Course Number & Name	**EECS 4220/5220 – Programmable Logic Controllers**
Credits & Contact hours	3 Credits – 5:30-6:45pm M, W – NE 2100, Labs – NE 2350, 2390, 1100
Coordinator	Wm Ted Evans, PhD, PE
Textbook	Hybrid Text, Hybrid Lab Text, youtube videos www.hybridplc.org
Course Information	An introduction to programmable logic controllers (PLCs), process control algorithms, interfacing of sensors and other I/O devices, simulation and networking. Prerequisite: EECS 3200. Elective course.
Specific Goals- Students Learning Objectives (SLOs)	The student will be able to 1. Demonstrate knowledge of programmable logic controllers. 2. Demonstrate knowledge of process control systems. 3. Program using ladder logic programming of software. 4. Design PLC based system for process control. 5. Use digital and analog I/O. 6. Understand various timers, counters, fault and interrupt systems. 7. Define and design a PLC based process control system, its software/hardware design. 8. Write a report and present results.
Specific Goals - EAC Criterion 3 Outcomes	Outcome 1: Supported by SLO 1, 2, 3, 4 and 7. Outcome 2: Supported by SLOs 1, 6. Outcome 4: Supported by SLOs 6, 7. Outcome 5: Supported by SLOs 1, 2, 3 and 8. Outcome 6: Supported by SLO 4, 5. Outcome 7: Supported by SLOs 2 and 3.
Topics	1. Introduction to Programmable Logic Controllers (PLCs) and its architecture 2. Input/output modules, power supplies, opto isolation and memory map 3. Allen-Bradley Compact Logix Instruction Set 4. Siemens Instruction Set 5. Addressing considerations for both PLC processors 6. IEC 61131-3 programming language standard 7. Ladder logic programming including combinational logic, branching and other rung conditions

8. Start/stop circuits, special contacts, transitional contacts, latching instructions, memory circuit constructs and S/R to Seal Circuit transfer
9. Timers, timing diagrams and examples for timer applications
10. Counter basic programming, Arithmetic, program control instructions
11. Control Panel Construction Standards
12. Control standards external to the Control Panel
13. Analog module-programming examples, Fault and interrupt service routines
14. Sequential Programming Concepts
15. Process control PLC programming including Faceplate
16. HMI Programming Organization
17. Siemens Function/Function Blocks
18. Motion Control of single axis motion systems
19. PID implementation including HMI

Class will be graded:

Labs	**40 %**	
Midterm exam	**25 %**	
Final Exam	**25 %**	
Quizzes	**10 %**	
(A >= 90, B >= 80, C > = 70, D > = 60)		
Midtern	**Class Period**	
Final	**Finals Week**	

There are no make-up exams for this course. If you have a problem or conflict and cannot attend an exam, let me know beforehand and we will try to work something out. No credit will be given for a missed exam that we haven't made arrangements about beforehand unless you have a *really excusable* emergency. Cell phone use will not be allowed. If you do not have a calculator, buy one and bring it to class.

Cheating is not allowed and will be punished by rules of U of Toledo Student Handbook.
A list of labs is found on syllabus: hybridplc.org -> Courses -> EECS 4220 -> syllabus

For this course, points listed are by schedule pg. 3.

Lab 2.1 is required.

You must have 20 points of labs submitted prior to April 1, 2026. Will only accept 20 points of labs after this date.

Half of the labs must be from Lab 8.2 or higher. Also, starting with lab 7.2, HMI may be used but you cannot get credit for both the 7.2 HMI and 15.1 HMI lab using the same platform. You will only get credit for the Cash Register lab for both if you use the 7.2 lab as a wired lab and 15.1 as an HMI lab for each platform.

Lectures

Review Lecture	Chapter 1	
Review Lecture	Chapter 2	
Lab 2.1	Chapter 2 – pg 31-35	
Review Lecture	Chapter 3, 4	
Lab 4.1	Chapter 4 – pg 34-37	
Review Lecture	Chapter 5	
Lab 5.1		
Review Lecture	Chapter 6	
Review Lecture	Chapter 6 cont.	
Review Lecture	Chapter 7	
Lab 7.1		
Lab 7.2		
Review Lecture	Chapter 8	
Lab 8.1		
Review Lecture	Chapter 9	
Review Lecture	Chapter 10	
Lab 10.		
Review Lecture	Chapter 11	
Lab 11.1		
Test 1	Ch. 1-10	
Review Lecture	Chapter 12	
Review Lecture	Chapter 13	
Lab 13.		
Review Lecture	Chapter 14	
Lab 14.1		
Review Lecture	Chapter 15	
Review Lecture	Chapter 15 cont.	
Lab 15.		
Review Lecture	Chapter 16	
Lab 16.		
Review Lecture	Chapter 17	
Review Lecture	Chapter 17 cont.	
Lab 17.		
Review Lecture	Chapter 18	
Review Lecture	Chapter 19	
Review Lecture	Chapter 19 cont.	
Lab 19.		
Review Lecture	Chapter 20	
Lab 20.1		
Review Lecture	Chapter 21	
Lab 21.		
Cognex		
Final		

