MECH3830 Laboratory

Course Code: MECH3830	**Course Title:** Laboratory
Required Course Or Elective Course: Required	**Terms Offered (Credits):** Spring (3 credits)
Faculty In Charge: Huihe Qiu	**Pre/Co-Requisites:** NA

Course Structure:

Lecture: 2 days per week, 3 hours; Tutorial: 1 day per week, 1 hour; Lab: 1 day per week, 3 hours

Textbook/Required Material:

1. Lab Manual
2. Class notes
3. Ernest O. Doebelin (1995): "Engineering Experimentation", McGraw Hill. (reference only)
4. Ernest O. Doebelin (1990): "Measurement Systems", McGraw Hill (reference only)
5. J. P. Holman (1994): "Experimental Methods for Engineers", McGraw Hill (reference only)

Course Description:

This is a required course for the BEng in Mechanical Engineering. It is an introductory laboratory course to provide training in experimental techniques and laboratory procedures, data acquisition, analysis, creative and innovative design of experiments, and technical communication.

Course Topics:

1. Introduction to writing engineering laboratory reports, presentation;
2. Basic concepts and terms: dimensions, units and standards; significant figures, precision, accuracy, and bias; resolution, sensitivity, and linearity;
3. Design of Experiments: innovative and creative design of experiments; test matrix and test sequence; calibration and dimensional analysis.
4. A/D conversion; data acquisition and sampling theory; quantization and discretization; aliasing and leakage errors;
5. Analysis of experimental data: method of least squares, Fast Fourier analysis; error analysis and uncertainty analysis;
6. Measurement principles and basic instruments: flow sensors, strain gauges, displacement sensors, temperature sensors, vibration and motion sensors;
7. Case studies of measurements: flow, displacement, temperature, vibration, motion, refrigeration and air-conditioning, viscoelastic properties and fracture toughness measurements

Course Objectives:	1. To introduce the basic understanding of physical measurements, the working principles of various transducers, and the knowledge of signal processing and data analysis. 2. To develop skills to design and analyze measurement systems. 3. To develop creative thinking and diagnostic skills. 4. To develop proficiency in data analysis, presentation and technical communication. 5. To provide a platform for practice in different engineering measurements.
Course Outcomes:	A. Explain key concepts of physical measurements, and the working principles of various transducers, signal processing and data analysis. B. Design and analyze measurement systems.

	C. Apply a range of diagnostic methods and approaches to analyze and determine creative solutions to a variety of engineering measurement problems. D. Conduct effective data analysis, and present findings using appropriate technical terminology. E. Practice different engineering measurements in a wide variety of scenarios.	
Assessment Tools:	Regular homework problems Lab projects & Technical Communication Mid-term and Final exams	10% 50% 40%