San José State University
Aviation and Technology Department
TECH 167 Control Systems, Fall 2017

Course and Contact Information

Instructor	Foroozan Koushan
Office Location	IS 117
Email address:	foroozan.koushan@sjsu.edu
Office Hours	Friday, 17:30 – 18:00
Class Days/Time	Lecture: F 16:00 – 17:30 Lab: F 18:00 – 20:45
Classroom	IS 117
Prerequisites	TECH 62, TECH 63, TECH 115, PHY 2B

Course Format
The course relies on lecture materials presented in class and students are strongly encouraged to attend.

Course Objectives
To develop an understanding and working knowledge of the fundamentals of feedback control systems, applications of controllers, conditioners, and sensors to implement control systems used in manufacturing

Course Description
Theory and application of feedback control systems; transfer function and block diagrams; Transducers, analog and digital controllers; signal conditioners and transmission

Course Learning Outcomes

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

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

Required Text/Readings

Textbook

Johnson, Curtis D. (2006). 6^{th} or 8^{th} Editions. "Process Control Instrument Technology." Upper Saddle River, NJ: Prentice Hall.

Lab

Lab Experiments and instructions will be assigned weekly, and topics will be related to lecture materials

Methodology

To achieve an effective teaching/learning outcome the following methodology will be used:

a. Students will work in groups to provide the solution or solutions to all proposed Design Problems.

b. Be prepared to participate in Group Discussion. This group discussion will reinforce and/or enhance your technical knowledge with current and relevant information.

c. Students learn at different pace, have different technical background, remember some of the concepts learned in previous classes, have certain

difficulty in applying different concepts from different courses. This is the opportunity to fill out any gaps about basic electronics, analog & digital circuits and systems, and microprocessors fundamentals.

d. Instructor will explain key points and answer questions from students. Instructor may add related material to enrich the course content. The instructor will also review materials that s/he knows her/his students do not fully understand before a design problem is assigned.

e. Instructor will become more as a facilitator of learning. This means that the instructor will provide as much individual or group assistance as needed.

f. Students should work and learn in teams. This is very important in order to be successful in the real world.

Class Participation

a. Students will be assigned homework problems weekly or biweekly depending upon the complexity of the assignment.

b. Students can work in groups or individually to answer the HW problems and lab work. But each individual student has to turn in his/her HW separately by the target date, whether it is complete or not

c. Lab works in done in groups of 2-3 students, depending on the class size. Students cannot switch groups in the middle of semester

d. Student may ask the instructor questions only after first asking his/her classmates.

e. It is expected that student will become an active participant of his/her own learning

Late Assignments

Late assignments will not be accepted. Assignments include **homework** and **Laboratory** reports. Homework will be assigned Friday of each week and must be submitted at the next Friday's class. On an average there will be three to four problems per home work set.

A missed examination and/or Homework assignment will be given a score of zero. There are no makeup opportunities for missed homework assignment. If you cannot take a scheduled examination due to illness, a signed copy you're your doctor must be given prior to the scheduled examination. Otherwise, there should be enough time to plan your activities around the scheduled test times.

Similarly, 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. One lab session at the end of semester will be dedicated to wrap up any missed assignments during the semester. A total of 8 experiments will be covered throughout the semester.

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. 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!

Final Examination or Evaluation

The final exam will be comprehensive, covering all material presented in class. There will be no make-ups for missed exams, except for medical or other reasons outside the student's control, and such must be documented with a written notice.

Grading Information
Course grade will be based on homework assignments, midterms, project & final exam.

Homework/design problem	16%		160 points
Lab	32%		320 points
Midterm 1	13%	10/06/2017	130 points
Midterm 2	14%	11/10/2017	140 points
Final	25%	12/15/2017	250 points
Total	100%		1000 points

Determination of Grades
There will be no curving of grades. Final grades will be assigned as follows:

A	>94	A-	90-93		
B+	85-89	B	80-84	B-	76-79
C+	72-75	C	69-71	C-	65-68
D+	62-64	D	59-61	D-	56-58
F	<55				

Class Protocol
Class participation and attendance are strongly encouraged. Use of cell-phones are not allowed. Laptop computers and tablet are allowed only for taking lecture notes.

University Policies
Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' Syllabus Information web page at http://www.sjsu.edu/gup/syllabusinfo/**"**

Tech 167 Course outline**

		Lecture Topic	Lab assignments	Homeworks assigned per week
25-Aug-17	wk#1	Review of Green sheet	*No Lab Session*	no HW
1-Sep-17	wk#2	1.1- introduction 1.2 Control system	Lab#1: Linear Circuits – part 1	HW#1
8-Sep-17	wk#3	1.3 Process-Control Block Diagram 1.4 Control System Evaluation 1.5 Analog & Digital processing		HW#2
15-Sep-17	wk#4	1.6 Units 1.7 Analog Data Representation	Lab#2: Linear Circuits – part 2	HW#3
22-Sep-17	wk#5	2.1 Introduction 2.2 Principles of analog signal	Lab#3: Wheatbridge	HW#4
29-Sep-17	wk#6	conditioning 2.3 Passive circuits		HW#5
6-Oct-17	**wk#7**	**Midterm#1**	*No Lab Session*	no HW
13-Oct-17	wk#8	2.4 Operational amplifiers 2.5 Op-Amp ckts in instrumentation	Lab#4: Op-Amp	HW#6
20-Oct-17	wk#9	2.6 Design guidelines	Lab#5: signal conditioning	HW#7
27-Oct-17	wk#10	3.1 Introduction 3.2 Review of Digital fundamental 3.3 converters	Lab#6: Digital-to-analog converter	HW#8
3-Nov-17	**wk#11**	**Midterm#2**	*No Lab Session*	no HW
10-Nov-17	wk#12	No Class - Campus closed		no HW
17-Nov-17	wk#13	4.1 Introduction 4.2 Definition of Temp 4.4 Thermistors 4.5 Thermocouples	Lab#7: Analog-to-digital converter	HW#9
24-Nov-17	wk#14	No Class - Campus closed		no HW
1-Dec-17	wk#15	6.1 Introduction 6.3 Photodetectors 6.5 Optical Sources	Lab#8: Temperature Sensor	HW#10
8-Dec-17	wk#16	Review for Final	*No Lab Session*	no HW
15-Dec-17	**wk#17**	**Final exam at 1445-1700**		

Final exam schedule: *http://info.sjsu.edu/static/catalog/final-exam-schedule-fall.html*

** Subject to change with fair notice

** Extra Lecture Topic if there is enough time at the end of semester: Cp & Cpk

Lab Session activities**:

1. Linear Circuits – part1
2. Linear Circuits – part2
3. Wheatstone Bridge
4. Op-Amp
5. Signal Conditioning
6. Digital-to-Analog converter
7. Analog-to-Digital converter
8. Temperature Sensor

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