

**Department of Mechanical Engineering**  
**ME 343 – Mechanical Laboratory**  
(Required)

**Catalog Description: ME 343 (2-2-3)**

Students also must register for the lab component. Laboratory and lecture in instrumentation and measurement for mechanical engineering students. Applications for the sensing of such variables as pressure, temperature, mass flow, and displacement. Particular attention to the applicability and sensitivity of instruments.

**Prerequisites:** ECE 405 – Electrical Engineering Principles  
Math 225 – Survey of Probability and Statistics  
ME 236 – Dynamics  
ME 304 – Fluid Mechanics (Co-requisite)

**Textbook(s) Materials Required:**

J.P. Holman, Experimental Methods for Engineers, 7th Edition, McGraw-Hill, 2001.

**Reference(s) (Not Required):**

1. Beckwith, Marangoni, and Lienhard, Mechanical Measurements, 5th Edition Addison Wesley, 1993.
2. J. Stenerson, Fundamentals of Programmable Logic Controllers, Sensors, and Communications, 3<sup>rd</sup> Edition, Prentice Hall, 2004.
3. D. Beer, A Guide to Writing as an Engineer, 2nd Ed., Wiley ISBN 0-471-43074-0

**Course Supervisor: Dr. C. Zhu**

**Pre-requisite by topic:**

1. Electric circuit and signal analysis
2. Probability and statistics
3. Dynamics
4. Stress and strain
5. Flow

**Course Objectives<sup>1</sup>:**

1. Students will learn the basic concepts of measurement systems and treatment of measurement uncertainties. (A, B, C, D,E)
2. Students will learn the characteristics of signal conditioning, data acquisition, and data analysis. (A, B, C, D, E)
3. Students will learn the measurement of speed. (A, B, C, D, E)
4. Students will learn the measurement of temperature. (A, B, C, D, E)
5. Students will learn the measurement of strain, force and torque. (A, B, C, D, E)
6. Students will learn the basic control technologies: programmable logic control and feedback control. (A, B, C, D, E)
7. Students will learn the measurement of flow rate, flow pattern, and flow velocity. (A, B, C, D, E)
8. Students will learn the basic sound measurement. (A, B, C, D, E)
9. Students will learn the basic concepts of effective written and graphical

communication of experimental methods, data and results. (A, B, C, D, E)

**Topics<sup>2</sup>:**

1. Basic concept of mechanical engineering measurements and uncertainty analysis (3 hrs)
2. Basic format and effective technical report writing. (3 hrs)
3. Theory and measurement of signal conditioning. (3 hrs)
4. Theory and measurement of rotation speed. (3 hrs)
5. Theory and measurement of temperature (6 hrs)
6. Theory and measurement of stress and strain (6 hrs)
7. Basic control theory and control experiment. (6hrs)
8. Theory and measurement of flow (6 hrs)
9. Theory and experiment of sound (3 hrs)

**Evaluation Method:**

1. Classroom Attendance
2. Lab Participation
3. Lab Reports
4. Quizzes
5. Exam
6. Homework

**Schedule:** Lecture Recitation:1.5 hours per week; Laboratory:2.5 hours per week

**Professional Component:** Engineering Science

**Program Objectives Addressed:** A, B, C, D, E

**Course Outcomes<sup>3</sup> :**

**Objective 1**

- 1.1 Students will show an ability to conduct the experiment and data acquisition. (2,3) (a,b,e,g,i,k)
- 1.2 Students will apply the analysis of measurement uncertainties. (3,4,5,6) (a,b,e,g,i,k,n)

**Objective 2**

- 2.1.Students will show an ability to conduct an experiment and data acquisition of signal conditioning. (1,2,3) (a,b,e,g,i,k)
- 2.2.Students will analyze the data and prepare a report. (3) (a,b,e,g,i,k)
- 2.3.Student will demonstrate understanding of signal conditioning theory. (3,4,5,6) (a,b,e,g,i,k)

**Objective 3**

3. 1. Students will show an ability to conduct a rotating speed experiment and data acquisition. (1,2,3) (a,b,e,g,i,k)
- 3.2 Students will analyze the data and prepare a report. (3) (a,b,e,g,i,k,n)
- 3.3 Student will demonstrate understanding of rotation speed measurement theory. (3,4,5,6) (a,b,e,g,i,k,n)

**Objective 4**

- 4.1 Students will show an ability to conduct a temperature experiment and data acquisition. (1,2,3) (a,b,e,g,i,k)

- 4.2 Students will analyze the data and prepare a report. (3) (a,b,e,g,i,k,l)  
4.3 Student will demonstrate understanding of temperature measurement theory. (3,4,5,6)  
(a,b,e,g,i,k,l)

**Objective 5**

- 5.1 Students will show an ability to conduct a strain experiment and data acquisition.  
(1,2,3) (a,b,e,g,i,k)  
5.2 Students will analyze the data and prepare a report. (3) (a,b,e,g,i,k)  
5.3 Student will demonstrate understanding of measurement theory of stress, strain, and  
torque. (3,4,5,6) (a,b,e,g,i,k)

**Objective 6**

- a. Students will show an ability to conduct a control experiment and record the control  
logic diagrams. (1,2,3) (a,b,e,g,i,k)  
b. Students will analyze the control logic process and prepare a report. (3) (a,b,e,g,i,k)

**Objective 7**

- 7.1 Students will show an ability to conduct a flow experiment and data acquisition.  
(1,2,3) (a,b,e,g,i,k)  
7.2 Students will analyze the data and prepare a report. (3) (a,b,e,g,i,k)  
7.3 Student will demonstrate understanding of flow measurement theory. (3,4,5,6)  
(a,b,e,g,i,k)

**Objective 8**

- 8.1 Students will show an ability to conduct a sound experiment and data acquisition.  
(1,2,3) (a,b,e,g,i,k)  
8.2 Students will analyze the data and prepare an extended abstract. (3) (a,b,e,g,i,k)  
8.3 Student will demonstrate understanding of sound measurement theory. (3,4,5,6)  
(a,b,e,g,i,k)

**Objective 9**

- 9.1 Students will show an ability to prepare effective engineering reports with substantial  
computer usage, graphical presentation, data analysis, and comparison against theories.  
(1,2,3) (a,b,c,e,g,h,i,k)

**Prepared by: Chao Zhu**

**Date: September 28, 2006**

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<sup>1</sup> Capital Letters in parenthesis refer to the Program Objectives of the Mechanical Engineering Department. Listed in Sec 2 d Tables B-2-9, B-2-12. Table B-2-8 links Program Objectives with the ABET a-k Criterion.

<sup>2</sup> Topic numbers in parenthesis refer to lecture hours. (three hours is equivalent to 1 week)

<sup>3</sup> Outcome numbers in parenthesis refer to evaluation methods used to assess the student performance. Lower case letters in parenthesis refer to ABET a-k outcomes.