

**Tentative Syllabus: Fall '13**  
**Data Acquisition and Controls**  
**Prof. Rhoades**

Sequence	Topic	Text Chapter	Chapter Sections	Comments
I.	Introduction and Concepts	1	All	Open-loop vs. closed-loop, process vs. motion
II.	Data Acquisition Overview	2	All	Relevant concepts: ADC, DAC, DAQ, PC-based control. PLCs next term
III.	Op-Amps: Proportional Gain	3	1	Inverting, non-inverting, sum, difference, etc.
IV.	Op-Amps: Integration and Differentiation.	3	1	Application to closed-loop controllers
V.	Frequency and Transient Response	3	1, notes	Rise time, settle time, bandwidth, etc. <i>Test 1.</i>
VI.	Signal Transmission	3	2-3	Current loops, cabling, etc.
VII.	Mechanical Systems	5	1-3	Response of linear and rotational systems.
VIII.	Mech. Power Transmission	5	4-6	Gears compared to transformers, belts, etc. <i>Test 2.</i>
IX.	Basic Sensors	6	1-2	Position, angular velocity
X.	Feedback Control	11	1-6	Overview: More in the next course.
XI.	Laplace Transform Analysis	–	–	Handouts – Transfer functions, “cookbook” approach to 1 <sup>st</sup> -order and 2 <sup>nd</sup> -order responses, closed-loop issues.
XII.	Data acquisition and NI LabVIEW	–	–	National Instruments website tutorials, hands-on LabVIEW exercises. <i>Test 3.</i>

Text: (1) Kilian, *Modern Control Technology*, 3<sup>rd</sup> edition (also for the follow-up course).

(2) LabVIEW online resources: <http://www.ni.com/labview/technical-resources> .

Class: Room E125, M & W 2:00-3:15 p.m. No class 9/2/13, 11/14/13.

Optional makeup days: 11/27/13, 12/18/13.

Office: Room C232 (office hours M & W 1:00-1:50, T 12:00-12:50).

Tests: Test results will be part of the course grade, probably three tests as shown above. A weighted-average system will be used.

Project: A project TBD may be assigned, part of the course grade. This could be a research paper, design problem, LabVIEW exercise, etc.

Homework: Part of the course grade. A few assignments will be collected, unannounced, for assessment. Also, each student, at random, will present the solution to a selected problem before the instructor's solution is revealed.

Lab Grade: This will be based largely on the submitted lab reports (either individual or group reports are acceptable), although attendance, punctuality, teamwork, etc. are also factors here. Note that the dates of the lab topics are approximate due to the splitting of the weekly "lab" component into two one-hour sessions. This is for scheduling purposes only; the actual lecture/lab times will be flexible. One combined letter grade will be submitted for the lab and lecture components.

Note: This course, in its present form, is fairly new, and problems had been encountered with LabVIEW data acquisition demonstrations and the assessment process. Therefore, the student should be aware that the probability of syllabus revisions is higher than usual.

## **Academic Honesty**

Students are expected to follow College policy on Academic Honesty regarding assignments. Specifically, be aware of the difference between collaboration and copying and be careful to cite sources when required. This policy also includes expectation of regular class attendance, punctuality, and timeliness in completing assignments.

## **College Withdrawal Policy**

Students may withdraw, in writing or verbally at the Registrar's Office for any reason until the end of the 10<sup>th</sup> week of classes. From the 11<sup>th</sup> week through the end of the 13<sup>th</sup> week, a student may withdraw with the instructor's written approval.

## **Disabilities Statement**

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact the Disabilities Counseling Services at 383-5240. To avoid any delay in the receipt of accommodations, you should contact the counselor as soon as possible. Please note that I cannot provide accommodations based upon disability until I have received an accommodation letter from the Disabilities Counselor.

