

Programmable Controllers (RBTC 1401)



Credit: 4 semester credit hours (3 hours lecture, 4 hours lab)

Prerequisite/Co-requisite: None required

Course Description

A study in programmable controllers (PLC). Topics include processor units, numbering systems, memory organization, relay type devices, timers, counters, datamanipulators, and programming.

Required Textbook and Materials

1. *Programmable Controllers, 4th Edition*, by Frank Petruzella, McGraw-Hill
 - a. ISBN number is 978-0-07-351088-0
2. *Programmable Controllers 4th Edition Activities Manual*
 - a. ISBN number is 978-0-07-330342-1
3. Scientific Calculator
4. Notebook.

Course Objectives

Upon completion of this course, the student will be able to:

1. Demonstrate a knowledge of programming basics for PLCs.
2. Demonstrate integration of PLCs into systems.
3. Diagnose faults in PLC programming.
4. Write working programs using ladder logic.

Course Outline

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| <p>A. Programmable Logic Controllers (PLCs): An Overview</p> <ol style="list-style-type: none">1. Programmable Logic Controllers2. Parts of a PLC3. Principles of Operation4. Modifying the Operation5. PLC's versus Computers6. PLC Size and Application <p>B. PLC Hardware Components</p> <ol style="list-style-type: none">1. The I/O Section2. Discrete I/O Modules3. Analog I/O Modules4. Special I/O Modules5. I/O Specifications6. The CPU7. Memory Design and Types | <ol style="list-style-type: none">8. Programming Devices9. Recording and Retrieving Data10. PLC Workstations <p>C. Number Systems and Codes</p> <ol style="list-style-type: none">1. Decimal System2. Binary System3. Negative Numbers4. Octal System5. Hexadecimal System6. BCD System7. Gray Code and ASCII Code8. Parity Bit9. Binary Arithmetic <p>D. Fundamentals of Logic</p> <ol style="list-style-type: none">1. The Binary Concept2. AND, OR, and NOT Functions |
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Approved mm/yyyy

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Course Syllabus

3. Boolean Algebra
4. Developing Circuits
5. Producing the Boolean Equation
6. Hardwired Logic/ Programmed Logic
7. Word Level Instructions
- E. Basics of PLC Programming
 1. Processor Memory Organization
 2. Program Scan
 3. PLC Programming Languages
 4. Relay Type Instructions
 5. Instruction Addressing
 6. Branch Instructions
 7. Internal Relay Instructions
 8. Entering the Ladder Diagram
 9. Modes of Operation
- F. Developing Wiring Diagrams and Ladder Logic
 1. Control Relays
 2. Contactors and Motor Starters
3. Manually and Mechanically Operated Switches
4. Transducers and Sensors
5. Output Control Devices
6. Seal-In Circuits
7. Latching Relays
8. PLC Ladder Programs
- G. Programming Timers
 1. Mechanical Timing Relay
 2. Timer Instructions
 3. On-Delay Timer Instruction
 4. Off-Delay Timer Instruction
 5. Retentive Timer
 6. Cascading Timers
- H. Programming Counters
 1. Counter Instruction
 2. Up-Counter
 3. Down-Counter
 4. Cascading Counters
 5. Incremental Encoder-Counter Applications

Grade Scale

90 – 100	A
80 – 89	B
70 – 79	C
60 – 69	D
0 – 59	F

Course Evaluation

Final grades will be calculated according to the following criteria:

<i>Activity</i>	<i>Percentage</i>
Homework/Labs	10%
Quizzes	10%
Major Test	50%
Final	30%
<i>Total</i>	<i>100%</i>

Late Penalties will be assessed on all work turned in late. 5 points per day

Course Requirements

1. Identify the main parts of a PLC and describe their function.
2. Describe the basic circuitry and applications for I/O modules and interpret I/O and CPU specifications.

