Course Number: EMET 141
Course Title: Programmable Logic Controllers
Professor: Curtis Maples, BSEE, MEng
Contact Information: curtis.maples@cincinnatistate.edu
Office: (513) 569-1765
Cell: (202) 509-4328
Office located in Main 210, Engineering and Information Technology

Office Hours: M-Th 9:30 am -11:30, Office, Phone or Virtual by appointment

Catalog Course Description:
"A course on fundamentals of using programmable logic controllers (PLC). Topics include: PLC applications, ladder logic programming, processor selection and configuration, digital and analog input and output wiring, and human-machine interface (HMI) concepts."

Course Requirements/Prerequisites:
EET 131, EMET 150, MAT 125 (minimum grade C for all)

Course Learning Outcomes and Objectives:
Upon completion of this course, the student will be able to:

1. Explain the history and development of the PLC.
2. Describe the major components of the PLC system.
3. Demonstrate use of elementary logic functions and truth tables.
4. Program a variety of PLC's using the Ladder Diagram (LD) language.
5. Identify alternate programming languages such as SFC, FBD, and ST.
6. Program a touch-screen HMI interface.
7. Troubleshoot PLC and HMI logic and wiring.

Program Learning Outcomes:
http://www.csabank.com/ProgramOutcomes/EIT_Program_Outcomes.pdf (PLO's #1, #2, #6)

Required Text(s):
Electrical Motor Controls for Integrated Systems, 5e Rockis & Mazur, ATP (also used in EMET 252)
Additional course reading material will be provided by the instructor primarily online via Blackboard.

Required Student Materials (safety equipment, tools, uniforms, etc):
Cloth mask, face shield (provided IF needed)

Additional Course Requirements:
(Optional) Windows-compatible laptop for PLC simulation and programming software. Software license is free or with free trial. *Students are highly encouraged to purchase the LogixPro 500 interactive simulator for $38.*
https://canadu.com/lp/logixpro.html

Attendance Policy:
Attendance is required. The student is expected to attend and participate in every class session and is responsible for completing all assignments on time. It is understood some absences are unavoidable and that

missing class hampers the student's ability to learn course material. A penalty will be assessed against your final grade for excessive unexcused absences through a reduction in attendance points. *If you miss more than two (2) weeks of class time equivalent, you may fail the class.* Grade Criteria /Scale:

The final letter grade for the course is based on the following scale.
A: 90-100% "Superior"
B: 80-89% "Good"
C: 70-79% "Average"
D: 60-69% "Poor"
F: Below 60% "Failure"

Testing/Grading Procedures:

The course grade will be determined by scores on several homework assignments, hands-on labs, and two (2) exams. The distribution of final grade points including class participation will be roughly as follows:

<div align="center">

Hands-on Labs 45%

Assignments 20%

Examinations 30%

Participation/attendance* 5%

</div>

*The participation/attendance points are a subjective measure of the student's attendance, participation, and improvement. The points typically improve the grade assigned when on the threshold between letter grades.

Classroom Decorum:

Although class meetings may be conducted virtually through a synchronous online connection, students are encouraged to focus on the lecture and lab content, free from distraction, and participate fully in class discussions. Please refrain from using cell phones and media devices during class periods. Texting in class will not be tolerated. You may step outside of the classroom if necessary. For class periods longer than two (2) hours, breaks for free time will be given as necessary.

Labs, Assignments & Exams:

There will be numerous laboratory assignments throughout the course. The labs will be completed individually or in small groups as announced in class. There will also be some homework assignments in the course. Lecture notes, textbook readings, and classroom activities can be used as a study guide. There will be two (2) written and/or laboratory exams. The exams will generally cover material from the immediately preceding topics. Exam content will be discussed in class prior to the exam date.

Teaching Philosophy:

Education focuses on knowing the reasons for the specific tasks such that ends can be met under a variety of conditions. With education comes the ability to respond to new problems more quickly and effectively. A key element of education is exploring the answers to the underlying questions of what, why, and how. That is, the "theory". Knowing the theory, however, is only half the equation. For engineering technologists, hand skills are uniquely important for putting theory into practice. Individuals who implement solutions to problems using the proper tools, and with quality workmanship, generally have more opportunity.

