# *Springfield Technical Community College*

School of Science, Technology, Engineering & Math
Department of Electrical Engineering Technology
Course Syllabus

**Course:** EET-250L LAB for Control System Theory **Date:** Spring 2023
**Instructor:** Rick Jagodowski **Credits:** 1 cr.
**Meeting Days, Times & Places:** EET-250L-D01 T. 12:05-2:35, 17/507
EET-250L-D02 Th. 12:05-2-35, 17/507

## Office Hours:

Prof. Rick Jagodowski: Bldg. 17 Rm. 633. X-4594 E-mail: Jagodowski@stcc.edu
Hours are posted on the door. Other hours by appointment.

**1. Catalog Description: Control System Theory**
The goal of this course is to provide a state-of-the-art resource on control system technology. This includes the terminology, concepts, principles, procedures, and computations used by technicians to select, analyze, specify, design, troubleshoot, and maintain all established methodology with the aid of examples, calculator and control system components, instrument characteristics, signal conditions, and sensors. A laboratory period is included to help amplify the concepts learned in the classroom. Some of the topics covered will include manipulation, control, analysis, and design. **Two lecture hours & Three lab hours.**

**PREREQUISITE:** MAT-125, ENG-101, EET-200, EET-210, EET-240 or permission.
**CO-REQUISITE:** EET-250L

**2. Course Content**
This course will give the students the skills necessary to understand the essential theories and applications of modern analog and digital control systems. Topics such as feedback, open-loop, closed-loop, servo control, proportional-integral-differential control concepts, sensor types, interface circuitry, ADC and DAC concepts, linear and digital circuit solutions. The lab portion will introduce practical applications of the concepts presented in the lecture part of the course. **Two lecture hours (hybrid: one hour classroom, one hour online) & Three lab hours.**

**3. Student Learning Outcomes (SLO's)**
*Upon successful completion of this course, the student will be able to*:
- differentiate between analog and digital circuits and signals.
- effectively use industry standard test & measurement equipment for diagnostics & testing.
- understand & analyze basic interface circuitry.
- recognize feedback, feedforward, open-loop and closed-loop systems.
- understand fundamental operating parameters of PID controllers and their applications.
- use and apply common sensors in modern control system applications.
- use a basic embedded controller to implement a PID controller solution.
- to read and create control system schematic diagrams.
- use a systems-level view of complex systems for trouble-shooting purposes.
- be familiar with technical software for technical diagrams, simulation and analysis.

**4. Grading & Performance Policy**

* **Attendance:** Attendance is mandatory. If you miss a scheduled lab you are required to make arrangements on your own to make it up or lose credit for that assignment.

* **Professional behavior:** Students are expected to act in a professional and mature manner at all times. Improper behavior will result in a reduced grade and if not corrected may result in removal from the course. The grade may be reduced due to being absent or late to the class, "fooling around",

improper language, being a disruption to the educational process, having conversations during lecture, or similar violations of the course rules. This applies to activity any time you are on STCC property or representing STCC or the E.E.T. Department.

*** Policy on course disruptions:** Students are expected to act in a respectful and mature manner. Course disruptions, loud or disruptive behavior, intimidation, violation of the policies and procedures set down in the STCC Student Handbook, or similar problems will result in the student being removed from the lab or lecture.

Be sure to turn off all cell phones or other electronic devices before entering the lecture or lab. In many cases the professors allow cell phones during lab but not while lectures are in process. Talking, texting or causing disruptions while a lecture is in process is also considered disruptive. At the professor's discretion he or she may attempt to correct the student's behavior or remove the student from the class.

The following is the STCC Code of Conduct from https://catalog.stcc.edu:

"*Springfield Technical Community College recognizes that all students, as members of the college community, enjoy the freedom of speech and assembly, freedom of association, freedom of the press, right of petition and the right of due process. These rights do not come without responsibilities and respect for others in the College community. Attendance at the College is a privilege and not a right, and enrollment carries with it obligations in regard to conduct, both in and out of class. Students are responsible for knowing and understanding the contents of this Code. Students are responsible for abiding by the laws governing the College and are expected to observe standards of conduct set by the College.*"

*** Due Dates:** Late lab reports and other work is depreciated by 25% every week or part of a week it is late. Solutions to the lab related assignments and lab exercises will be made available. Once the solution is distributed no further homework will be accepted. It is the student's responsibility to be aware of all work assigned and the due dates.

***Weekly Progress Reports:** You will be required to make weekly progress reports on the EET-250L area on the CSET FORUMS at EET-250L For 2023SP on cset.stcc.edu

*** Quality:** Submission of poor quality work will not be accepted. Submissions which do not meet minimum documentation standards set forth in class, are incoherent, or are illegible will be returned [not graded] to the student. These cases are treated as if no work was submitted.

*** Academic Honesty:** All students are assumed to do their own work. Using other's work is permitted, under some circumstances, with proper credit to the original author(s). Academic dishonesty of any manner is not tolerated. In the event it is discovered by the professor ALL PARTIES INVOLVED receive a grade of "F" [0.0]. No distinction is made between those "cheating" and those being "cheated from". If a student believes his/her work is being borrowed without consent it is her/his responsibility to report the incident. This is the only means to escape the consequences. All incidents are examined on a case-by-case basis by the professor whose decision is final.