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Course Syllabus

3. Define the decimal, binary, octal, and hexadecimal, numbering systems and explain BCD, Gray, and ASCII Codes and be able to convert from one numbering or coding system to another.
4. Convert relay ladder schematics to ladder logic programs and program instructions that perform logical operations.
5. Write and enter ladder logic programs and use internal relay instructions.
6. Explain the operation of sensors and output control devices commonly found in PLC installations.
7. Analyze and interpret typical PLC timer ladder logic programs.
8. Analyze and interpret typical PLC counter ladder logic programs.
9. Apply combinations of counter and timers to control systems.

Attendance Policy:

1. Missing more than 20% of classes will result in an automatic “F” for the course.
2. Absences are counted for unexcused, excused and coming to class late.
3. Missing more than 20% of a class period will count as an absence.
4. Being tardy 3 times equals 1 absence.

Course Policies

1. No food, drinks, or use of tobacco products in class.
2. No foul or harsh language will be tolerated
3. Turn off all Cell Phones during lectures
4. Headphones may be worn only upon Instructor approval
5. Do not bring children to class.
6. No Cheating of any kind will be tolerated. Students caught cheating or helping someone to cheat can and will be removed from the class for the semester. Cheating can result from expulsion from LIT.
7. If you wish to drop a course, the student is responsible for initiating and completing the drop process. If you stop coming to class and fail to drop the course, you will earn an ‘F’ in the course.

Disabilities Statement

The Americans with Disabilities Act of 1992 and Section 504 of the Rehabilitation Act of 1973 are federal anti-discrimination statutes that provide comprehensive civil rights for persons with disabilities. Among other things, these statutes require that all students with documented disabilities be guaranteed a learning environment that provides for reasonable accommodations for their disabilities. If you believe you have a disability requiring an accommodation, please contact the Special Populations Coordinator at (409) 880-1737 or visit the office in Student Services, Cecil Beeson Building.

Student Code of Conduct Statement

It is the responsibility of all registered Lamar Institute of Technology students to access, read, understand and abide by all published policies, regulations, and procedures listed in the LIT Catalog and Student Handbook. The LIT Catalog and Student Handbook may be accessed at www.lit.edu or obtained in print upon request at the Student Services Office.

Course Schedule

Week	Topic	Reference
1	Course introduction, policies and PLC's <ul style="list-style-type: none">• Lecture• Lab: Allen Bradley PLC's	Handouts SLC 100 & 1000
2	Overview of PLC's. <ul style="list-style-type: none">• Lecture• Lab: Activities Manual exercises	Chapter 1
3	PLC Instruction Sets <ul style="list-style-type: none">• Lecture• Lab: Place controller in program mode and enter program into memory. Place controller in run mode and run the program..	Chapter 1
4	PLC Hardware <ul style="list-style-type: none">• Lecture• Lab: Chapter Exercises and Activity Manual exercises• Test 1	Chapter 2
5	Number Systems <ul style="list-style-type: none">• Lecture• Lab: Conversions and Radix Function	Chapter 3
6	Codes <ul style="list-style-type: none">• Lecture• Lab: Chapter and activity manual Exercises	Chapter 3
7/8	Logic <ul style="list-style-type: none">• Lecture• Lab: Activity manual Exercises Boolean Algebra.• Test 2	Chapter 4

9/10	Programming Basics <ul style="list-style-type: none"> • Lecture • Lab: Activity manual Exercises • Entering basic Programs, editing, and running programs using SLC 100 	Chapter 5
11	Fundamental PLC Wiring Diagrams <ul style="list-style-type: none"> • Lecture • Lab: Activity manual exercises and sequential and combination processes Programming. • Test 3 	Chapter 6
12/13	Programming Timers <ul style="list-style-type: none"> • Lecture • Lab: Activity manual Exercises • Analyze and interpret timer ladder Logic programs • Program control of outputs using Timer control bits 	Chapter 7
14/15	Programming Counters <ul style="list-style-type: none"> • Lecture • Lab: Activity manual Exercises • Analyze and interpret counter ladder Logic programs • Apply counter function and circuitry To control systems 	Chapter 8
16	Combination counter and timers applied To control systems <ul style="list-style-type: none"> • Lecture • Test 4 • Review for Final 	Comprehensive