**MECHANICAL ENGINEERING PROGRAM**

**ABET COURSE SYLLABUS**

**ME 410: Experimental Methods in Mechanical Design I (4) Elective**

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| **Course Description: (2019-2020 Catalog)** | Bonded resistance strain gages for static and dynamic measurements; rosettes, bridge circuits, lead wire effects, special gages. Data acquisition systems, and measurement of displacement, velocity, and acceleration. Photoelastic methods including birefringent coatings. Applications in mechanical design and metrology. 3 lectures, 1 laboratory. |
| **Prerequisite Courses:** | ME 328, Recommended: ME 318 |
| **Prerequisites by Topic:** | Introduction to Design<br>Recommended: Vibrations |
| **Textbook**: **(and/or other required material)** | Handouts, web resources, and technical reports. |
| **References:** | None |
| **Course Coordinator/Instructor:** | John Ridgely, Professor of ME. |
| **Course Learning Outcomes:** | 1. Use bonded strain gages to analyze real world problems<br>2. Understand the principles of photoelasticity and how it can be used to solve mechanical engineering design problems<br>3. Use accelerometers, rate gyros, and other sensors to determine accelerations, displacements, and velocities<br>4. Choose appropriate measurement techniques to solve mechanical design problems<br>5. Develop and execute a test plan to analyze a mechanical engineering design problem<br>6. Validate experimental measurements using analytical techniques<br>7. Apply statistics and uncertainty analysis to evaluate the quality of experimental results. |

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| **Relationship of Course to Mechanical Engineering Student Outcomes:** | SO 1: Mastered (M)<br>SO 2: Mastered (M)<br>SO 3: Mastered (M)<br>SO 4:<br>SO 5: Develop (D)<br>SO 6: Mastered (M)<br>SO 7: Mastered (M) |
| **Topics Covered:** | 1. Bonded resistance strain gauges, gauge selection, cements. Strain gauge bridge circuits<br>2. Strain rosettes, transverse sensitivity correction, thermal and lead wire effects.<br>3. Data acquisition, signal conditioning, and analog to digital conversion.<br>4. Experimental design and statistics.<br>5. Theory and application of accelerometers and rate gyros to static and dynamic measurements. |
| **Laboratory Projects:** | 1. Strain gauge application and bridge circuit wiring.<br>2. Design, construction, and testing of a load cell using strain gauges.<br>3. Applications of modern software to data acquisition.<br>4. Use of accelerometers and gyros to measure impact, accelerations, tilt, and angular velocity.<br>5. Multi-week final project. |
| **Class/Lab Schedule:** | Three one-hour lectures and one three-hour lab per week. |
| **Contribution of Course to Meeting the Professional Component:** | (a) College-level mathematics and basic sciences: 0 credits<br>(b) Engineering Topics (Science and/or Design): 4 credits<br>(c) General Education: 0 credits<br>(d) Other: 0 credits |
| **Prepared by:** John Ridgely | **Date:** 7/5/2020 |