***Grade Evaluation:***

**Lab:**

| | |
|---|---|
| **Attendance & Professionalism** | **25%** |
| **Progress Reports** | **25%** |
| **Lab Reports & Research** | **25%** |
| **Lab Practical Exams (2)** | **25%** |

**5. Text and Equipment requirements:** There is no text which needs to be purchased for this lab. Students will be given lab assignments in advance for each week's lab assignment. There will also be numerous pdfs which contain supplemental materials and additional lab investigations, including the Process Control text from Parallax.com. All of these materials will be made available for download from the cset.stcc.edu/forums website. Students must have a USB Flash Drive to save the files for the electronic documentation and to keep their work backed up. This drive will also be necessary to save screenshots of oscilloscope displays pertinent to each lab exercise. A smartphone, tablet or notebook/netbook computer would be handy and students are encouraged to bring their own.

You will need a functional BoE (Board of Education) to perform the microprocessor based control system circuits scheduled. If you do not have one you must acquire one. See the EET-250L Forums at *cset.stcc.edu/forums* for links to the Parallax components.

You should have your own Digital Multimeter and bring it to lab for each session. It doesn't need to be an expensive unit. An entry level model for about $30 will suffice for most measurements. Purchasing a better quality unit should be seriously considered at this stage in your professional career.

**Internet Access:** It is expected that each student have internet access to do supplemental research outside of the classroom. Links to these sites will be posted on the *STCC Electronics Group Forums*. If you have access at home then you may do such research at home. Otherwise it is expected that you do the research where ever necessary. The Student Success Center also has computers available for student use.

**Forums:** The Electronics Group of STCC maintains Forums at *cset.stcc.edu/forums*. Each student in the lab will be required to have an account to access and post on these forums. See your instructor if you have problems accessing your account.

**6. STCC EET-250L Tentative Lab Schedule***

| Week | Topic |
|---|---|
| 1 | Intro to Lab area, Exp. #1 on 555 Time Astable and Monostable Operation |
| 2 | Exp. #2 Equipment Investigation: The PAD-234 Protoboards |
| 3 | Exp. #3 Op-Amp Integrator and Differentiator Circuits. |
| 4 | Exp. #4 PWM Motor Control, Current Driver Circuits |
| 5 | Exp. #5 Digital to Analog (DAC) & Analog to Digital (ADC) Converter Simulations |
| 6 | ****Mid-Semester Lab Practical Evaluation**** |
| 7 | Introduction to Parallax Process Control – Week #1 |
| 8 | ******SPRING BREAK****** |
| 9 | Parallax Process Control – Week #2 |
| 10 | Parallax Process Control – Week #3 |
| 11 | Parallax Process Control – Week #4 |
| 12 | Parallax Process Control – Week #5 |
| 13 | Parallax Process Control – Week #6 |
| 14 | Exp. #6 Differential & Instrumentation Amplifiers, dB Measurement, CMRR |
| 15 | ****Lab Practical Final Evaluation**** |

***NOTE:** The above outline may be modified to best serve the educational needs of the student.

**Special days for Spring 2023 Schedule from the Academic Calendar found here:**

***STCC Academic Calendar Spring 2023***

Monday, January 23: Spring 2023 Classes Begin.
Monday, February 20: President's Day Holiday - College is closed.
Monday-Saturday, March 13-18: Mid-Semester Break - No classes.
Monday, April 17: Patriots Day Holiday - College is closed.
Tuesday, April 18: All classes follow a Monday schedule.
Tuesday, April 25: Last Day to Withdraw from 14 week Spring classes.
Thursday, April 27: Last day to file a Candidate for Graduation Form for June 2023 Commenement
Tuesday, May 9: Last Meeting Day of Classes
Thursday-Tuesday, May 11-16: Final Exams for Day Classes
Thursday, May 18 (*most likely date*): EET Advisory Board/Adv. Automation Project Demonstrations
Sunday, May 21: Final Grades Due
Wednesday, May 31: Honors Convocation
Thursday, June 1: Commencement

**7. Students with Special Needs:** Any student who feels s/he may need an accommodation based on the impact of a disability should contact the instructor privately to discuss your specific needs. Before any accommodations are put in place, you should contact the Office of Disability Services at 755-4785 or stop by Building 19 Room 141 to coordinate reasonable accommodations for students with documented disabilities.

# Course Methodology and Philosophy

S.T.C.C. invests a considerable amount of resources into equipment for student and faculty use. As a member of the faculty, I will make use of all available teaching methods and tools. For lectures, most instruction will be delivered via a combination of Power Point/Computer Presentation and blackboard/whiteboard notes. Students are encouraged to actively participate by way of relevant questions and comments about the subject matter under discussion. It is my responsibility to make sure that the subject matter is presented in as clear a manner as possible. Your feedback is invaluable to my ability to accomplish this goal.

You, as the student, also have your share of responsibility:

**Attendance:** The scope of the material presented in this course is broad. Attendance is required to experience all the information as presented by the instructor. In addition, your input into the classroom discussion helps other students to better understand the material.

**Preparation:** It is your responsibility to complete all assignments, reading and written, in a timely manner. Thorough preparation will help instill greater confidence in the subject matter and will facilitate lively classroom discussions. Proper preparation for quizzes and tests is also expected.

**Attitude and Behavior:** It is your responsibility to make sure that your contributions to this course, and your attitude toward the people around you, are positive. Foul language and disruptive behavior will not be tolerated in this course. In addition, school property must be treated with respect at all times. This is especially true in laboratories. If you do not understand how to use a particular piece of equipment, you are encouraged to ask for assistance. You should report malfunctioning equipment immediately. Always return equipment and components to their proper locations. Leave your study or work area clean and neat for the next student.