

COURSE CODE	COURSE TITLE	L	T	P	C
1154AE208	STRAIN GAUGE AND TRANSDUCERS DESIGN	1	0	4	3

Course Category:

University elective

a. Preamble :

This course provides knowledge on principles of measurements, Basic theories of mechanical, optical and electrical strain gauges for measuring stresses.

b. Prerequisite Courses:

- Nil

c. Related Courses:

- Structural Health monitoring system

d. Course Educational Objectives :

Students undergoing this course are expected:

- To study the various measuring techniques involved for measuring displacements, stresses, strains.
- To apply modern experimental techniques to measure strains and stresses in engineering components and structures.

e. Course Outcomes :

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Understand the Principles of measurements	K1
CO2	Explain the principles and techniques of electrical strain gage measurement	K2
CO3	Mount strain gages and measure strains using different strain rosettes	K3
CO4	Design strain gage-based transducers for measuring specific loads	K3
CO5	Force measurement techniques used in wind tunnel balances	K3

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 MEASUREMENT SYSTEM

Principles of measurements, Accuracy, precision, Sensitivity and range of measurements -errors in measurements-Stress, Strain and Displacement fields for various problems

UNIT II ELECTRICAL RESISTANCE STRAIN GAUGES

Mechanical strain gauges-Introduction to Strain Gauges-Physical principle-Types of **electrical** strain gauge -Wire gauges, foil gauges -bonded, unbonded strain gauges - Gauge factor-Wheatstone bridges

UNIT III STRAIN MEASUREMENTS

Strain gauges selection criteria- Selection of adhesives- Surface preparation- bonding of strain gauge-soldering and cable routing- Moisture proofing- Strain rosettes analysis- Types- Application of strain gauge rosettes

UNIT IV LOAD CELL TRANSDUCER

Load cells- working principle- various types of load cell-resistive-capacitive-piezoelectric load cell-applications

UNIT V LOAD MEASUREMENTS ON WIND TUNNEL BALANCES

Wind Tunnel- Introduction, Load Measurements – Internal and external strain gauges, three and six component force balance systems used in wind tunnel

Total Periods: 15 + 30 = 45

List of experiments

1. Strain gage mounting and soldering
2. Measurement of strain on a cantilever beam using strain gauge.
3. Measurement of strain on a simply supported beam using strain gauge.
4. Measurement of longitudinal and transverse strain on a bar using strain gauge.
5. Measurement of strain on a hollow shaft.
6. Strain measurement on a cylindrical pressure vessel.

7. Measurement of force/load using load cell.
8. Measurement of forces using three component balances.

h. Learning Resources

i. Text Books:

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, New Delhi, 1996.
3. Rae, W.H. and Pope, A. “Low Speed Wind Tunnel Testing”, John Wiley Publication, 1984.

ii. References:

1. Dally, J.W., and Riley, W.F., “Experimental Stress Analysis”, McGrawHill Inc., New York, 1998.
2. Hetenyi, M., “Hand book of Experimental Stress Analysis”, John Wiley and Sons Inc., New York, 1972.
3. Measurement Systems: Application & Design – Doebelin