as isotropic point in a polariscope set up? **[7M]**

   (b) Explain separation technique based on the equilibrium equations and Hooke's law. What are the properties of photoelastic materials? **[7M]**

UNIT – IV

7. (a) Deduce horizontal, vertical and shearing strains from the displacements given by the moire's fringe order. **[7M]**

   (b) Is the resin based coating (stress coat) sensitive to minor changes in temperature? Specify the limiting temperature. Highlight on the effect of oil and water; firing of coating requirement; possibility of visual observations; strain sensitivity; and suitability for all materials. **[7M]**

8. (a) Which are the characteristics being used to evaluate the coating? **[7M]**

   (b) Severable variables are there to influence the behavior of the coating, which can be minimized with proper precautions. Highlight the testing conditions; effect of stress conditions; and the effect of refrigeration and dye-etchant. **[7M]**

UNIT – V

9. (a) Explain the advantages and the limitations of the radiographic techniques. **[7M]**

   (b) Categorize the types of the non-destructive techniques and why there is no universal non-destructive test applicable to all situations? **[7M]**

10. (a) Explain the advantages and the limitations of the ultrasonic techniques **[7M]**

    (b) Categorize and write briefly about the types of defects with examples detected by NDT techniques. **[7M]**

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