

COURSE CODE	COURSE TITLE	L	T	P	C
1152AE118	EXPERIMENTAL STRESS ANALYSIS	3	0	0	3

Course Category:

Programme Elective

a. Preamble :

To enrich knowledge on principles of measurements, Basic theories of optical, electrical, and mechanical instrumentation strain gauges, extensometers, photo elasticity for measuring stresses

b. Prerequisites:

- Strength of Materials

c. Link to other courses:

- Finite Element Method

d. Course educational objectives :

Students undergoing this course are expected:

- To understand the relation between the mechanics theory and experimental stress analysis and to establish the fundamental concepts of experimental techniques
- To enrich the knowledge of photo elastic, electrical resistance strain gage, accelerometer methods for the experimental solution of 2-D and 3-D structures problems under static and dynamic loadings

e. Course outcomes :

Upon the successful completion of the course, learners will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Define the principles of measurements	K1
CO2	Explain experimental techniques to measure displacements, strains or stresses on small or full scale specimens	K2
CO3	Explain the principles and techniques of electrical strain gage measurement	K3
CO4	Apply the principles and techniques of photo elastic measurement both in 2D and 3D	K3
CO5	Explain Non-destructive Testing and its application	K3

(K1 – Remember; K2 – Understand; K3 – Apply)

f. Correlation of cos with programme outcomes :

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1.	H	H			H		H	H				
CO2.	H	H			H		H	H				
CO3	H	H			H		H	H				

CO4	H	H			H		H	H				
CO5	H	H			H		H	H				

H- High; M-Medium; L-Low

g. Course contents:

UNIT I -MEASUREMENTS L-9

Principles of measurements, Accuracy, Sensitivity and range of measurements.

UNIT II- EXTENSOMETERS L-9

Mechanical, Optical Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

UNIT III- ELECTRICAL RESISTANCE STRAIN GAUGES L-9

Principle of operation and requirements, Types and their uses, Materials for strain gauge. Calibration and temperature compensation cross sensitivity, Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT IV- PHOTOELASTICITY L-9

Two dimensional photo elasticity, Concept of light – photo elastic effects, stress optic law, Interpretation of fringe pattern, Compensation and separation techniques, Photo elastic materials. Introduction to three dimensional photo elasticity.

UNIT V- NON – DESTRUCTIVE TESTING L-9

Fundamentals of NDT, Radiography, ultrasonic, magnetic particle inspection, Fluorescent penetrant technique, Eddy current testing, Acoustic Emission Technique, Fundamentals of brittle coating methods.

TOTAL: 45 periods

h. Learning resources

i. Textbooks :

1. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., “Experimental Stress Analysis”, Tata McGraw-Hill, New Delhi, 1984.
2. Sadhu Singh “Experimental Stress Analysis”, Khanna Publishers (2009)

ii. REFERENCES:

1. Dally, J.W., and Riley, W.F., “Experimental Stress Analysis”, McGraw-Hill Inc., New York, 1998.
2. Hetenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc., New York, 1972. Pollock A.A., “Acoustic Emission in Acoustics and Vibration Progress”, Ed. Stephens R.W.B., Chapman and Hall, 1993.