

Three Rivers Community College
EET K266 – Advanced Controls and Robotics
co-listed as
MFG K221 – Mechatronics
Course Syllabus – Fall 2019

Instructor

Aaron Dahlen

Office C-140

adahlen@trcc.commnet.edu

Course Description

Credit Hours: 3.0

Format: Class

Prerequisite: EET K105 and Math K172

Presents the programming fundamentals of a particular Programmable Logic Controller (PLC) including logic, sequencing, timing, counting, arithmetic, and state level representations necessary to control industrial equipment. Students conduct a survey of sensors and actuators; from the thousands available, they select a representative subset to interface to the PLC. In the lab portion of the class, students construct a PLC based electromechanical system from the ground up, learning valuable lessons in controlling real time devices along with methods to document and construct robust installations suitable for industrial environments.

Class Time

EET CRN 33536 / 33537 co-listed with MFG CRN: 33608 / 33609

Tuesday and Thursday 03:16 pm-04:06 pm / 02:00 pm-03:15 pm

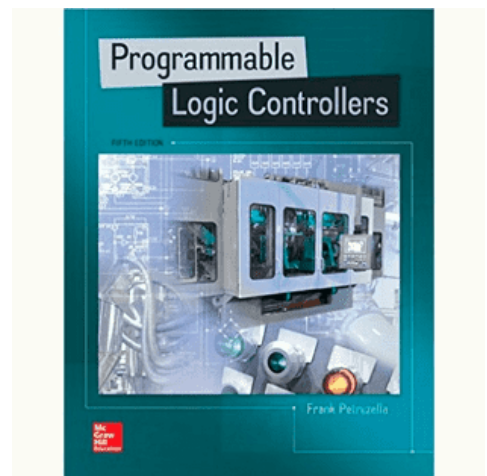
Office Hours

Scheduled hours posted on Blackboard, and office door; also available by appointment.

Required Materials

Textbook: “Programmable Logic Controllers (5th Edition)” by Frank Petruzella, ISBN-13: 978-0073373843

Calculator: An engineering / scientific calculator is required. Cell phones are not allowed.



University Policy

Academic integrity policy / statement: Academic integrity is essential to a useful education. Failure to act with academic integrity severely limits a person's ability to succeed in the classroom and beyond. Furthermore, academic dishonesty erodes the legitimacy of every degree awarded by the College. In this class and in the course of your academic career, present only your own best work; clearly documenting the sources of the material you use from others; and act at all time with honor.

Student disabilities policy / statement: Three Rivers Community College (TRCC) is committed to the goal of achieving equal educational opportunity and full participation for individuals with disabilities. To this end, TRCC seeks to ensure that no qualified person is excluded from participation in, is denied the benefit of, or otherwise is subjected to discrimination in any of its programs, services, or activities. Achieving full participation and integration of persons with disabilities requires the full cooperation and effort of all TRCC faculty and staff. The college will strive to maintain excellence in its services and to deliver those services equitably and effectively.

Student: Students must complete and submit the form for self-disclosure of a disability to the college Advising and Counseling Center (Room A113) . Students should also contact and meet with a college disability service provider and provide adequate documentation of disability to their disability service provider as soon as possible after admission.

Instructor: As needed, the college disability service provider will interact with faculty to help ensure reasonable and appropriate adjustments for a student with a documented disability. The college disability service provider will complete a memo to faculty and a form detailing appropriate adjustments for the student. Generally, the student will carry this information to instructors and discuss it with them. Whenever possible, the student and faculty member will collaborate on the implementation of the student's adjustments.

The college's two disability service providers are:

Elizabeth Willcox, Advisor
(860) 215-9289, ewillcox@trcc.commnet.edu

Matt Liscum, Counselor
(860)215-9265, mliscum@trcc.commnet.edu

Non-discrimination policy / statement: Three Rivers Community College does not discriminate on the basis of race, color, religious creed, age, sex, national origin, marital status, ancestry, present or past history of mental disorder, learning disability or physical disability, sexual orientation, gender identity and expression, or genetic information in its program and activities. In addition, the College does not discriminate in employment on the basis of veteran status or criminal records. The following person has been designated to handle inquires regarding the non-discrimination policies:

Ken Saad, Equity and Diversity Officer,
(860) 215-9319, KSaad@trcc.commnet.edu

Sexual misconduct policy / statement: Three Rivers Community College strongly encourages all students to report any incidents of sexual misconduct, which includes, but is not limited to, sexual harassment, intimate partner violence, and sexual assault. Students have the right to the prompt and fair resolution of all claims, and the College will preserve the confidentiality of all who report to the fullest extent possible and allowed by law. College employees will explain the limits of confidentiality before information about the incident is revealed. To report sexual misconduct, or to learn more about your options, please contact the Title IX Coordinator. **If you need immediate, confidential assistance, please call the Sexual Assault Crisis Center of Eastern Connecticut (SACCEC) hotline at 860-456-2789**

Maria Krug
Title IX Coordinator
Three Rivers Community College
574 New London Turnpike, Norwich, CT 06360
(860) 215-9208; mkrug@trcc.commnet.edu.

SACCEC
78 Howard Street, 2nd floor
New London, CT 06320
(860) 442-0604
<http://www.saccecc.org/>

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.

