**MECHANICAL ENGINEERING PROGRAM**

**ABET COURSE SYLLABUS**

**ME 236 Engineering Measurement and Data Analysis (3) Required**

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| **Course Description: (2019-20 Catalog)** | Introduction to principles and practice of measurement. Application of probability distributions, sampling, confidence intervals, uncertainty, and regression analysis to engineering experiments and design. Techniques for measuring common physical quantities such as temperature, pressure, and strain. Introduction to laboratory report writing and communication of technical data. 2 Lectures, 1 Laboratory. |
| **Prerequisite Courses:** | Engineering Majors only; RECOMMENDED prerequisites: CHEM 125, ENGL 149, and PHYS 132. |
| **Prerequisites by Topic:** | General chemistry<br>Technical writing and techniques of composition<br>General physics |
| **Textbook: (and/or other required material)** | Glen E. Thorncroft, ME 236 Course Pack, University Publications (Includes Course Notes, Laboratory Manual, and *A Guide to Writing Laboratory Reports* |
| **References:** | Lapin, L.L., *Modern Engineering Statistics*, Duxbury Press, 1997.<br>Levine, D.M., Ramsey, P.P., and Smidt, R.K., *Applied Statistics for Engineers and Scientists*, PrenticeHall, New Jersey, 2001.<br>Holman, P., Experimental Methods for Engineers, 6th Ed., McGraw-Hill, Inc., New York, 1994. |
| **Course Coordinator/Instructor:** | Glen E. Thorncroft, Professor, Mechanical Engineering |
| **Course Learning Outcomes:** | The student will be able to:<br>1. Recognize and identify general sources of error and uncertainty in measurements; break down measurements into its constituent sources.<br>2. Perform statistical analysis of data; estimate measurement errors and generate confidence intervals for infinite populations and finite samples of data; statistically analyze real sets of data; perform regression analysis and generate curve-fits of data; predict the accuracy of a measurement from curve-fitted data.<br>3. Apply uncertainty analysis to functions consisting of multiple measured quantities; compare the relative importance of a set of measured quantities to their influence on the calculated result.<br>4. Identify and compare methods of measuring common physical quantities, as well as use them and analyze and communicate the resulting measurements. Measurement techniques include: length (Vernier, dial, digital calipers, micrometers), temperature (focus on |

thermocouples); pressure (manometers, pressure transducers, barometers); strain (focus on thin-film strain gauges); oxygen-bomb calorimeter.

5. 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 Student Outcomes:**

SO 1: Develop (D)
SO 2:
SO 3: Develop (D)
SO 4: Introduce (I)
SO 5: Introduce (I)
SO 6: Develop (D)
SO 7:

**Topics Covered:**

1. Introductory Concepts in Measurement.
2. Introduction to Statistics.
3. Statistics of Infinite Populations (z-statistics).
4. Finite-sample Statistics (t-statistics).
5. Other Aspects of Sampling; Outlier Detection.
6. Uncertainty Analysis (Propagation of Uncertainty).
7. Regression Analysis, Modeling, and Uncertainty.

**Laboratory Projects:**

1. Basic Measurement Practice.
2. Temperature Measurement, Thermocouple Calibration and Laws.
3. Dynamic Calibration and Time Constant.
4. Measurement of Pressure.
5. Strain Measurement.
6. Bomb Calorimetry.

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

**Contribution of Course to Meeting the Professional Component:**

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| (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: 02/07/2020**