

EETBD 341 - MEASUREMENTS AND INSTRUMENTATION - FALL 2003

COURSE DESCRIPTION: Measurement concepts, transducers, electronic-aided measurement, mechanical and electrical measurements

PRE-REQUISITES: EET 117; EET 216; PHYS 151; MTHBD 210 (or concurrent)

TEXT: Learning with LabVIEW - by Bishop (Chapters 1-6,8,11)

REFERENCE: Electronic Principles - by Malvino
Op amps for Everyone – by Mancini
LabVIEW for Everyone – by Wells, Travis
Transducer Interfacing Handbook - by Sheingold
Modern Instrumentation for Scientists and Engineers - by Blackburn
Mechanical Measurements - by Beckwith, Marangoni, Lienhard

INSTRUCTOR: Mr. David Loker -- 898-6478, B-180, DRL3@psu.edu

OFFICE HOURS: Wed. 11:00 - 11:50, 1:00 – 1:50, or by appt.

LECTURE: Wed. and Fri. -- 2:00 - 2:50 – **B185** (first 5 weeks of the semester)
S117 (remainder of the semester)

LABORATORY: Mon. -- 11:00 - 12:50 or 1:00 - 2:50 -- **P105**

GRADING:

Exams (3 @ 15%)	- 45%
Laboratory	- 30%
Research Proj. or Final Exam	- 15%
Homework/Quizzes	- 5%
Professional Development	- 5%

A	93-100	B	83-86.9	C	70-76.9
A-	90-92.9	B-	80-82.9	D	60-69.9
B+	87-89.9	C+	77-79.9	F	less than 60

HOMEWORK/QUIZZES: Homework will be due every Wednesday (except as otherwise indicated) from the previous week's assigned problems. When handing in your assignment, place name, date, course number, and title of assignment in the upper right corner of the paper. Use only 8.5" x 11" paper and write on one side of the paper only. **Illegible papers will not be collected or graded.**

Quizzes will be approximately 10-15 minutes long. They will be given at various times during the semester. Unless otherwise noted, the quizzes are closed book and notes.

LAB REPORTS: Lab reports will be due the week following the completion of the experiment indicated on the tentative lab schedule. The outline for the lab report is attached.

POLICIES:

- Acts of academic dishonesty will not be tolerated.** It is unacceptable to copy homework, lab work, lab reports, or exams. It is also unacceptable to allow anyone else to copy your work. The affected assignment will be given a zero.
- No make-up exams will be given.** However consideration will be given to exceptional circumstances explained in writing.
- Homework assignments are to be turned in at the beginning of the class period on the due date. **No late homework assignments will be accepted or graded.**
- Lab reports are due at the beginning of the lab period on the due date. **The overall grade for lab reports will be reduced by 10% for each day late.** Each lab experiment is to be demonstrated to the instructor before the next lab experiment is scheduled to begin.

**RESEARCH PROJ. or
FINAL EXAM:**

A student may choose to take a final exam or to complete an individual research project in place of taking the final exam. The research project will be to demonstrate and document a working prototype of the design for the control of a temperature measurement system. Details about the project will be given during the semester.

PROFESSIONAL DEVELOPMENT: It is important for students to begin to prepare for a career in the electrical field. Companies will be attending the Annual Career Fair at Behrend this fall and will be considering summer internship positions and co-op positions. The Career Development Center (CDC) at Behrend will assist you in developing your resume and enhancing your interviewing skills.

You will be graded based upon the following criteria:

- Research paper on career planning. More details will be given during the semester.
- Attendance at the Annual Career Fair at Behrend **or** the UP Career Fair. The dates are available on the CDC web site.
- Attitude of professionalism. Students are expected to act professionally at all times. Honesty and integrity are most important.
- Participation. Attendance and active participation in classes and labs are very important. Attendance in all labs is required.

