

Drexel University
College of Engineering
Department of Engineering Technology

Course: Measurement Laboratory

Term: Winter 2013-2014

Credits: 3.000

Course description:

The course focuses on accurate and specific measurements of physical phenomena. The recording and interpretation of these measurements will be presented in detail in formatted reports. Measurement transduction into computerized data acquisition system is studied.

Course objectives:

- Basic concepts of measurement systems – calibration and units
- Understanding measurements techniques and methods
- Analysis of experimental data – causes of error, uncertainty analysis, statistical analysis of experimental data
- Measurements with data logging and functional response (LabVIEW)
- Report writing – format and requirements

Course Outcomes: Students will be able to:

1. Recognize sources of measurement errors and how they propagate, and be capable of using this knowledge in calculations
2. Describe the advantages and limitations of the various sensors used in this course
3. Plan experiments to meet specific engineering accuracy/resolution goals
4. Prepare a high quality engineering reports including presentation of goals, background, results, analysis, and conclusions

Prerequisites: PHYS 104 Minimum Grade: D and STAT 201 Minimum Grade: D

Required Text: • *Introduction to Engineering Experimentation, 3rd Ed., A.J. Wheeler and A.R. Ganji, Pearson Education/Prentice Hall 2010.*

Required Materials:

- *LabVIEW 2010 (Version 10) software or later, National Instruments (Available in virtual server mht226.goodwin.drexel.edu)*

Optional Reference Texts:

- *Theory and Design for Mechanical Measurements, 4th ed., R.S. Figliola and D.E. Beasley, Wiley 2006. Available as hardcover (ISBN 978-0471445937) and e-book (ISBN 978-0470508664). Web resources are also available.*
- *Experimental Methods for Engineers, J.P. Holman, 7th ed., McGraw-Hill 2001.*

Instructor: Irina N. Ciobanescu Husanu, Ph. D.

Office: Room 015

Telephone: 215-895-5957


Email: inc22@drexel.edu

Office hours: Tuesdays and Thursdays: 3:30pm – 5:00 pm

Course schedule and practical work:

<i>Week</i>	<i>Topic</i>	<i>Sections</i>	<i>Lab Activity</i>	<i>Homework</i>
1 01/07	Course intro, Intro to Measurement Systems; Planning and Documenting Experiments Probability and Statistics: Measurement Statistics	Chapter 1 and 2 Chapter 12 Chapter 6 6.1-6.5	<i>No Lab</i>	Problems: 2.8, 2.14, 2.16, 2.21, 2.23, 2.27, 2.30, 2.43 <i>Due on 01/16</i>
2 01/14	Probability and Statistics	Chapter 6 6.6-6.7	Lab 1 Basic Measurements <i>Report due on 01/23</i>	Problems: 6.4, 6.8, 6.15, 6.18, 6.24, 6.30, 6.41, 6.42 <i>Due on 01/23</i>
3 01/21	Uncertainty Analysis	Chapter 7	Lab 3 Viscosity Measurement Lab 2 Voltage and Reaction Time Measurement <i>Report due on 01/30</i>	Problems: 6.49, 6.55, 6.64, 6.70, 6.81 <i>Due on 01/30</i>
4 01/28	Uncertainty Analysis Measuring Rotation and Acceleration	Chapter 7 Chapter 8	Lab 4 Renishaw XL-80 Laser Interferometer System: Linear Measurement <i>Report due on 02/06</i>	Problems: 7.3, 7.11, 7.14, 7.19, 7.31, 7.34, 7.45, <i>Due on 02/06</i>
5 02/04	Measuring Rotation and Acceleration	Chapter 8 Midterm Review	Lab 5 Error Measurements - Angular and Yaw (CNC and Laser Ballbar System) Lab 6 Error Measurements (CNC and Laser Ballbar System) <i>Report due on 02/13</i>	Problems: 8.33, 8.35, 8.40, 8.51, 8.55 <i>Due on 02/13</i>
6 02/11	Midterm Ch 1, 2, 6, 7	-	Lab 7 Measurement of T and P in micro-fluidic set-up <i>Report due on 02/20</i>	-
7 02/18	Measuring Temperature, Pressure and Humidity	Chapter 9	Lab 8 Temperature Measurement	Problems: 9.11, 9.12, 9.17, 9.21, 9.24, <i>Due on 02/27</i>
8 02/25	Measuring Temperature, Pressure and Humidity; Measuring Flow Rate, Fluid Velocity	Chapter 9	Lab 8 Temperature Measurement <i>Report due on 03/06</i>	Problems: 9.27, 9.37, 9.42, 9.44 <i>Due on 03/06</i>
9 03/4	Measuring Flow Rate, Fluid Velocity;	Chapter 10	Lab 9 Pressure and Flow Measurements <i>Report due on 03/13</i>	Problems: 10.13, 10.21, 10.32, 10.36, 10.41 <i>Due on 03/13</i>
10 03/11	<i>Final Review</i>		<i>Final Review</i>	-
11 03/18	<i>Final Exam Comprehensive</i>		-	-

