Master Course Syllabus

For additional course information, including prerequisites, corequisites, and course fees, please refer to the Catalog: https://catalog.uvu.edu/

Semester: Spring
Year: 2025
Course Prefix: AET
Course and Section #: 2250-601
Course Title: Industrial Programmable Logic Controllers - PLCs
Credits: 4

Course Description

Covers the theory, programming and industrial control system applications of small and medium sized programmable logic controllers (PLCs). Studies basic maintenance, operation, troubleshooting and programming instructions/techniques for industrial PLCs. Concentrates on interfacing analog and digital I/O to the PLC. Covers human machine interface (HMI) configuration, programming and PLC integration. Includes lecture, demonstration, print reading and industry examples.

Course Attributes

This course has the following attributes:

☐ General Education Requirements
☐ Global/Intercultural Graduation Requirements
☐ Writing Enriched Graduation Requirements
☒ Discipline Core Requirements in Program
☐ Elective Core Requirements in Program
☐ Open Elective

Other: *Click here to enter text.*

Instructor Information

Instructor Name: Trever Parker

Student Learning Outcomes

Upon successful completion, students should be able to:

1- Describe safe work practices.
2- Define how a PLC works.
3- Convert relay logic to PLC ladder logic.
4- Describe operation of basic PLC ladder logic instructions.
5- Draw PLC I/O wiring diagrams.
6- Utilize binary numbering in industrial Ethernet.
7- Describe standard installation practices and techniques.
8- Calculate component sizes for analog systems.

Course Materials and Texts

Textbook:

- Programmable Logic Controller (Petruzella, 6th edition, integrated into CANVAS)

Tools:

- Basic electrical AET tools from 1st semester in the program.
- You will need to bring one of the following:
  - Charged smart phone
  - Charged tablet
  - Charged laptop computer

Course Requirements

Course Assignments, Assessments, and Grading Policy

- Assignments: Are given weekly online through the textbook, which is integrated with Canvas via McGraw-Hill Connect. Assignments are graded automatically by Canvas, minus a few questions in several of the assignments. (25% of grade)
- Homework: Is given periodically throughout the semester, with due dates posted in Canvas. (10% of grade)
- Quizzes: Most will be given at the beginning of class and you must be present to take. The quizzes will be taken online in Canvas, which requires you to have a way of accessing the internet. A couple quizzes you will be given a date range (typically a week) to submit the quiz. (10% of grade)
- Attendance / Discussions: Attendance is required and is part of your overall grade. Discussions will be given periodically throughout the semester. They are all online in Canvas and you are expected to make a scholarly post, with respectful and meaningful replies to other student's posts. It is your responsibility to be aware of when discussion are due. (10% of grade)
- Midterm: Is done in class and you must be present to take. (20% of grade)
- Final: Will be given during finals week and will be remotely proctored online in Canvas. (25% of grade)

All assignments, homework, quizzes, discussions and exams are due on the posted dates in Canvas. **No assignments, homework, quizzes, discussions and exams will be accepted after the due date**, other than approved University exceptions.

Final grades are rounded to the nearest whole number and assigned the corresponding letter grade:

A = 100% to 94%	B- = <84% to 80%	D+ = <70% to 67%
A- = < 94% to 90%	C+ = <80% to 77%	D = <67% to 64%
B+ = < 90% to 87%	C = <77% to 74%	D- = <64% to 61%
B = < 87% to 84%	C- = <74% to 70%	F <61% to 0%

Required or Recommended Reading Assignments

The follow chapters from the course textbook are required reading and have assignments:

- Chapters 1, 3, 7, 8, 9, 10, 11, 12, 13, and 15 are required reading
- Chapters 2, 4, 5 and 6 are recommended reading
- Only chapter 14 is not required or recommended to read

General Description of the Subject Matter of Each Lecture or Discussion

Chapter 1: Overview of Programmable Logic Controllers.

1.1 – 1.6: Programmable Logic Controllers, Parts of a PLC, Principles of Operation, Modifying the Operation, PLCs versus Computers and PLC size and Application

Chapter 3: Number Systems and Codes.
3.1 – 3.8: Decimal System, Binary System, Negative Numbers, Octal System, Hexadecimal System, Binary Coded Decimal System, Grey Code and ASCII Code

Chapter 7: Programming Timers
7.1 – 7.6: Mechanical Timing Relays, Timer Instructions, On-Delay Timer Instruction, Off-Delay Timer Instruction, Retentive Timer and Cascading Timers

Chapter 8: Programming Counters
8.1 – 8.4: Counter Instructions, Up-Counter, One-Shot Instruction, Down-Counter, Cascading Counters
8.6: Combining Counter and Timer Functions

Chapter 9: Program Control Instructions
9.1 – 9.9: Program Control, Master Control Reset Instruction, Subroutine Functions, Immediate Input and Immediate Output Instructions, Forcing External I/O Addresses, Safety Circuitry, Fault Routine and Temporary End Instruction

Chapter 10: Data Manipulation Instructions
10.1 – 10.6: Data Manipulation, Data Transfer Operations, Data Compare Instruction, Data Manipulation Programs, Numerical Data I/O Interfaces and Closed-Loop Control

