17MD016EXPERIMENTAL STRESS ANALYSIS

COURSE CODE	COURSE TITLE	L	P	T	C
17MD016	EXPERIMENTAL STRESS ANALYSIS				

Course Description and objectives:

Experimental Stress Analysis plays a very vital role in engineering design and performance monitoring of mechanical equipment. Various types of stress measurement techniques are discussed in this course. The main focus is on Photoelasticity, strain gauges. Topic of stress transformations is also included to provide knowledge about converting the experimental stress values into stress components that can be easily used in machine design.

Course Outcomes:

Upon successful completion of the course student should be able to:

Understand the process of conversion of stress components from one coordinate system to the other.

Acquire knowledge in selection of strain gauges.

Suggest suitable experimental stress measuring technique based on application.

Explain the measurement of strains or stresses by using different experimental methods.

Skills acquired:

Computation of stresses from the strain rosette data.

Computation of stresses from the data obtained from moiré fringe pattern.

Computation of stress from the data obtained from photo elastic experiment.

Identification of stress conditions from Brittle coating patterns.

Activities:

Calculation of principle stresses and their directions for three dimensional problems.

Calculation of strains for a given strain gauge arrangement.

Calculation of stresses in prototypes from the results of Photoelastic experiment.

UNIT-I

Introduction: TheoryofElasticity, Planestressandplanestrainconditions,Compatibilityconditions, Problemsusingplanestressandplanestrainconditions.Three-dimensional stressstrainrelations.

UNIT-II

Strainmeasurementmethods: Varioustypesofstraingauges,ElectricalResistancestraingauges, semiconductorstraingauges,gaugefactor,straingaugecircuits.Calibrationof straingauges, temperaturecompensationinstraingauges.

UNIT-III

Brittlecoatings:Introduction,coatingstresses,failuretheories,brittlecoatingcrackpatterns,crack patterns,crackdetection,ceramicbasedbrittlecoatings,resinbasedbrittlecoatings,testprocedures forbrittlecoatingsanalysis,calibrationprocedures,analysisofbrittlecoatingdata.

UNIT-IV

MoireMethods: Introduction, mechanism offormationofMoirefringes,thegeometrical approachto 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 proceduresandtechniques.

Birefringent Coatings: Introduction, Coating stresses and strains, coating sensitivity, coating materials,applicationofcoatingeffectsofcoatingthickness,Fringe-order determinations incoatings, stressseparationmethods.

UNIT-V

Photoelasticity: Polariscope–Planeandcircularly polarized light. Brightanddarkfieldsetups, Photoelasticmaterials–Isochromaticfringes–Isoclinics,three-dimensional Photoelasticity: locking inmodel deformation, materials forthree 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-stressmethod,thescattered-lightmethod.

TEXTBOOKS:

1. DallyandRiley,"Experimental stressanalysis",3rd Edition,McGrawHill,1991.
2. Dr.SadhuSingh,"Experimentalstressanalysis",2rd Edition,KhannaPublications,1990.

REFERENCEBOOKS:

1. TimoshenkoandGoodierJN,"TheoryofElasticity",3rd Edition,TataMcGrawHill,2010.
2. Frocht,"PhotoElasticity",3rd Edition,WileySons&Co.,2008.