ME 3057 Experimental Methods Laboratory (Required)

Catalog Description: ME 3057 Experimental Methods Laboratory (2-3-3)
Prerequisites: COE 3001 Deformable Bodies, ME 3015 System Dynamics and Control, ME 3340 Fluid Mechanics
Corequisites: MATH/ISYE 3770 Statistics and Applications and ME 3345 Heat Transfer
Introduction to basic instrumentation and experimental methodology used in mechanical engineering, including calibration, use, precision, and accuracy. Consideration of errors, precision, and accuracy in experimental measurements. Preparation of technical reports.

Textbooks: Laboratory Manual for *ME 3057, Experimental Methodology.* The George W. Woodruff School of Mechanical Engineering.
Jeff Donnell and Sheldon Jeter, *Uniform Writing and Style Manual*, College Publishing, 2004.

Topics Covered:

1. Teaming, planning, and collaboration
2. Technical report writing
3. Data acquisition, instrument response, precision, and accuracy (consideration of 1st and 2nd order systems; practice with MATLAB modeling)
4. Characterization of second order systems
5. Introduction to microprocessors (consideration of ADC, aliasing, and data I/O; practice with a piezoelectric film strain sensor on a vibrating beam)
6. Open loop control (consideration of calibration, resolution, and sensitivity; programming practice; using optical encoder and tachometer)
7. Closed loop control (consideration of feedback in control; further programming practice)
8. Thermal measurements (practice in the use of thermocouples, RTDs, and heat flux sensors) for transient and steady-state heat transfer problems
9. Stress, strain, and force measurements (consideration of resonance and damping; practice with load cells, strain gauges and rosettes, and LVDTs)
10. Viscosity measurements (use of various viscometers)
11. Machine diagnostics (time domain and frequency domain representation of data, FFT analysis and aliasing)
12. Acoustics(consideration of sound pressure levels and use of the anechoic chamber)
13. Optics (laser interferometric & diffractive sensors)

Course Outcomes:

Outcome 1: To apply in practice the logical steps in experimentation: conceptualization, planning, execution, data acquisition, analysis, interpretation, conclusion, and reporting.

> 1.1 Students will demonstrate proficiency in planning and performing experiments, data acquisition, and in writing laboratory reports. Knowledge and understanding of data acquisition from sensors used in the many fields of mechanical engineering is tested. Proficiency with varieties of signal conditioning and filtering and spread sheet based data analysis will be demonstrated.

Outcome 2: To develop the ability to work in teams.

> 2.1 Students will successfully perform experiments and prepare reports individually and in teams. A standard format is used for reports, graphs, charts, and sample calculations.

Outcome 3: To practice the principles of operation, calibration, and use of basic instrumentation.

3.1 Students will demonstrate an understanding of the operating principles, calibration, and use of basic instrumentation.

Outcome 4: To apply concepts of sensitivity, resolution, random and systemic errors, precision, accuracy, and uncertainty in experimental measurements.

4.1 Students will demonstrate an understanding of sensitivity and resolution, random and bias error, and precision and accuracy in evaluating data. Estimation of uncertainty error will be performed using statistical analysis.

Correlation between Course Outcomes and Program Educational Outcomes:

ME 3057												
	Mechanical Engineering Program Educational Outcomes											
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
Course Outcome 1.1	X	X		X			X				X	X
Course Outcome 2.1	X			X	X		X				X	X
Course Outcome 3.1	X	X			X						X	
Course Outcome 4.1	X				X						X	

Prepared by: Nader Sadegh