## Course Outcomes

### ABET Outcome Requirements– Associate Degree Programs - 2013/2014

- a. an ability to apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities;
- b. an ability to apply a knowledge of mathematics, science, engineering, and technology to engineering technology problems that require limited application of principles but extensive practical knowledge;
- c. an ability to conduct standard tests and measurements, and to conduct, analyze, and interpret experiments;
- d. an ability to function effectively as a member of a technical team;
- e. an ability to identify, analyze, and solve narrowly defined engineering technology problems;
- f. an ability to apply written, oral, and graphical communication in both technical and nontechnical environments; and an ability to identify and use appropriate technical literature;
- g. an understanding of the need for and an ability to engage in self-directed continuing professional development;
- h. an understanding of and a commitment to address professional and ethical responsibilities, including a respect for diversity; and
- i. a commitment to quality, timeliness, and continuous improvement.

### TRCC EET Stated Outcomes

1. Students will practice the skills needed to work effectively in teams and as an individual.
2. Students will demonstrate the ability to use appropriate mathematical and computational skills needed for engineering technology applications.
3. Students will combine oral, graphical, and written communication skills to present and exchange information effectively and to direct technical activities.
4. Students will know of a professional code of ethics.
5. Students will describe concepts relating to quality, timeliness, and continuous improvement.
6. Students will describe how the concepts of electric circuits, electrical measurements, digital electronic devices, programmable logic circuits, electromechanical and automated systems, affect the design, maintenance, and operation of electrical systems.
7. Students will illustrate an ability to think critically and identify, evaluate and solve complex technical and non-technical problems; demonstrate creativity in designing problem solutions; and conduct and interpret experimental data and outcomes.
8. Students will recognize actions and acts of professionalism that allows them to become informed and participating citizens cognizant of ethics, civic duty, and social responsibility.
9. Students will recognize the need to be lifelong learners.

### K264/5 Course Outcomes

1. Mastery of Electrical Technology concepts as defined in the course syllabus
2. Knowledge of concepts of closed-loop control systems
3. Demonstrate an ability to build and test circuits and systems related to control systems
4. Demonstrate an ability to analyze and solve problems related to closed-loop control systems
5. Demonstrate an ability to build and test software systems related to LabVIEW data acquisition and control
6. Demonstrate an ability to analyze and solve problems related to LabVIEW systems
7. Demonstrate senior level oral and written communication skills
8. Demonstrate an appreciation for lifelong learning
9. Demonstrate proper professional and ethical behavior
10. Demonstrate a commitment to quality, timeliness and continuous improvement

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<b>Week</b>	<b>Date (2013)</b>	<b>Room</b>	<b>Title</b>
L1	8/26 & 28	B229	Inverting and Non-Inverting Amplifier
L2	9/4*	B229	Sum and Difference Amplifier
L3	9/9 & 11	B229	Integrator and Differentiator
L4	9/16 & 18	B229	Passive Filters: Low-Pass, High-Pass, Band-Pass
L5	9/23 & 25	B229	Simulation of First-Order Electrical Systems
L6	9/30, 10/2	B229	Simulation of First-Order Mechanical Systems
L7	10/7 & 9	B229	Characteristics of Second-Order Systems
L8	10/14 & 16	B229	Simulation of Second-Order Systems
L9	10/21 & 23	B229	MultiSim Control System Simulation I
L10	10/28 & 30	B229	MultiSim Control System Simulation II
L11	11/4 & 6	B229	Introduction to National Instruments LabVIEW
L12	11/13 & 18*	B229	LabVIEW I: Basics (Stand-alone Utility Programs)
L13	11/20 & 25*	B229	LabVIEW II: Data Acquisition (Simulator)
L14	12/2 & 4	D117	LabVIEW III: Data Acquisition (ELVIS)
L15	12/9, 11, 16	–	Only if needed for makeup

Office: Room C232 (office hours M & W 1:00-1:50, T 12:00-12:50).

Note: Lab meets in Room B229 or D117, M & W 3:16-4:06 p.m. Exact meeting times and topics are TBD, following the lecture sessions. No class 9/2/13, 11/14/13. Optional makeup days: 11/27/13, 12/18/13.

\* Earlier than normal, flexible scheduling. The LabVIEW experiments in November will likely occupy the entire “lecture” time as well (TBA).