

SYLLABUS
ME 3600/5600 Experimental Measurements and Instrumentation
Spring 2015

3 credit hours
WRIGHTSTATEUNIVERSITY
Department of Mechanical and Materials Engineering

INSTRUCTORS: Dr. Yang, Room 131 RC, Phone 775-5091, E-mail: zifeng.yang@wright.edu

Lab Assistant: James Davidson, Room 223 RC, E-mail: davidson.45@wright.edu

WEB SITE: See PILOT web site. Homework solutions, laboratory write-ups, and other materials are located here.

CLASS TIME AND LOCATION: M, W 6:10 – 7:30 pm, Room 144 RC

LAB TIME AND LOCATION: Sec 01 – 7:45-9:35pm, 142RC,
Sec 02 – 8:00-9:50pm, 142RC.
~~Sec 03 – TBA,~~

OFFICE HOURS: Dr. Yang: T 1:30 – 3:30 pm, R 1:30 – 3:30 pm or by appointment

2012 - 13 CATALOG DATA: ME 3600/5600: Experimental Measurements and Instrumentation (Credits 3 – three hours lecture and two hours lab). Techniques, equipment and measurement procedures used by Mechanical Engineers. Writing lab reports, performing data acquisition, and applying statistics to experimental data. Prerequisites: EE 301 with minimum grade of D, ME 199 with minimum grade of D, ME 213 with minimum grade of D, and MTH 235 with minimum grade of D.

TEXTS: Figliola, R. S. and Beasley, D. E, *Theory and Design for Mechanical Measurements*, 5th Edition, Wiley, 2011.

REFERENCES: Beckwith, T. G., Marangoni, R. D., and Lienhard, J. H., *Mechanical Measurements*, 6th Edition, Prentice Hall, 2007.
Dunn, P. F., *Measurement and Data Analysis for Engineering and Science*, 1st Edition, McGraw Hill, 2005.
Doebelin, E. O., *Measurement Systems: Application and Design*, 5th Edition, McGraw-Hill, 2005.
Holman, J. P., *Experimental Methods for Engineers*, 7th Edition, McGraw Hill, 2001.
Bishop, R., *LabVIEW 8: Student Edition*, Prentice Hall, 2007.

GOALS: Strengthen student's ability to perform experimental work including setting up experiments, running experiments, and working with the experimental results. Students will learn signal processing, data acquisition, data reduction, data accuracy, data precision, instrument response, and statistics. Students will be exposed to a number of measurement tools used by Mechanical Engineers. The student should be aware that electrical engineering principles are used in this class. In addition, the student's skill at writing lab reports will be improved.

PREREQUISITES: Incoming students are expected to have knowledge of:

- I. Differential Equations
- II. Newton's Law
- III. Electrical Circuits
- IV. Some ability to work in a lab.

TOPICS COVERED IN COURSE:

- I. Experimental procedures
- II. Writing a lab report
- III. Probability and statistics as applied to experiments
- IV. Data acquisition
- V. Signal processing

- VI. Measurement system behavior
- VII. Strain measurement devices
- VIII. Temperature measurement devices
- IX. Pressure measurement devices

HOMEWORK: Homework will be assigned in class and on most occasions is due one week after it is assigned. Late homework will receive a 50% grade reduction and late homework that is a duplicate copy of the posted solutions will receive an 80% grade reduction. Students may work together on their homework, but each student must contribute to the process and individually write out their solution. Use of the solution manual is not allowed for homework until after the due date. Problems should be done such that there is a Given, Find, and Solution. The Given should contain all useful information stated in the problem in abbreviated form. Many times it is best to make a sketch of the problem and place the given information on this sketch. Do not recopy the problem statement! The Find section should briefly state the quantities being sought. Lastly, the Solution section should contain an orderly display of how you solved the problem. The solution should be such that it is easy for someone else to understand how you deduced your answers. All important equations should be written out in symbolic form, as well as showing the substitution of numbers into the equation. Assumptions should be clearly stated and any additional figures required should be shown. Put a box around your final answers. The use of commonly used symbols to state the Given, Find, and Solution information is encouraged.

EXPERIMENTS: The experiments will be performed by the students. Lab reports and lab results will be required. It may take more than the 2 hour lab sessions to finish the required experiment. The student will be able to come into the laboratory on their own to finish the experimental work. Students will have swipe access to the laboratory.

EXAMS: One midterm and one final will be given. On a test the student is responsible for the material in the lecture sessions as well as the laboratory sessions. All exams are to be the student's own work and no collaboration is allowed.

ATTENDANCE: Attendance and performance of every lab is required. Attendance in class is not required, but the student is responsible for everything that occurs in class. Attendance at tests is required.

