

## (ME 516) EXPERIMENTAL STRESS ANALYSIS ( ELECTIVE - IV )

### **Objective of the Course :**

*Provides knowledge about different experimental stress analysis techniques. These are very much needed to validate the design outputs.*

### **UNIT - I**

**Introduction:** Theory of Elasticity, Plane stress and plane strain conditions, Compatibility conditions, Problems using plane stress and plane strain conditions. Three-dimensional stress strain relations.

### **UNIT - II**

**Strain measurement methods:** Various types of strain gauges, Electrical Resistance strain gauges, semiconductor strain gauges, gauge factor, strain gauge circuits. Calibration of strain gauges, temperature compensation in strain gauges.

### **UNIT - III**

**Brittle coatings:** Introduction, coating stresses, failure theories, brittle coating crack patterns, 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.

### **UNIT - IV**

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

**Birefringent Coatings:** Introduction, Coating stresses and strains, coating sensitivity, coating materials, application of coating effects of coating thickness, Fringe-order determinations in coatings, stress separation methods.

### **UNIT - V**

**Photo elasticity:** Polari scope – Plane and circularly polarized light. Bright and dark field setups, Photo elastic materials – Isochromatic fringes – Isoclinics, three-dimensional Photo elasticity: locking in model deformation, materials for three dimensional photo elasticity, machining, cementing and slicing the three dimensional models, slicing the model and interpretation of the resulting fringe patterns, effective stresses, the shear-difference method in three dimensions, application of the Frozen-stress method, the scattered-light method.

### **TEXT BOOKS:**

1. Dally and Riley, "Experimental stress analysis", 3<sup>rd</sup> Edition, Mc Graw Hill, 1991.
2. Dr. Sadhu Singh, "Experimental stress analysis", 2<sup>nd</sup> Edition, Khanna Publications, 1990.

### **REFERENCE BOOKS:**

1. Timoshenko and Goodier JN, "Theory of Elasticity", 3<sup>rd</sup> Edition, Tata Mc Graw Hill, 2010.
2. Frocht, "Photo Elasticity", 3<sup>rd</sup> Edition, Wiley Sons & Co., 2008.