ITT Technical Institute

ET345

Control Systems

Onsite Course

SYLLABUS

Credit hours: 4

Contact/Instructional hours: 50 (30 Theory Hours, 20 Lab Hours)

Prerequisite(s) and/or Corequisite(s):

Prerequisites: ET285 Digital Electronics II

Course Description:

Students examine the control of systems with programmable units. Applying digital logic to control industrial processes is emphasized.

STUDENT SYLLABUS

Instructor: _____

Office hours: _____

Class hours: _____

Major Instructional Areas

- PLC Hardware Components
- PLC Programming
- Fundamentals of Logic
- Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs
- Programming Timers and Counters
- Program Control Instructions
- Data Manipulation and Math Instructions
- Sequencer and Shift Register Instructions
- PLC Installation Practices, Editing, and Troubleshooting

Course Objectives

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

1. Differentiate between conventional hard-wired relay systems and PLC controlled systems.
2. Describe the operation of a PLC system.
3. Explain I/O Addressing and corresponding file image tables.
4. List and describe the components of a PLC system, specifically the Allen Bradley SLC 500/02.
5. Describe the PLC scan sequence and PLC operating modes.
6. Create correct ladder logic programs.
7. Interpret relay ladder schematics and convert to ladder logic diagrams.
8. Identify sensors, actuators, and controls used in PLC systems.
9. Explain the operation of timers and counters in PLC systems.
10. Use PLC timers and counters with associated circuitry to control a system.
11. Explain the methods used for program control in a PLC system.
12. Differentiate between data manipulation methods and explain purposes of data instructions.
13. Differentiate between word and file operations.
14. Explain the operation of sequencers and shift-registers in PLC systems.
15. Use PLC sequencers and shift-registers with associated circuitry to control a system.
16. Identify electrical and safety requirements to install and interface a PLC system.
17. Describe proper preventive maintenance and troubleshooting procedures.
18. Design and implement a final lab project that reflects the culmination of skills learned in this course.

Teaching Strategies

Students examine the control of systems with programmable logic control units. Applying digital logic to control industrial processes is emphasized. A lab project in laboratory provides the students with the opportunity to apply knowledge of industrial systems gained in this course.

Student Textbook and Materials

Programmable Logic Controllers, 4th ed. Frank D. Petruzella, McGraw-Hill

Programmable Logic Controllers Activities Manual, 4th ed. Frank D. Petruzella, McGraw-Hill

Lab Manual with LogixPro PLC Simulator for Programmable Logic Controllers, 4th ed. Frank D. Petruzella, McGraw-Hill

Course Outline

Unit	Topic (Lecture Period)	Chapters	Lab and Other Coverage
1	PLCs: An Overview PLC Hardware Components Number Systems & Codes: REVIEW	1 2 3	Homework Lab & Project
2	Basics of PLC Programming Fundamentals of Logic Process Control: Types of Processes	5 4 14-1	Homework Lab & Project
3	Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs Process Control: Structure of Control Systems	6 14-2	Homework Lab & Project
4	Programming Timers Process Control: On/Off Control	7 14-3	Unit Exam I- Units 1, 2 & 3 Homework Lab & Project
5	Programming Counters Process Control: PID Control	8 14-4	Homework Lab & Project
6	Program Control Instructions Process Control: Motion Control	9 4-7 14-5	Homework Lab & Project
7	Data Manipulation Instructions Process Control: Data Communication- Hardware	10 14-6	Unit Exam II- Units 4, 5 & 6 Homework Lab & Project
8	Math Instructions Process Control: Data Communication- Protocol	11 14-6	Homework Lab & Project
9	Sequencer and Shift Register Instructions Process Control: SCADA	12 14-7	Homework Lab & Project
10	PLC Installation and Troubleshooting	13	Unit Exam III- Units 7, 8, & 9 Homework Lab & Project
11	Review and Final Examination		The final examination will be based on the content covered in chapters 1-13.

Evaluation Criteria and Grade Weights

Quizzes	10%
Homework	20%
Exams	15%
Lab exercises	20%
Final exam	15%
Final Lab Project	20%

Final grades will be calculated from the percentages earned in class as follows:

A	90 - 100%	4.0
B+	85 - 89%	3.5
B	80 - 84%	3.0
C+	75 - 79%	2.5
C	70 - 74%	2.0
D+	65 - 69%	1.5
D	60 - 64%	1.0
F	<60%	0.0

Final Lab Project

Final Lab Project:

Is worth 20% of your final grade
Is a program project that demonstrates industrial systems control competence.
Is a team effort, with a maximum team size established by the instructor.
Approved by the Instructor and Program Chair

Requirement

The final lab project must be a system controlled by the PLC.

The minimum requirement of the electronics system is as follows:

1 signal input
1 user controlled input
1 signal output
1 user controlled output
System level process that demonstrates integrates an industrial process with PLC control

1. Implement a functioning system.
2. Detailed documentation must be provided. (schematic and theory of operation)
3. Project management plan that is correctly tracked. (MS Project or format approved by the instructor)
4. Must look be professionally dressed for the presentation. (you are selling yourself via this project)
5. You will present your project in a formal presentation, an appropriate presentation is expected.

Grading

F	Does not meet the requirement
D	Does meet the requirement
C	A Portfolio entry for the lab project and a report on an associated industrial system.
B	Demonstrates the ability to use DC and AC input and output devices.
A	Demonstrates the ability to integrate an analog to digital or digital to analog input or output.

Milestones

Week 2- Written Proposal that describes operation of your system.
Week 3- MS Project plan laying out the required steps, due dates, etc.
Week 4- Functional technical description of the system with block diagram
Week 5- Component list with I/O schematic
Week 6- Review of work completed to date
Week 7- See what is working
Week 8- See what is working
Week 9- Practice demo, see what is working
Week 10- Practice presentation
Week 11- Final presentation