Chapter 11: Math Instructions
11.1 – 11.6: Math Instructions, Addition Instruction, Subtraction Instruction, Multiplication Instruction, Division Instruction and Other Word-Level Instructions

Chapter 12: Sequencer and Shift Register Instructions
12.1 – 12.4: Mechanical Sequencers, Sequencer Instructions, Sequencer Programs and Bit Shift Registers

Chapter 13: PLC Installation Practices, Editing and Troubleshooting
13.1 – 13.9: PLC Enclosures, Electrical Noise, Grounding, Voltage Variations and Surges, Program Editing and Commissioning, Programming and Monitoring, Preventive Maintenance and Troubleshooting

Chapter 15: ControlLogix Controllers
Part 1: Memory Layout, Configuration, Project, Tasks, Programs, Routines, Tags, Structures, Monitoring and Editing Tags and Array
Part 2: Program Scan, Creating Ladder Logic, Tag-Based Addressing, Adding Ladder Logic to the Main Routine, Internal Relay Instructions, Latch and Unlatch Instructions and One-Shot Instruction
Part 3: On-Delay Timer, Off-Delay Timer and Retentive Timer
Part4: Count-Up Counter and Count-Down Counter
Part 5: Math Instructions, Comparison Instructions and Move Instructions

Required Course Syllabus Statements

Generative AI
You are encouraged to use AI to help you understand the principles and topics that are taught throughout the semester. You may use AI to help you on your homework but you may not use AI to do the assignment for you. You are also not allowed to use AI on exams, quizzes, tests and final.

Using Remote Testing Software
☐ This course does not use remote testing software.

☒ This course uses remote testing software. Remote test-takers may choose their remote testing locations. Please note, however, that the testing software used for this may conduct a brief scan of remote test-takers' immediate surroundings, may require use of a webcam while taking an exam, may require the microphone be on while taking an exam, or may require other practices to confirm academic honesty. Test-takers therefore shall have no expectation of privacy in their test-taking location during, or immediately preceding, remote testing. If a student strongly objects to using test-taking software, the student should contact the instructor at the beginning of the semester to determine whether alternative testing arrangements are feasible. Alternatives are not guaranteed.

Required University Syllabus Statements

Accommodations/Students with Disabilities
Students needing accommodations due to a permanent or temporary disability, pregnancy or pregnancy-related conditions may contact UVU Accessibility Services at accessibilityservices@uvu.edu or 801-863-8747.

Accessibility Services is located on the Orem Campus in BA 110.

Deaf/Hard of Hearing students requesting ASL interpreters or transcribers can contact Accessibility Services to set up accommodations. Deaf/Hard of Hearing services can be contacted at DHHservices@uvu.edu

DHH is located on the Orem Campus in BA 112.

Academic Integrity
At Utah Valley University, faculty and students operate in an atmosphere of mutual trust. Maintaining an atmosphere of academic integrity allows for free exchange of ideas and enables all members of the community to achieve their highest potential. Our goal is to foster an intellectual atmosphere that produces scholars of integrity and imaginative thought. In all academic work, the ideas and contributions of others must be appropriately acknowledged and UVU students are expected to produce their own original academic work.

Faculty and students share the responsibility of ensuring the honesty and fairness of the intellectual environment at UVU. Students have a responsibility to promote academic integrity at the university by not participating in or facilitating others' participation in any act of academic dishonesty. As members of the academic community, students must become familiar with their rights and responsibilities. In each course, they are responsible for knowing the requirements and restrictions regarding research and writing, assessments, collaborative work, the use of study aids, the appropriateness of assistance, and other issues. Likewise, instructors are responsible to clearly state expectations and model best practices.

Further information on what constitutes academic dishonesty is detailed in UVU Policy 541: *Student Code of Conduct*.

Equity and Title IX

Utah Valley University does not discriminate on the basis of race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, age (40 and over), disability, veteran status, pregnancy, childbirth, or pregnancy-related conditions, citizenship, genetic information, or other basis protected by applicable law, including Title IX and 34 C.F.R. Part 106, in employment, treatment, admission, access to educational programs and activities, or other University benefits or services. Inquiries about nondiscrimination at UVU may be directed to the U.S. Department of Education's Office for Civil Rights or UVU's Title IX Coordinator at 801-863-7999 – TitleIX@uvu.edu – 800 W University Pkwy, Orem, 84058, Suite BA 203.

Religious Accommodation

UVU values and acknowledges the array of worldviews, faiths, and religions represented in our student body, and as such provides supportive accommodations for students. Religious belief or conscience broadly includes religious, non-religious, theistic, or non-theistic moral or ethical beliefs as well as participation in religious holidays, observances, or activities. Accommodations may include scheduling or due-date modifications or make-up assignments for missed class work.

To seek a religious accommodation, a student must provide written notice to the instructor and the Director of Accessibility Services at accessibilityservices@uvu.edu. If the accommodation relates to a scheduling conflict, the notice should include the date, time, and brief description of the difficulty posed by the conflict. Such requests should be made as soon as the student is aware of the prospective scheduling conflict.

While religious expression is welcome throughout campus, UVU also has a specially dedicated space for meditation, prayer, reflection, or other forms of religious expression.