EET K266 Course Outcomes:

1. **Practice** electrical safety in a lab environment.
2. **Demonstrate** (testable) knowledge of PLC standards and safety practices.
3. **Convert** between commonly used base numbering systems including decimal, binary, decimal, and hexadecimal.
4. **From memory, present** the truth table for primitive logic gates including NOT, AND, NAND, OR, NOR, XOR.
5. **Convert** a written description of a logic problem to a truth table.
6. **Convert** the description of a combinational logic circuit between a truth table, Karnaugh map, ladder logic, and Boolean expression.
7. Given a written description of a sequential operation, **construct** a state diagram to include hierarchical sub-diagrams for complex operations.
8. **Survey** available industrial sensors and the accompanying module level devices required interface the sensor to the PLC. **Categorize** according to function and PLC interface. **Interface** the PLC to representative sensors. **Evaluate** the performance.
9. **Survey** industrial actuators. **Categorize** according to function and PLC interface. **Interface** the PLC to representative actuators. **Evaluate** the performance.
10. **Wire** PLC control panels using industry wire and labeling practices.
11. **Design, construct, and program** a PLC based system to interface with a real-world process simulating a factory setting e.g., motion and manipulation of components or fluid.
12. **Troubleshoot** PLC circuits using traditional measuring instruments as well as software monitoring
13. **Design** fault tolerant PLC based systems incorporating redundancy, independence, and diversity.
14. **Implement** a closed loop Proportional Integral (PI) control system on the PLC. e.g., thermal system. **Analyze** the performance of a control system in terms of rise time, percent overshoot, and settling time.
15. **Read, interpret, and draft** schematics for machinery that utilizes the PLC.
16. **Critique** industrial designs in terms of failsafe and fault tolerant measures designed into the system.

Class Policy

Security: Any student who has difficulty affording groceries or accessing sufficient food to eat every day or who lacks a safe and stable place to live and believes this may affect their performance in the course, is urged to contact the student services office for support. Furthermore, please notify me if you are comfortable in doing so. This will enable me to provide any other resources that I may possess.

Course Web Page: Course material will be posted to Blackboard. The site includes links to a complete syllabus, course schedule, and select homework / quiz / exam solutions. All course announcements including changes to the schedule and modifications to assignments will be made via email announcements to the student's default TRCC email address.

Schedule: The class schedule and homework assignments are posted to Blackboard. This will be adjusted as necessary to account for snow days or other unexpected events.

Participation: Every class include a "Peer Time" activity where students work together to solve exercises reinforcing the day's lecture.

Collaboration: Students shall not collaborate on quizzes or exams. Collaboration on homework is allowed and highly encouraged. However, submitted solutions must be independent work. See also: <https://www.threerivers.edu/about/policies/academic-integrity/>

Homework: Daily homework will be assigned and collected. All homework assignments are due at the beginning of class on the scheduled date. There are times when the instructor is pressed for time and is unable to carefully grade all homework. Rather than delay grading, only portions of the homework or random student's work will be graded. Items that are not graded are assumed to be correct. Students are encouraged to follow up by comparing their work to the Blackboard solutions.

Quizzes: There will be at about 10 quizzes this semester (see Blackboard posted schedule). Students are allowed to use a single 3 x 5 note card for the quiz. When complete, this card is to be stapled to the quiz. There will be some quizzes where calculators are NOT allowed.

Exams: There will be at least three in-class examinations (see Blackboard posted schedule). Students are allowed to use a single 3 x 5 note card (both sides) and a calculator for all exams.

Labs: All labs must be completed to pass this course. Students are responsible for contacting the instructor to make arrangements for the make up lab. A grading rubric is included with each lab assignment.

Late Assignments Policy: Make up exams and quizzes are allowed. However, the opportunity to do so ends in one week unless there are extenuating circumstances or other arrangements have been made with the instructor. This allows the instructor to post solutions to Blackboard in a timely manner. Students, who, in the opinion of the instructor, have a valid excuse will be allowed to take a quiz or exam without penalty. Others may take the quiz or exam but will have their score multiplied by 0.8. Late homework and labs write-ups will be accepted, but will be graded with a 10% penalty for every day late.

Students are encouraged to contact the instructor as soon as possible after a missed class.

Assignments and Grading: All problems for quizzes and exams will be graded approximately as described in this rubric:

Percentage	Reflection of content/correctness
100 %	<p>Solution is correct and supporting work is included. Work is clear and concise.</p> <p>When required a clear and concise explanation is given.</p> <p>Drawing and figures are included and properly labeled when required.</p>
80 %	<p>Solution is almost correct but includes a minor computation error copy error, or error in notation. Work is clear and concise.</p> <p>When required clear and concise explanations are given.</p> <p>Drawing and figures are included and properly labeled when required.</p>
60 %	<p>Solution is partially correct but is missing a critical element in the chain of reasoning.</p> <p>When required an explanations is given but may contain flaws in the chain of reasoning.</p> <p>Drawing and figures are included when required but lack a critical element.</p>
40 %	<p>Some understanding of the chain of reasoning is present but the solution incomplete.</p> <p>When required an explanations is given but may contain flaws in the chain of reasoning.</p> <p>Drawing and Figures are not present when required</p>
20 %	Understanding of the chain of reasoning is not demonstrated.
0 %	Work is missing or meaningless.

Extra Credit: Extra credit may be given on rare occasions. All such opportunities will be made available to all students and announced in class or email.

Grade Weight: The class grade is calculated using the following weighting scale:

Item	Weight
Exams	50%
Quizzes	15%
Homework	10%
Formal labs	15%
Peer time participation	10%

The overall grade conversion is:

A+	95% - 100%	A	93% - 94%	A-	90% - 92%
B+	87% - 89%	B	83% - 86%	B-	80% - 82%
C+	77% - 79%	C	73% - 76%	C-	70% - 72%
D+	67% - 69%	D	63% - 66%	D-	60% - 62%
F	0 - 59%				

The class policies and procedures outlined in this document may be changed due to extenuating circumstances or as agreed upon by instructor and students.