MECHANICAL ENGINEERING PROGRAM

ABET COURSE SYLLABUS

ME 236 Engineering Measurement and Data Analysis (3) Required

Course Description: (2013-15 Catalog)	Introduction to principles of experimental measurement, including practical instrument reading, data collection, and uncertainty analysis. Techniques for measuring temperature, pressure and other parameters. Introduction to theory and practice of writing laboratory reports and communication of experimental data. 2 Lectures, 1 Laboratory
Prerequisite Courses:	Engineering Majors only; RECOMMENDED prerequisites: CHEM 125, ENGL 134, PHYS 132, ME 128
Prerequisites by Topic:	General chemistry Writing and techniques of composition General physics, with topics including Temperature and the First Law of Thermodynamics
Textbook: (and/or other required material)	Glen E. Thorncroft, ME 236 Course Pack, El Corral Publications (Includes Course Notes, Laboratory Manual, and *A Guide to Writing Laboratory Reports*
References:	Figliola, R.S. and Beasley, D.E., *Theory and Design for Mechanical Measurements*, 3rd Edition, 2000 Taylor, J.R., *An Introduction to Error Analysis, 2nd Edition*, University Science Books, 1997. Lapin, L.L., *Modern Engineering Statistics*, Duxbury Press, 1997. Levine, D.M., Ramsey, P.P., and Smidt, R.K., *Applied Statistics for Engineers and Scientists*, PrenticeHall, New Jersey, 2001. Coleman, H.W. and Steele, W.G., *Experimentation and Uncertainty Analysis for Engineers, 2nd Ed.*, John Wiley and Sons, New York, 1999. Holman, P., Experimental Methods for Engineers, 6th Ed., McGraw-Hill, Inc., New York, 1994.
Course Coordinator/Instructor:	Glen E. Thorncroft
Course Learning Outcomes:	The student will be able to: Recognize and identify general sources of error and uncertainty in measurements; break down measurements into its constituent sources; discriminate between instrumentation error, statistical error, and bias error in measurements. Perform statistical analysis of data; estimate measurement errors and generate confidence intervals for infinite and finite samples of data; apply statistical theory to real sets of data; perform regression analysis, and generate curve-fits of data; predict the accuracy of a measurement from

curve-fitted data.
Apply uncertainty analysis to functions consisting of measured quantities; compare the relative importance of a set of measured quantities to their influence on the calculated result.
Identify and compare methods of temperature measurement; interpret the thermocouple laws; calibrate a thermocouple and use it to measure temperature
Identify and compare methods of pressure measurement; calculate pressures across a liquid-filled manometer; measure and calculate atmospheric pressure using a mercurial barometer.
Communicate the results of an experiment; write a complete laboratory or test report; illustrate the results in appropriate figures and tables; describe the procedure, results, and interpret physically the behavior of experimental data in thermal measurements; judge the accuracy of a measured or calculated result; critique an experiment and suggest methods for improvement.

Relationship of Course to MECHANICAL ENGINEERING Program Outcomes:														
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*L*	*m*		
M	H	L	M	L	M	H	L	L	L	M	M	L		

Topics Covered:

Basic concepts in measurement: Accuracy vs. precision; bias and precision errors; methods and uncertainty in instrument calibration; measurement standards.
Data analysis: Graphical characterization of data; probability distributions; statistical properties of the Gaussian distribution; parameter estimation and confidence intervals for normally-distributed, infinite data sets; statistical analysis for finite samples; data outlier detection; regression analysis and curve-fitting
Uncertainty analysis: propagation of the uncertainty of measured variables to a calculated result or function
Temperature and its measurement: Thermocouple calibration; Thermocouple laws; a survey of other methods of temperature measurement
Pressure and its measurement: Pressure variation with depth in a fluid; Manometry; a survey of other methods of pressure measurement
Regression Analysis: curve-fitting, developing statistical models for assessing the accuracy of a curve fit, and strategies for developing appropriate curve-fit models.

Laboratory Projects:

Introduction to laboratory report writing
Thermocouple calibration; identification of governing thermoouple laws
Dynamic calibration: measurement of thermocouple time constant
Bomb Calorimetry: measurement of the Higher Heating Value of Diesel fuel
Pressure measurement and calibration of a pressure transducer

Introduction to computerized data acquisition (DAQ)

Class/Lab Schedule: Two 50-minute lectures and one 3-hour laboratory each week.

Contribution of Course to Meeting the Professional Component:		
	(a) College-level mathematics and basic sciences:	0 credits
	(b) Engineering Topics:	3 credits
	Design	no
	(c) General Education:	0 credits
	(d) Other:	0 credits

Prepared by: G. Thorncroft **Date: 5/09/2014**