San Jose State University
Department of Aviation/Technology
College of Engineering

Tech 167: **Control Systems**
IS 117 S01 Lec: T 3:00 – 4:45 pm
IS 117 S11 Lab: R 3:00 – 5:45 pm
Fall Semester 2013
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Course Description

Theory and applications of feedback systems, transfer functions and block diagrams. Transducers, analog and digital controllers, signal conditioners, and transmission. Analysis, testing, and troubleshooting of electronic systems with feedback.

Prerequisite: Tech 63, Tech 115, and CMPE 030 or CS 049C or CS049J

Textbook

Johnson, Curtis D. (2006). 8th Edition. "Process Control Instrument Technology." Upper Saddle River, NJ: Prentice Hall.

Course Objectives

Upon successful completion of this course, students will be able to:

- Draw a block diagram of a process-control loop and identify each element.
- Explain the difference between analog and digital control systems.
- Design an RC low-pass and high-pass filter circuits to eliminate unwanted signals.
- Design a Wheatstone bridge circuit to convert resistance change to voltage change.
- Explain how a successive approximate ADC operates.
- Calculate the expected output of a bipolar DAC for a given input.
- Develop the design of a system to measure temperature using a solid-state temperature sensor.
- Describe electromagnetic (EM) radiation in terms of frequency, wavelength, speed of propagation, and spectrum.

Course Evaluation Criteria

Examinations

Examination #1	October 08	10%	100
Examination #2	November 19	10%	100

Quizzes

Quiz #1	September 17	5%	50
Quiz #2	October 29	5%	50

Laboratory	30%	300
Homework	15%	150
Final: Monday, December 16	25% Time: 2:45 – 5:30 pm	250
Total	100%	1000

Grading

97 - 100	A+	85 - 88	B+	73 - 76	C+	61 - 64	D+
93 - 96	A	81 - 84	B	69 - 72	C	57 - 60	D
89 - 92	A-	77 - 80	B-	65 - 68	C-	0 - 56	F

Late Assignments

Late assignments will not be accepted. Assignments include **homework** and **Laboratory** reports. Homework will be assigned Tuesday of each week and must be submitted at the next Tuesday's class. On an average there will be five problems per home work set. Each problem will carry a value of 3 points maximum. We will do approximately thirteen home work problem sets, but only ten of the thirteen sets will be recorded. These ten sets will be the highest score received from the thirteen homework sets.

A missed examination or quiz will be given a score of zero. If you cannot take a scheduled examination or quiz, notification must be given prior to the scheduled examination or quiz.

Similar, experiments are to be submitted on their designated dates. Each experiment assigned will be discussed in the Lecture and in the Laboratory as required for clarification. We are scheduled to do six experiments. They are listed as follows:

1.	Current and Voltage Measurements both ac and dc	30
2.	Low and High Pass Passive single pole filters	40
3.	Wheatstone Bridge to measure an unknown resistor/temperature	40
4.	Active band-pass double-pole filter	50
5.	Digital-to-analog converter	70
6.	Analog-to-digital converter	70
	Total	300

Some experiments will take more than one lab period. So, the specific date to turn-in an experiment will be given in the lab a week before the experiment is due. Submit one laboratory report per group. A group is two students. Upon completion, you must submit a final lab report. Do not submit the report given to you. Use the written experiment and the **Experiment Write-Up Format** as a guide to submit your group report.

Experiment write-up Format

A written laboratory report for each experiment is required. The report should contain the following components:

Cover Page: This page includes the title of the experiment, the date, the course number, the course name, and each team member's name with signatures as an indication that each member contributed toward the experiment completion.

Objective: The objective tells what the experiment is all about. Write short sentences to explain the reasons for doing the experiment.

Equipment: Write down the equipment and the components used for the experiment

Procedure: Write down the steps in a logical sequence to do the experiment. Any one should be able to take your group experiment and follow the procedure to obtain the similar results.

Theory: The solution to the expected problem should exemplify the theory with calculations. All steps must be clarified with circuit diagrams. After you have solved the problem your next step will be to make a table showing all the parameters to be verified when you do the actual experiment. In other words, you simply want to verify your theoretical results or calculations in the laboratory.

Data: Your data must represent the experimental results.

Conclusion: The conclusion tells what you accomplished by doing the experiment. In other words, did the experimental results agreed with your expected results?

General Comments: The report must be neat, legible, and double spaced, and submitted in a type written form (use your computer). Use simple sentences that get right to the point. Be specific! Use 8 ½ x 11 inch paper with **no holes** or **perforated edges**. Staple all of the pages together at the upper left-hand corner. **Do not tear** or **fold** the corners!

General Laboratory Grading per Experiment

	Points			
• Objective	3	5	5	5
• Equipment Listing	2	4	4	5
• Theory	5	10	10	10
• Procedure	7	8	10	15
• Data	8	8	15	20
• Conclusion	5	5	6	15
• Total points	30	40	50	70

Tentative Calendar

Week of	Lecture Topics	Problems
8/27/13	Green Sheet, Lab Procedures 1.1 Introduction	
9/03/13	1.2 Control Systems 1.3 Process-Control Block Diagram	1.3, 1.5 1.9, 1.11,1.13
9/10/13	1.4 Control System Evaluation 1.5 Analog and Digital Processing	1.15,1.17,1.19,1.21,1.23 1.27,1.29,1.30,1.31,1.33
9/17/13	**Quiz #1**	
9/24/13 & 10/01/13	2.1 Introduction 2.2 Principles of Analog Signal Conditioning 2.3 Passive Circuits	2.1,2.3, 2.5, 2.7, 2.9 2.11,2.13,2.15, 2.17, 2.19
10/08/13	**Examination #1**	
10/15/13 & 10/22/13	2.4 Operational Amplifiers 2.5 Op Amp Circuits in Instrumentation 2.6 Design Guidelines	2.23, 2.25, 2.27,2.29,2.31 2.33, 2.35,2.37,2.39
10/29/13	**Quiz #2**	
11/05/13 & 11/12/13	3.1 Introduction 3.2 Review of Digital Fundamentals 3.3 Converters	3.1, 3.3, 3.5,3.7,3.9 3.11, 3.17, 3.19,3.21,3.23
11/19/13	**Examination #2**	
11/26/13	4.1 Introduction 4.2 Definition of Temperature 4.4 Thermistors 4.5 Thermocouples	4.1, 4.3,4.5,4.7,4.9 4.11, 4.13,4.15,4.17, 4.23, 4.25
12/03/13	6.1 Introduction 6.3 Photodetectors 6.5 Optical Sources	6.1, 6.3, 6.5, 6.13,6.15 6.17,6.19,6.21
	Final	
Dec16, Monday	**Final, Rm IS117, Time:2:45-5:00pm**	

Subject to change with fair notice

University, College, or Department Policy Information

a) **Academic Integrity statement (from Office of Student Conduct and Ethical Development)**:
"Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development. The policy on academic integrity can be found at http://sa.sjsu.edu/student_conduct."

b) **Campus policy in compliance with the Americans with Disabilities Act**:
"If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with DRC to establish a record of their disability."