General comments about the course:

- My primary responsibilities are:
 - To make certain that you understand the material through lecturing and problem solving. *I **can't** make certain that you understand the material without getting adequate feedback from you.*
 - To provide feedback to you through graded homework, quizzes, exams, and lab work.
- Your primary responsibilities are:
 - To learn (or master) the material. *This is accomplished by **completing and understanding** all assigned work and by **asking** questions during class. Stop me if you don't understand the material.*
 - To provide feedback to the instructor during the lectures on whether you understand the material.
- This class will probably require more work than most of the other classes you have taken at PSU. Many of the labs focus on solving real-world problems and will require outside class time to successfully complete. This is done in order to better prepare you to enter the job market and be successful at obtaining the right job. *Plan to spend on average approximately 6-9 hours of productive outside class time per week to successfully complete all the course work.*
- This course includes the development of both hardware and software. In order to successfully complete this course, you must be proficient in both.
- Focus on working hard and on learning the material rather than on obtaining the proper grade. If you have learned the material, the proper grade will follow.
- **I will do everything I can to help you be successful in this course!**

After completing this course, a student should be able to:

1. Understand the LabVIEW graphical programming language
2. Program a PC-based data acquisition board for analog input and output operations
3. Design signal conditioning circuits for interfacing to sensors
4. Understand how to design a temperature measurement system
5. Understand how to design a measurement system to measure mass

“Press on: Nothing in the world can take the place of perseverance.”

(Calvin Coolidge)

EETBD 341 – MEASUREMENTS AND INSTRUMENTATION***Tentative Course Outline***

WEEK	DATE	CHAPT	TOPICS
1	9/2,9/3,9/5	1,2	LabVIEW Basics, VIs
2	9/10,9/12	3,5,6	Editing & Debugging, Formula Node
3	9/17,10/19	4,6	SubVIs, Arrays
4	9/24,9/26	5,11.7-11.8	Structures, Signal Generation, Butterworth Filters
5	10/1,10/3	--	Review EXAM 1
6	10/8,10/10	8 Handout	Analog I/O VIs Data Acquisition
7	10/15,10/17	Handout	Signal Conditioning
8	10/22,10/24	Handout	A/D,D/A
9	10/29,10/31	Omega CD (Temp hand- book, Tech. Ref. Sect.)	Review EXAM 2
10	11/5,11/7	Omega CD (Temp hand- book, Tech. Ref. Sect.)	Temperature measurement using thermocouples
11	11/12,11/14	Handout	Bridge circuits
12	11/19,11/21	Handout	Force measurement
13	11/26,11/28	***	No Classes – Thanksgiving Holiday
14	12/3,12/5	--	Review EXAM 3
15	12/10,12/12	--	Review for final exam
16	12/16	--	Completion of Research Project by 5:00 pm

EETBD 341 – MEASUREMENTS AND INSTRUMENTATION
Tentative Lab Schedule

WEEK	DATE	LAB NUMBER	LAB EXPERIMENT
2	9/8	1	Temperature VI
3	9/15	2	Thermocouple VI
4	9/22	3	Thermistor VI
5	9/29	4	Signals in the presence of noise
6-7	10/6,10/13	5	Digital Voltmeter
8-9	10/20,10/27	6	Temperature Measurement System
10-12	11/3,11/10,11/17	7	Signal Conditioning
13-15	11/24,12/1,12/8	8	Measurement System for Applied Mass

LAB REPORTS

General Comments:

- Each lab group will consist of at most 2 students.
- 1 lab report will be submitted per group.
- Each lab report will be typed using a word processor.
- The lab report should be formal with no reference to the first person.
- The lab report will be weighted by a factor equal to the number of weeks to complete the lab experiment covered within the lab report.

Report Format:

- Copy of your LabVIEW program with correct results indicated and complete documentation (VI online description, online description for each control and indicator, title information on the front panel, documentation on the block diagram explaining each section). Include answers to all questions asked within the lab handout.

Grading Criteria:

Items for consideration	Grade %
Lab experiment completed on-time with technically accurate results	70
LabVIEW program with correct results indicated and complete documentation, and answers to all questions asked on the lab handout	30