IV B.TECH - II Semester
EXPERIMENTAL STRESS ANALYSIS

Course Code: ME8T3D **Credits: 3**
Lecture: 3 periods/week **Internal assessment: 30 marks**
Tutorial: 1 period/week **Semester end examination: 70 marks**

COURSE OBJECTIVES:

- Recognize the various techniques available to measure the stress and Strains using different sources.
- Realize the working of recording instruments and data logging methods
- Distinguish the principles of photo elasticity in two dimensional stress analyses

COURSE OUTCOMES:

Upon completion of this course the student will be able to:

1. Understand the overall concepts of stress/strain analysis by experimental means.
2. Familiar with the theory and practice of common experimental stress analysis Methods including moire methods, photo elasticity
3. Acquire the knowledge on Brittle and bi-refrigent coatings and working of strain gauges.

Prerequisites: Strength of materials

UNIT I
STRAIN MEASUREMENT METHODS:
Various types of strain gauges, Electrical Resistance strain gauges, Gage Sensitivity and Gage Factor Semiconductor strain gauges, Temperature compensation, strain gauge circuits
ANALYSIS OF STRAIN GAGE DATA: Three Element Rectangular Rosette, Delta Rosette, strain gauge rosette.

UNIT II
RECORDING INSTRUMENTS:
Introduction, static recording and data logging, dynamic recording at very low Frequencies, dynamic recording at intermediate frequencies, dynamic recording at high Frequencies, dynamic recording at very high frequencies.

UNIT III
BRITTLE COATINGS and BIREFRINGENT COATINGS:
Brittle Coatings: Introduction, coating stresses, failure theories, brittle coating crack patterns, crack detection, ceramic based brittle coatings, resin based brittle coatings, test procedures for brittle coatings analysis, calibration procedures, analysis of brittle coating data.
Birefringent Coatings:
Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coatings, effects of coating thickness, Fringe-order determinations in coatings, stress separation method Undercoating.

UNIT IV

MOIRE METHODS:

Introduction, mechanism of formation of Moire fringes, the geometrical approach to Moire-Fringe analysis, displacement field approach to Moire-Fringe analysis, out of plane displacement measurements, out of plane slope measurements, sharpening and multiplication of Moire-Fringes, experimental procedure and techniques.

UNIT V

PHOTO ELASTICITY:–

Introduction Polariscope – Plane and circularly polarized light, Bright and dark field setups, Isochromatic Fringe Patterns, Isoclinic Fringe Patterns, CompensationTechniques, Calibration Methods, Separation Methods, Shear Difference Method, Materials for Two-Dimensional Photo elasticity

Learning Resources

Text Books:

1. Experimental stress analysis, (Third Edition) by James Dally and Riley, Mc Graw-Hill International, New Delhi.1978.
2. Experimental stress analysis, (6^{th} edition) by Dr. Sadhu Singh, KhannaPublishers, New Delhi, 1996.

Reference Books:

1. A treatise on Mathematical theory of Elasticity, by Augustus Edward Hough Love, University Press, fourth edition, 1906.
2. Experimental stress analysis principles and methods, by G.S. Holister, Cambridge university press, 1967.
3. Theory of Elasticity, (Third Edition), S.Timoshenke and JN. Goodier McGraw-Hill, New York ,1970.