Student Learning Focus:

Education is a personalized journey that requires reflection and study. Please allow sufficient time to review concepts before and after class. It is also important to identify how you learn best so that lessons may be presented more effectively if possible. Critical thinking and troubleshooting are "money-makers" in the engineering world. Armed with an understanding of the root causes of problems in systems, troubleshooting is a skill much easier to master. Importantly, technical language and communication are keys to success. Vocabulary exists so that complete and accurate ideas can be shared efficiently. As I learned from a mentor long ago, it is best to say what you mean, and not what you meant.

Student Responsibility:
Students are responsible for material that may be assigned on this syllabus as well as additional information announced in class. The instructor will not rely exclusively on material from the textbook(s). Good note taking is highly encouraged and helps make learning successful. Often class sessions are conversational in nature with much of the information presented orally. Students are advised to capture key ideas and instructions on paper as formal notes will generally not be presented on the board. Students are expected to complete all assignments on time. Assignments may be submitted online through Blackboard, collected in class on paper, demonstrated using lab equipment, or through other means. Late work will be penalized 5% per day up to seven (7) days, after which a grade of 0% will be recorded.

E-mail Communication:
Electronic mail (e-mail) is a valuable communication tool and especially useful in distance learning and online education programs. The ease of sending e-mail, however, has encouraged the loss of writing etiquette and social courtesy. Good message composition has given way to fragments and absent punctuation. I encourage students to read E-Mail Etiquette: The Do's and Don'ts in hardcopy or online. At a minimum, when sending e-mail messages please include in the subject line the class number and section. And, in the body, open with a greeting and close with a salutation including your name.

No Show Policy:
A student who enrolls but does not attend face-to-face class sessions or does not complete course work in online classes during the first two weeks of a 15-week course (or equivalent on flexible schedules) and does not officially drop or withdraw from the class or withdraws from a course without having attended the class, will be designated as a "no show" (NS). Being marked a no show can have serious financial implications and cannot be reversed unless the NS is assigned in error. Consult the Cincinnati State Catalog for additional information.

Withdrawal from Course:
Students are highly encouraged to consult their instructor before dropping a course. Too often students withdraw because they incorrectly believe they are in danger of receiving a poor grade. Instructors will help students fully understand their scores and provide support to help them complete a class whenever possible. It is also important to check with an academic advisor before dropping classes. Advisors can help students understand the consequences of withdrawal and avoid costly mistakes that could slow the time to graduation.

Non-Attendance Leading to Administrative Withdrawal:
A student who is enrolled in a course and does not attend any class session of that course for the consecutive equivalent of 20% of the total course length at any time during the semester may be administratively withdrawn from the course. Please consult individual instructors' class policies for information on how attendance is taken and how many class sessions comprise 20% of the course.

College Communication:
All Cincinnati State students have a SurgeMail account. Students should check email frequently for important announcements and communications from faculty members, advisors, and service offices. Students should conduct all email communication with faculty and staff of the College using SurgeMail or Blackboard. The instructor will only correspond via email using your Cincinnati State account. It is mandatory that this account be checked at least once daily, in addition to Blackboard.

Information Technology Help Desk:
The College's Information Technology Services Help Desk can assist online students with technical problems related to Blackboard, email, or other College technology services. Help Desk assistance is available at (513) 569-1234 and by email at itshelpdesk@cincinnatistate.edu.

Academic Integrity:

Ethical conduct is the obligation of every member of the Cincinnati State community. Violations of academic integrity that constitute serious breaches of ethical behavior include, but are not limited to cheating, fabrication, facilitating academic dishonesty, and plagiarism. If an instructor has reason to believe a violation of academic integrity has occurred, the Academic Integrity Violations Procedure will start in the classroom as outlined by the instructor's syllabus. Penalties imposed by the instructor are limited to those actions whose ramifications fall within the confines of the class, such as failure of the assignment or failure of the course. The instructor has the option of filing a report of the incident with the Provost for documentation purposes. Only the Provost can impose suspension or dismissal from the College. All work submitted in class not original to the student must be cited. This includes text, graphics, images, and the like. No excuses.

Disability Services:

The Office of Disability Services (ODS) ensures that students with special needs receive the academic accommodations they need in their courses of study. Any student or prospective student who has a disability, as defined under the Americans with Disabilities Act (ADA) of 1990 or the guidelines for section 504 of the Rehabilitation Act of 1973, may register with ODS. Students who are eligible or think they might be eligible for may visit the office in Main 129 or contact ODS by phone (513) 569-1775 or email disabilities@cincinnatistate.edu.