GRADING: The grading for the course is as follows:

Homework - 10%	Formal Lab Reports - 30%
Midterm -15%	Other Lab Work - 10%
Final - 35%	

The student will be awarded the highest grade according to the following scale:

- A - 90% or more of the total points
- B - 80% or more of the total points
- C - 70% or more of the total points
- D - 60% or more of the total points
- F - less than 60% of the total points

ACADEMIC Cheating will not be tolerated. In this class students are encouraged to work together on the

INTEGRITY: homework. On the tests the students are to work alone. Students may discuss lab reports with one another; however, each student must write their own lab report. Copying of other students lab reports will result in a grade of zero on the lab and possible failure for the class. No paper or electronic materials should exchange hands between students on the lab reports. If these items are exchanged, you have crossed the boundary of discussion only on the lab reports. In addition, the student is not allowed to use any work from prior quarters of ME314 (Now ME3600). Therefore no homework or lab reports from prior quarters of this class should be used. Copying of prior lab reports or homework will result in a grade of zero on the lab and possible failure for the class. Students are encouraged to use the library, internet, and other course books in ME3600 to help them complete their homework and lab reports. Of course, the library, internet, and other course books cannot be used on a test. Any references used in lab reports need to be cited. Any material taken from other sources needs to be cited. All work in this course must be completed in a manner consistent with WSU Policy and Code of Academic Responsibility and Conduct. Violation of this code will result in a penalty to be

determined by the instructor to fit the gravity of the offense and the circumstances of the particular case. The instructor may: 1) fail the student for the particular assignment, test, or laboratory, 2) give the student a failing grade in the course, 3) recommend that the student drop the course, or 4) bring the case in front of the University Student Honesty or Discipline Committee.

TENTATIVE SCHEDULE

<u>PERIOD</u>	<u>DATE</u>	<u>TOPIC</u>	<u>ASSIGNED READING</u>	
Week 1	Lab	No Lab		
1	1/12	Introduction, Basic Concepts of Measurements	Chapter	
1	2	1/14	Introduction, Basic Concepts of Measurements	Chapter 1
Week 2	Lab	No lab		
3	1/19	MLK Day, University Closed		
4	1/21	Statistics	Chapter 4	
Week 3	Lab	Group Statistics Lab	Lab Manual	
5	1/26	Statistics	Chapter 4	
6	1/28	Statistics	Chapter 4	
Week 4	Lab	Individual Statistics Lab	Lab Manual	
7	2/02	Statistics	Chapter 4	
8	2/04	Statistics	Chapter 4	
Week 5	Lab	No Lab		
9	2/09	How to write a lab report	Appendix A	
10	2/11	Uncertainty	Chapter 5	
Week 6	Lab	LabVIEW Orientation	Lab Manual	
11	2/16	Uncertainty	Chapter 5	
12	2/18	Time Dependent Characteristics of Signals	Chapter 7.1, 7.2	
Week 7	Lab	Data Acquisition (Formal Lab Report)	Lab Manual	
13	2/23	Time Dependent Characteristics of Signals	Chapter 2	
14	2/25	Time Dependent Characteristics of Signals	Chapter 2	
Week 8	Lab	No lab		
15	3/02	Spring Break ☺		
16	3/04	Spring Break ☺		
Week 9	Lab	No lab	Lab Manual	
17	3/09	Time Dependent Characteristics of Signals & Midterm Review	Chapter 2	
18	3/11	EXAM - I , Chapters 1, 4, 5, 7.1, 7.2, small part of 2		
Week 10	Lab	Fourier Transform Lab	Lab Manual	
19	3/16	Measurement System Behavior	Chapter 3	
20	3/18	Measurement System Behavior	Chapter 3	
Week 11	Lab	Dynamic Response		
21	3/23	Measurement System Behavior	Chapter 3	
22	3/25	Measurement System Behavior	Chapter 3	
Week 12	Lab	No Lab		

	23	3/30	Strain and Stress Measurement	Chapter 11
	24	4/01	Strain and Stress Measurement	Chapter 11
Week 13	Lab		Strain Measurement (Formal Lab Report) Manual	Lab
				11/19
				Temperature Measurement Chapter 8
	25	4/06	Strain and Stress Measurement	Chapter 11
	26	4/08	Temperature Measurement	Chapter
8		11/23	No class (Thanksgiving)	
Week 14	Lab		No Lab	
	27	4/13	Temperature Measurement	Chapter 8
	28	4/15	Pressure and Velocity Measurement	Chapter 9
Week 15	Lab		No Lab	
	29	4/20	Pressure and Velocity Measurement	Chapter 9
	30	4/22	Pressure and Velocity Measurement & Final Review	Chapter 9
Final		4/29	FINAL EXAM , 5:45 – 7:45pm, Chapters 1, 2, 3, 4, 5, 7.1, 7.2, 8, 9, 11, and Appendix A, in Room 144 RC	