MECH 6354
Experimental Mechanics

INSTRUCTOR Dr. Hongbing Lu, Professor, Associate Department Head, and Louis A. Beecherl, Jr. Chair, Mechanical Engineering, hongbing.lu@utdallas.edu, 972-883-4647, ECSN 2.528.

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REQUIRED TEXT Springer Handbook of Experimental Solid Mechanics, Editor: William Sharpe, Springer, New York, 2008. Available online at www.utdallas.edu/library.

PRE-REQUISITES MECH 4301 or Equivalent.

LAB HOURS 9:30 am – 12:00 pm, Mondays; or 12:30 pm -3:00 pm Mondays.

WEBSITE Up-to-date information about the course (syllabus, projects, handouts, etc.) is on eLearning.utdallas.edu.

COURSE DESCRIPTION This course provides experimental techniques and theoretical analysis for measurements of deformations and analysis of stress in engineering materials and natural bio-materials subjected to mechanical loadings. Various methods for measurement and characterization of chimerical properties such as elastic modulus, strength, failure strain, toughness, etc. will be discussed. Essential theoretical modeling for analysis of experimental results will be presented. Experimental techniques such as scanning probe microscopy, nanoindentation, and micro-tensile testing, etc. will be introduced through several lab sessions.

COURSE OBJECTIVES Introduce measurements of mechanical properties of materials, stress and deformations.

- Measure mechanical properties of different materials under different loading conditions, including stress-strain relationship, Young's modulus, Poisson's ratio, yield strength, hardness, and impact energy.
- Learn to follow and adhere to internationally acceptable test standards such as ASTM, ISO standards to generate and process data as well as to write reports and prepare presentations.
- Become proficient in operation of materials test system for characterization of mechanical behavior of materials and design experiments.
- Learn how to observe the microstructures (grains, grain boundary, etc.) on an optical microscope, and correlate microstructures with macroscopic mechanical properties (including yield strength, ductility, impact energy absorption, etc.).

- Introduce optical techniques such as photoelasticity and projection moiré.
- Introduce 2D, and 3D Digital Image Collation (DIC) techniques to measure surface strains.
- Introduce calibration, data processing, error analysis, laboratory report writing and professional presentations.

COURSE CONTENT, COURSE SCHEDULE

Introducing operation of materials test system, Mechanical properties in tension	Weeks 1-2
Mechanical Property measurement using extensometer	Weeks 3-4
Mechanical properties in compression, loading-unloading	Week 5
Flexural tests using deflectometer	Weeks 6-7
Observation of microstructures, measurement of hardness Charpy or IZOD impact testing	Weeks 8
Fracture Mechanics	Weeks 9
Delamination Mechanics	Week 10
Projection moiré	Week 11
Digital Image Correlation	Weeks 12-14
An approved self-designed experiment	Week 15

Note: Experiment sequence is tentative.

PROJECT

Project Report is due at the start of class, and will be collected at that time. Late project report **will not be accepted** without the consent of the instructor or the teaching assistant *prior to the due day*, and will not be accepted except for unusual circumstances, under which arrangement has to be made *prior to the due day*.

GRADE BASIS

In calculating your final grade for the course, the following percentages will be used:

Mid-term Exam	20%
Lab Reports	80%