Title IX:

Title IX is a federal civil rights law that prohibits discrimination based on sex in the College's programs and activities. Sexual harassment, including sexual violence and retaliation, are forms of discrimination prohibited by Title IX. Staff and faculty have a "duty to report and a duty to act" in instances of situations or observations that would meet discriminatory and/or harassment guidelines under Title IX. If you are unsure of someone's duties and abilities to maintain privacy, ask them before speaking to them. To ensure confidentiality in instances that might qualify, problems may be reported to College Counseling Services. Reports of sexual violence, assault, discrimination, or harassment may also be reported by contacting the Director of Human Resources at (513) 569-1565 or hr@cincinnatistate.edu. Incident reports may also be filed online: https://publicdocs.maxient.com/incidentreport.php?CincinnatiState.

Additional Support Services:

You are encouraged to use support services available such as those listed below. Please call the number provided for services on Main or at other College locations as well.

✓ Tutoring Center   569-1614 Main 261
✓ Writing Center   569-1736 Main 235
✓ Math Center   569-1614 Main 228B
✓ Counseling Center 569-5779 Main 171
✓ ESL Resources   569-4769 Main 196

COVID-19:

For the latest updates on the COVID-19 response and policies, Safely Staying on Track at Cincinnati State, go to https://www.cincinnatistate.edu/COVID-19. The full text of the Student Statement of Personal Responsibility is online at https://www.cincinnatistate.edu/wp-content/uploads/2021/04/Cincinnati-State-Student-PersonalResponsibility-Statement-REV-Apr2021.pdf.
Refer to the COVID-19 exposure guidelines flowchart at https://www.cincinnatistate.edu/wp-content/uploads/2022/01/Cincinnati-State-COVID-19-Guidelines_Spring2022.pdf.

Course Content:

<mark>The content or timing may change. Check Blackboard often for due dates and announcements.</mark>

Week	Lecture Topics	Chapter(s)	Quizzes/Labs
1	Syllabus, Class Expectations Begin Boolean logic fundamentals		
2	Overview and introduction to the PLC, PLC applications, and interface components; PLC hardware Review of Boolean logic fundamentals, truth tables, and practical logic circuits	AD-1,2 EM-27 EM-5 PPT	Quiz 1 – Intro to PLC's Download LogixPro 500 simulator Lab 0 Lab 1- Garage Door Simulator
3	Introduction to industrial control circuits, symbols, drawings; relay logic control Introduction to fundamental SLC 500 PLC instructions – input/output; LogixPro500 simulator	EM-2,5,8 PPT SLC500 manual	Quiz 2 – PLC Basics Part 1 Lab 2 – Bearing Lubrication Control
4	Additional SLC 500 instructions – timers; I/O wiring diagrams	PPT	Quiz 3 – PLC Basics Part 2 Quiz 4 – Intro to Timers Lab 3 – Process Line Simulator
5	Additional SLC 500 instructions – counters Additional SLC 500 instructions – comparison instructions	PPT SLC500 manual	Quiz 5 – Intro to Counters Lab 4 – Relay-to-PLC Implementation **EXAM 1**
6	Additional SLC 500 instructions – math instructions; binary, hexadecimal, and BCD Introduction to the A-B MicroLogix 1000 PLC, addressing, programming environment	SLC500 manual SLC500 manual	Lab 4 cont. Assignment 1 – Math Instructions Lab 5 – Temperature Conversion Assignment 2 – Comparison Inst.
7	Additional SLC 500 instructions – sequencer instructions	SLC500 manual	Lab 6 – Simple Three-Wire Starter
8	Additional PLC programming; PLC connectivity and communication protocols Introduction to the Automation Direct CLICK PLC, addressing, programming environment	EM-6 PLC manual	Lab 7 – Automatic Dishwasher
9	Introduction to the Human-Machine Interface (HMI), using it with the PLC for motor control Additional PLC instructions – analog inputs	HMI manual manuals	Lab 8 – CLICK Three-Wire Starter with HMI
10	Additional PLC programming	manuals	Lab 9 cont. (implementation) **EXAM 2**

**Syllabus compiled from EMET department files and materials.