ECE 4340 Syllabus (Fall 2011)

Course No: ECE 4340
Title: Microcomputer-based Instrumentation Laboratory
Credits: 2
WSU Catalog Description:
Prereq: ECE 3570, 3580, 3630; prereq. or coreq: ECE 4330. Multipurpose personal-computer-based approach to real-time instrumentation. Interfacing using Laboratory Virtual Instrument Engineering Workbench (LabVIEW) for data acquisition (DAQ), transmission and analysis. Course is offered every term.

Coordinator: Dr. Mohamad Hassoun, Professor of Electrical and Computer Engineering
Instructor: Ayman Mansour
Office Hours: 2:00PM – 3:30PM Wednesday or by appointment.
Office: 3124, Engineering Building.
Phone: (313) 577- , Email: mansour@wayne.edu
Course Meeting Time: Monday: 12:50PM – 05:00PM, 09/01/2011 - 12/19/2011.
Course Meeting Location: 3340, Engineering Building.

Goals: Understand and implement the techniques of PC-based real-time instrumentation. Design software using LabVIEW for data acquisition and simulation of electronic laboratory measurement instruments.

Learning Objectives: At the end of this course, students will be able to:

1. Develop software programs called virtual instruments that apply user interfaces, program control, SubVI, data structures, file input-output, hardware interfacing, data analysis and signal processing.

2. Design software applications and graphical user interfaces in LabVIEW using good programming techniques, including documentation, and an understanding of human computer interfaces.
3. Use various editing and debugging techniques for Vis.
4. Use LabVIEW for creating applications that use plug-in DAQ devices.
5. Design a data acquisition instrumentation system with understanding of the trade-offs for different signal types, number of channels, sampling resolution, and sampling frequency.


Reference Texts: None.

Blackboard:
Blackboard will be used throughout the course for communication among students and the instructors. Homework assignments, course handouts, and reference materials will be posted on Blackboard for the student to download. In order to use the system, you must log on through Pipeline. Please activate your Wayne State email address, and forward emails to your regular email address if you wish. This will be the address with which the instructor communicates with you.

Prerequisites by Topic: (ECE 3570, 3580 and 3630) Graphical and small signal analysis of semiconductor devices; equivalent circuits; gain and bandwidth; multi-state and feedback amplifiers; special-purpose circuits. Experimental investigation of semiconductor devices and their behavior in single-stage amplifier, pulse, and power circuits. Design of simple single-state circuits. Design of decoders and other combinatorial logic circuits, design of flip-flops, counters, shift registers, and other sequential logic circuits. Choice of logic families, interfacing different logic families

Corequisites by Topic: (ECE 4330) Laplace transform for complete solution of linear network or system response. Homogeneity, superposition, and time invariance properties. Convolution; Fourier analysis of periodic signals; discrete-time signals, difference equations, and z-transform methods. Formulation of equilibrium equations for electromechanical systems. Linear incremental concepts.
Topics:
1. Introduction to LabVIEW and virtual instruments (VIs)
2. Creating, editing and debugging techniques for Vis
3. Creating SubVIs and making Icons and connector panes
4. Using WHILE and FOR loops, waveform charts and shift registers
5. Dealing with arrays and array functions, graphs to display data, clusters and cluster functions
6. Use of case structure, sequence structure and formula nodes
7. Creating string controls and Indicators, string functions, file I/O operations, formatting text files and high level file I/O
8. Dealing with analog input and sampling of signals
9. Analog output: how to generate an analog output signal
10. Digital input/output techniques

Computer Resources: 10 Windows NT based computers, LabVIEW Software.
Laboratory Resources: Oscilloscopes, function generators, BNC connectors and other accessories.
Laboratory Policy: There is absolutely no smoking, eating or drinking in any ECE instructional laboratory. These labs must be kept neat and each student is responsible for insuring that the equipment on his/her workbench is neatly arranged, that all components and equipment are put away at the end of the session, and that are no scraps of paper or other garbage left on or near his/her workstation. Coats, briefcases, knapsacks and other personal belongings are not permitted on or near the benches. The door to the lab must be kept locked at all times; unlocking or propping open the door at any time is expressly forbidden. Guests are not permitted in the lab at any time, and no one but the instructor may open the door to admit anyone after the class has begun.

