

Course code	Course Name	L-T-P - Credits	Year of Introduction
AO309	EXPERIMENTAL STRESS ANALYSIS	3-0-0-3	2016
<b>Prerequisite: Nil</b>			
<b>Course Objectives</b>			
<ul style="list-style-type: none"> <li>To study the various experimental techniques involved for measuring displacements, stresses, strains in structural components.</li> </ul>			
<b>Syllabus</b>			
Principles of measurements – Extensometers - Capacitance gauges, Laser displacement sensors- electrical resistance strain gauges - static and dynamic strain measurements - strain indicators- Rosette analysis- stress gauges- load cells- Two-dimensional photo elasticity- Transmission photo elasticity- polariscopes - Introduction to three-dimensional photo elasticity -Relation between stresses in coating and specimen-Fundamentals of NDT			
<b>Expected Outcome</b>			
The students will acquire knowledge about			
<ul style="list-style-type: none"> <li>Stress and strain measurements in loaded components.</li> <li>The usage of strain gauges and photo elastic techniques of measurement.</li> <li>Use of NDT in stress analysis</li> </ul>			
<b>Text Books:</b>			
<ol style="list-style-type: none"> <li>Dally, J.W., and Riley, W.F., "Experimental Stress Analysis", McGraw Hill Inc., New York 1998.</li> <li>Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, New Delhi, 1996.</li> <li>Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and RaMachandra, K., "Experimental Stress Analysis", Tata McGraw Hill, New Delhi, 1984.</li> </ol>			
<b>References:</b>			
<ol style="list-style-type: none"> <li>Durelli. A.J., "Applied Stress Analysis", Prentice Hall of India Pvt Ltd., New Delhi, 1970</li> <li>Hetenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.</li> <li>Max Mark Frocht, "Photo Elasticity", John Wiley and Sons Inc., New York, 1968</li> <li>Pollock A.A., Acoustic Emission in Acoustics and Vibration Progress, Ed. Stephens R.W.B., Chapman and Hall,1993.</li> <li>Ramesh, K., Digital Photoelasticity, Springer, New York, 2000</li> </ol>			
<b>Course Plan</b>			
Module	Contents	Hours	Sem. Exam Marks
<b>I</b>	Principles of measurements, Accuracy, Sensitivity and range of measurements	1	15%
	Mechanical and Optical extensometers and their uses, Advantages and disadvantages	2	
	Acoustical and Electrical extensometers and their uses, Advantages and disadvantages	2	
	Capacitance gauges.	1	
<b>II</b>	Principle of operation of electrical resistance strain gauges and requirements, Types and their uses.	2	15%
	Materials for strain gauges	1	

	Calibration and temperature compensation, cross sensitivity	2	
<b>FIRST INTERNAL EXAMINATION</b>			
<b>III</b>	Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements	1	15%
	Rosette analysis – Numerical Problems	4	
	strain indicators	1	
	Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements	2	
<b>IV</b>	Two-dimensional photo elasticity, Photo elastic materials	2	15%
	Concept of light - photo elastic effects	1	
	Stress optic law, Transmission photo elasticity	3	
	plane and circular polariscopes.	1	
<b>SECOND INTERNAL EXAMINATION</b>			
<b>V</b>	Interpretation of fringe pattern	1	20%
	Calibration of photo elastic materials	2	
	Compensation and separation techniques	2	
	Moire method of strain analysis.	2	
	Introduction to three-dimensional photo elasticity	2	
<b>VI</b>	Fundamentals of NDT	2	20%
	Acoustic Emission Technique	2	
	Radiography, Thermography, Ultrasonic Testing	2	
	Eddy Current testing, Fluorescent Penetrant Testing	1	
	Introduction to brittle coating	1	
<b>END SEMESTER EXAM</b>			

### Question Paper Pattern

Maximum marks: 100

Exam duration: 3 hours

The question paper shall consist of three parts

**Part A**

4 questions uniformly covering modules I and II. Each question carries 10 marks  
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part B**

4 questions uniformly covering modules III and IV. Each question carries 10 marks  
Students will have to answer any three questions out of 4 (3X10 marks =30 marks)

**Part C**

6 questions uniformly covering modules V and VI. Each question carries 10 marks  
Students will have to answer any four questions out of 6 (4X10 marks =40 marks)

**Note:** In all parts, each question can have a maximum of four sub questions, if needed.