Lab Assn 2.1	Ch. 2.1	Explained in Ch. 2, pg 28-33	Results with report – 2 pts	
Lab Assn 4.1	Ch. 4.1	Ch. 4, Hot Dog Counter	Siemens – no sign off – 2 pts A-B – no sign off – 2 pts	
Lab Assn 5.1	Ch. 5.1	Ch. 5, Coin Changer (35-cent option)	Siemens – sign-off – 2 pts A-B – sign-off – 2 pts	Hybrid Lab Text Ch. 2 – 2 pts Hybrid Lab Text Ch. 3 – 2 pts
Lab Assn 7.1	Ch. 7.1	7.1 Traffic Intersection (7.1F)	Siemens – sign-off – 2 pts A-B – sign-off – 2 pts	Hybrid Lab Text Ch. 4 – 2 pts
Lab Assn 7.2	Ch. 7.2	7.2 Cash Register (7.2D &E)	Siemens – sign-off – 2 pts A-B – sign-off – 2 pts	Hybrid Lab Text Ch. 5 – 2 pts Hybrid Lab Text Ch. 6 – 4 pts
Lab Assn 8.1	Ch. 8.1	8.1b (subtract only)	Siemens – sign-off – 2 pts A-B – sign-off – 2 pts	Hybrid Lab Text Ch. 7– 2 pts
Lab Assn 8.2	Ch. 8.2	Lab 8.2A or B	Siemens – sign-off – 4 pts	Hybrid Lab Text Ch. 8 – 4 pts
Lab Assn 10.2	Ch. 10.1	10.1 (MUX)	Siemens – sign-off – 4 pts A-B – sign-off – 4 pts	Hybrid Lab Text Ch. 9 – 4 pts
Lab Assn 10.3	Ch. 10.3	10.3 Calories from Bike	Siemens – sign-off – 4 pts	Hybrid Lab Text Ch. 10 – 4 pts
Lab Assn 11.1	Ch. 11.1	11.1 Pumps	Siemens – sign-off – 4 pts A-B – sign-off – 4 pts	Hybrid Lab Text Ch. 11 – 4 pts
Lab Assn 11.2	Ch. 11	Any Festo 1 max	Siemens – Hybrid Lab Txt Ch. 28 – 4 pts	
Lab Assn 13.1	Ch. 13.1	13.1C Simon Says	Siemens – sign-off – 4 pts A-B – sign-off – 4 pts	Hybrid Lab Text Ch. 12 – 4 pts
Lab Assn 13.2	Ch. 13.2b	13.2b Whack-a-mole	Siemens – sign-off – 4 pts	Hybrid Lab Text Ch. 13 – 4 pts
Lab Assn13.2c	Ch. 13.2c	13.2C1	Siemens – sign-off – 4 pts	
Lab Assn 13.3	Ch. 13.3	13.3	Siemens – sign-off – 4 pts	Hybrid Lab Text Ch. 14 – 4 pts
Lab Assn 14.	Ch. 14.1 Ch. 14.2 Ch. 14.3	Function	Siemens – sign-off – 4 pts/each	Hybrid Lab Text Ch. 15 – 4 pts
Lab Assn 15.1	Ch. 15.1	Cash Register HMI	Siemens – sign-off – 2 pts A-B – sign-off – 2 pts A-B – sign-off – 2 pts	Hybrid Lab Text Ch. 16 – 2 pts/ea
Lab Assn 15.2	Ch. 15.2	Animation	Siemens – sign-off – 2 pts A-B – sign-off – 2 pts A-B – sign-off – 2 pts	Hybrid Lab Text Ch. 16 – 2 pts/ea
Lab Assn 15.	Ch. 15.3 Ch. 15.4 Ch. 15.5 Ch. 15.6		Siemens – Sign-off – 4 pts/each	Hybrid Lab Text Ch. 16 – 4 pts/ea
Lab Assn 16.	Ch. 16.1 Ch. 16.2 Ch. 16.3 Ch. 16.4 Ch. 16.5	RFID Peer to Peer Peer to Ascii Device Cyber Report Cognex-PLC Xmit	Siemens – sign-off – 4 pts A-B – sign-off – 4 pts	Hybrid Lab Text Ch. 17 – 4 pts/ea
Lab Assn 17.	Ch. 17.1 Ch. 17.2	Siemens Motion A-B Motion	Siemens – sign-off – 4 pts A-B – sign-off – 4 pts	Hybrid Lab Text Ch. 18 – 4 pts Hybrid Lab Text Ch. 19 – 4 pts
Lab Assn 19.	Ch. 19	PID	Ball-in-Tube Hybrid Text Ch. 22 – 4 pts Tank over Tank Hybrid Text Ch. 25 – 4 pts	Hybrid Lab Text Ch. 22 – 4 pts Hybrid Lab Text Ch. 25 – 4 pts
Lab Assn 20.	Ch. 20	20.1	Safety Lab Hybrid Text Ch. 26 - 4 pts	Hybrid Lab Text Ch. 26 – 4 pts
Lab Assn 22	Cognex	Cognex Labs in EET 4450 Folder		
Lab Assn				
Lab Assn				