Engineering Technology Course: MHT 226
Student Learning Outcomes (SLOs) Aligned with ABET Student Outcomes (a-k)

ABET Student Outcomes¹			a	b	c	d	e	f	g	h	i	j	k
SLO 1:	Recognize sources of measurement errors and how they propagate, and be capable of using this knowledge in calculations		X	X	X			X					
SLO 2:	Describe the advantages and limitations of the various sensors used in this course		X	X	X								
SLO 3:	Plan experiments to meet specific engineering accuracy/resolution goals		X	X	X	X		X	X		X		
SLO 4:	Prepare a high quality engineering reports including presentation of goals, background, results, analysis, and conclusions		X	X	X	X	X	X	X		X		X

Upon successful completion of this program, students will attain the following outcomes:

- a. an ability to select and apply the knowledge, techniques, skills, and modern tools of the discipline to broadly-defined engineering technology activities;
- b. an ability to select and apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require the application of principles and applied procedures or methodologies;
- c. an ability to conduct standard tests and measurements; to conduct, analyze, and interpret experiments; and to apply experimental results to improve processes;
- d. an ability to design systems, components, or processes for broadly-defined engineering technology problems appropriate to program educational objectives;
- e. an ability to function effectively as a member or leader on a technical team;
- f. an ability to identify, analyze, and solve broadly-defined engineering technology problems;
- g. an ability to apply written, oral, and graphical communication in both technical and non- technical environments; and an ability to identify and use appropriate technical literature;
- h. an understanding of the need for and an ability to engage in self-directed continuing professional development;
- i. an understanding of and a commitment to address professional and ethical responsibilities including a respect for diversity;
- j. a knowledge of the impact of engineering technology solutions in a societal and global context;
- k. a commitment to quality, timeliness, and continuous improvement.

Computer usage: Each laboratory activity will be based on LabVIEW and data analysis software such as EXCEL or MATLAB

Evaluations:

Course Requirements	Course Grading Percentages	Grading Scale		
Attendance	included in lab	97-100: A+	87-89: B+	77-79: C+
Project	N/A	93-96: A	83-86: B	73-76: C
Laboratory reports	50%	90-92: A-	80-82: B-	70-72: C-
Homeworks	15%			
Final presentation	N/A	67-69: D+	64-below F	
Midterm exam	15%	65-66: D		
Final exam	20%			

Course Policies

Attendance/Participation: As a student in this course, it is expected that you will actively participate in laboratory activities and complete assignments on time. Assignments are due no later than the assigned due date. Exceptions to this policy will require explicit permission of the instructor. **If you are absent for more than 3 (three) lab sessions you may fail the course regardless of your overall grade in the course (this means you are absent 4 laboratory sessions or more)**. Laboratory sessions cannot be made-up. However I might consider extreme hardship or extenuating circumstances in allowing a student to make-up for a lab session. In case of hardships and emergencies, you need to contact me **prior to the lab session** and arrange for documented proof of your situation.

Presentation: The primary mode of instruction will be lectures (1/3 of the class time), laboratory (2/3 of the class time), in-class discussions, and homework. Students will be expected to perform all laboratory work and all assignments given, as well as any supplemental materials assigned relating to various topics.

Lab Reports and Homework:

- Lab reports are due a week after conclusion of an experimental work. Homework will be assigned. Each homework assignment will have a due date; **it is due at the start of class on that date**. If you will not be in class, you can email the work. **Late homework and/or lab reports will lose 10% per day**. You may wish to make a copy for your own use until the assignment is returned.
- Your work should be neat and organized. **I will not accept any late assignment after I have graded and returned other students' work and/or I posted homework solutions (whichever comes first)**.

Make-Up Exam: **No make-up exams will be given.** In case of hardships and emergencies, you need to contact me **prior to the exam** and arrange for documented proof of your situation. Students are encouraged to discuss their instructional and accommodation needs with their professors early in the semester.

Disclaimer:

The content in this course information is not a legal binding contract between the student and the instructor and can be modified by the instructor only, as the circumstances will require. The student will be notified in a timely manner if such modification will occur.