It is not allowed to use internet during class time. If I find you using the internet during the class 2 points will be taken off your final score. It is also not allowed to use your cell phone inside the lab.
**Equipment Handling Policy:** Handle equipment with care. Report malfunctioning of units to instructor immediately. Ask the instructor if you are not sure about handling certain equipment. Arrange equipment in proper order once you are done using them.

**Distribution of Points:**

1. Lab participation: 5%
2. Lab performance: 10%
3. Quizzes: 20%
4. Midterm: 25%
5. Final Exam: 40%

**Exams:**

- The midterm will be held in the lab on **Monday, October 24** during regular class meeting time.
  The exam is closed book, and closed notes. Cell phones will not be allowed to be used as calculators.

- The final exam will be held in the lab on **Monday, December 19** during regular class meeting time.
  The exam is closed book, and closed notes. Cell phones will not be allowed to be used as calculators.

**Quizzes:**

- Quizzes will be closed book, closed notes. Cell phones will not be allowed to be used as calculators.
  Simple scientific calculator (with no internet capability) is acceptable.

- Quizzes will be during the first 30 minutes of the lab on the following dates:

<table>
<thead>
<tr>
<th>Quiz</th>
<th>Date</th>
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<tbody>
<tr>
<td>Quiz 1</td>
<td>09-26-2011</td>
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<tr>
<td>Quiz 2</td>
<td>10-10-2011</td>
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<tr>
<td>Quiz 3</td>
<td>11-14-2011</td>
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<td>Quiz 4</td>
<td>11-28-2011</td>
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**Make up Exams:** No makeup exams allowed except for the case of a documented emergency.

**In Lab Performance:** You are expected to show the instructor the results of your experiments throughout the lab time. Your performance part of grade will be given to you according to your effort and understanding of the experiment.
Grading Scale:


Outcome Coverage:
(a) *An ability to apply math, science and engineering:* The laboratory exercises and exams require applications of mathematical and engineering knowledge to successfully complete the course.
(b) *An ability to design and conduct experiments, as well as to analyze and interpret data:* A major focus of the course is to teach students LabVIEW programming. In the laboratory sessions, students design and test programs to solve various problems related to data acquisition and electronic instrument simulations.
(c) *An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability:* Students work in the laboratory to design and implement code to solve specific instrumentation problems. Students go through several iterations of refining and debugging their initial code before they are able to arrive at working designs (programs).
(e) *An ability to identify, formulate, and solve engineering problems:* This is achieved by students as they analyze a given problem and write a working LabVIEW program to solve it. Students learn to formulate their understanding of a given problem in the form of a logical sequence of steps. They then translate those steps into programs for generating practical solutions for instrumentation problems.
(f) *An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice:* Students learn to use the LabVIEW software.

Attendance:
A student is expected to attend all lectures. An Attendance Sheet will be required to be signed by every student in every lab session. For every lab session you miss, **2 points will be taken off your final score.**
It is the student's responsibility to learn the course material. When classes are missed, for whatever reason, it is the obligation of the students to obtain copies of the class materials. An excused absence does not excuse the student from completing assigned work, including exams.

**Cheating Policy and Penalty for Cheating:** Cheating is defined by the University as “intentionally using or attempting to use, or intentionally providing or attempting to provide, unauthorized materials, information, or assistance in any academic exercise.” This includes any group efforts on assignments or exams unless specifically approved by the professor for that assignment or exam. Evidence of fabrication or plagiarism, as defined by the University in its brochure “Academic Integrity,” will also result in downgrading for the course. Students who cheat on any assignment or during any examination will be assigned a failing grade for the course.

**Prepared by:** Ayman Mansour.