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Course Code

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Seventh Semester B.E. Degree Examinations, February 2025

EXPERIMENTAL STRESS ANALYSIS

Duration: 3 hrs

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data, if any, may be suitably assumed

<u>Q. No</u>	<u>Question</u>	<u>Marks</u>	<u>(RBTL:CO:PI)</u>								
<u>Module-1</u>											
1.	a. Briefly explain the basic concepts in dynamic measurements.	04	(1 : 1 : 1.2.1)								
	b. With a neat sketch explain the generalized measurement system.	08	(1 : 1 : 1.2.1)								
	c. Briefly explain the points of general consideration in data analysis.	08	(1 : 1 : 1.2.1)								
(OR)											
2.	a. Derive an equation for gauge factor for an electrical resistance strain gauge.	10	(2 : 1 : 1.2.1)								
	b. Briefly explain any two methods of metallic sensing elements of resistance strain gauge.	10	(2 : 1 : 1.2.1)								
<u>Module-2</u>											
3.	a. Derive an expression for two and three element strain gauge rosettes.	10	(2 : 2 : 1.2.1)								
	b. The strain gauges are applied to an area at a point in such a manner that gauge 'b' makes a positive angle of 30° with gauge 'a' & gauge 'c' makes a positive angle of 45° with gauge 'b'. The strain readings obtained from the gauges are as follows	10	(3 : 2 : 1.6.1)								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Gauge</td><td style="padding: 5px;">A</td><td style="padding: 5px;">B</td><td style="padding: 5px;">C</td></tr> <tr> <td style="padding: 5px;">Strain</td><td style="padding: 5px;">-600</td><td style="padding: 5px;">300</td><td style="padding: 5px;">400</td></tr> </table>				Gauge	A	B	C	Strain	-600	300	400
Gauge	A	B	C								
Strain	-600	300	400								
Calculate the principal strains, principal stresses and principal directions. Take $E = 200 \text{ GPa}$ and Poisson's ratio $\nu = 0.3$ for the gauge material											
(OR)											
4.	a. Derive an expression for plane shear gage.	10	(2 : 3 : 1.2.1)								
	b. Briefly explain (i) Elastic element for force measurement (ii) Torque measurement.	10	(1 : 3 : 1.2.1)								
<u>Module-3</u>											
5.	a. Derive the stress optic law, as applied to two dimensional photo elasticity.	10	(2 : 3 : 1.2.1)								
	b. With a neat sketch, explain circular polariscopic under dark field set up.	10	(1 : 3 : 1.2.1)								
(OR)											
6.	a. Explain the shear difference method for the separation of principal stresses.	10	(1 : 3 : 1.2.1)								

Note: (RBTL - Revised Bloom's Taxonomy Level: CO - Course Outcome: PI- Performance Indicator)

- b. Explain briefly the properties of an ideal 2D photo-elastic model material. **10** (2 :3 : 1.2.1)

Module-4

7. a. With a neat sketch, explain stress freezing technique for 3D photo-elasticity. **10** (1 :3 : 1.2.1)
- b. Explain with a neat sketch scattered light polariscope. **10** (2 :3 : 1.2.1)

(OR)

8. a. Describe the geometrical approach for Moire fringe analysis. **10** (2 :3 : 1.2.1)
- b. Explain the Moire fringes produced by mechanical interference. **10** (2 :3 : 1.2.1)

Module-5

9. a. Define birefringence. Explain how stresses and strains can be measure using birefringent coating. **10** (2 :4 : 1.2.1)
- b. Derive an equation for birefringent coating stresses. **10** (2 :4 : 1.6.1)

(OR)

10. a. What is brittle coating technique? With neat sketches discuss the crack patterns which be obtained in brittle coating under various combinations of stresses. **10** (3 :5 : 1.6.1)
- b. Explain the different crack detection methods used in brittle coating method. **10** (3 :5 : 1.2.1)

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