The final course grade will be computed on the following basis:

Homework	15%
Laboratory Reports	50% (attendance included)
Midterm exam	15%
Two (+) Hour Final Exam	20%

Note: Any student with special problems with respect to any test taking difficulties, is a senior, has a minimum grade requirement for scholarships, etc., is strongly encouraged to discuss them with the instructor early in the term to prevent complications at the end.

Americans with Disabilities Act:

Student with disabilities requesting accommodations and services at Drexel University need to present a current accommodation verification letter (AVL) to faculty before accommodations can be made. AVL's are issued by the Office of Disability Services (ODS). For additional information, contact ODS at www.drexel.edu/ods , 3201 Arch St., Street, Suite 210, Philadelphia, PA 19104, 215.895.1401 (V), or 215.895.2299 (TTY).

Academic Honesty Policy:

Drexel University is committed to a learning environment that embraces academic honesty. In order to protect members of our community from results of dishonest conduct, the University has adopted policies to deal with cases of academic dishonesty. Please read, understand, and follow the “Academic Honesty Policy” as written in the Official Student Handbook: http://www.drexel.edu/provost/policies/academic_dishonesty.asp.

By placing his/her name on work submitted for credit, the student certifies the originality of all work not otherwise identified by appropriate acknowledgments. Drexel's policies to address violations are found at: <http://www.drexel.edu/judicial/honesty.html>

Student’s Responsibilities:

Course Evaluation:

Your feedback about the course and instructor is the only way instructors and academic units can improve the quality of a course and its content. Courses administered by the Goodwin College are evaluated electronically via the Online Course Evaluation System. Students will receive all necessary information via email by the 8th week of classes (or by the 4th week of classes in case of accelerated courses). The evaluations are entirely **confidential and will preserve your anonymity**.

Dropping a course or withdrawing from a course:

Once a student is registered, it is his/her responsibility to attend the course, drop the course, or withdraw from the course. Dropping and withdrawing are distinct actions governed by different policies and impact a student’s course enrollment status.

Dropping a course causes the name of the course to disappear from the student’s transcript.

Withdrawing from a course causes both the name of the course and the grade of “W” to appear on the student’s transcript. Before withdrawing from a course, students should consult the instructor.

In either case, a signed form is required. There are billing consequences and academic record impact during this process; therefore, the student must attend to the proper procedure when dropping or withdrawing from a course. All students must obtain the instructor’s and the Academic Advisor’s signature on the “Add/ Drop/Withdraw” form, which is available online at <http://www.drexel.edu/src/academics/forms/> or in the lobby of Goodwin College.

Financial/academic record impact for Drop/Withdrawal:

Dropping or withdrawing from courses can have serious financial and academic implications, possibly affecting billing, financial aid, VA benefits, eligibility to participate in NCAA athletic events, and for foreign students, immigration status. Students are strongly encouraged to consult with their Academic Advisor and financial aid counselor before withdrawing. Students are considered the responsible parties for any/all transactions processed against their academic record.

Drop/Withdraw Policies and Procedures

- To drop or withdraw a course for which you have paid or contracted:
 - Complete drop/withdraw form and obtain instructor and Academic Advisor signatures
 - Either give the form to your Academic Advisor or fax to 215.895.4988
 - Notify your funding source (if appropriate)

REFUND SCHEDULE

<u>6-week course</u>	<u>Full quarter course</u>	<u>Tuition Refund</u>	<u>Record Impact</u>
Before 1 st class session begins	Before 1 st class session begins	100%	No Record
Start of 1 st class meeting until the following Friday	The first two calendar weeks of class	100%	No Record
Start of 2 nd class meeting until the following Friday	Week three	50%	“W” on Record
N/A	Week four and five	25%	“W” on Record
Start of 3 rd class meeting until the following Friday	Week six	0%	“W” on Record

As shown above, withdrawal has financial and academic implications.

Please note: Whenever you add, drop, or withdraw from a course, please check your schedule in Banner Web to verify that your transaction was successful. This is very important! Ultimate responsibility for proper course adjustment rests with the student.

Financial Obligations:

Students who do not satisfy financial obligations to Drexel University are not entitled to a grade by the instructor or the University.

Incomplete Policy:

If the student requests an incomplete (I) or no-credit (NC) grade, it is the student’s responsibility to make sure she/he meets the University criteria and deadlines for requesting these grades. If the student stops attending the class, she/he will not be automatically dropped from the course and she/he will receive a grade according to her/his overall performance. It is the student’s responsibility to make sure that she/he is properly enrolled or de-enrolled in the course.

The instructor reserves the right to make changes to this syllabus if circumstances warrant such change. All changes will be provided to students in writing.