

**Texas A&M University – Corpus Christi**  
**College of Science and Technology**  
**Engineering Technology**

**Course number and title:** ENTC 4322 Programmable Logic Controllers

**Weekly Schedule:** 3 hours lecture and 3 hours laboratory

**Prerequisite:** ENTC 3416, ENTC 3444

**Course description:**

Relay and ladder logic leads to the study of the Programmable Logic Controllers used in current industrial automation; counters, timers, and other functions are explored.

**Textbooks**

Programmable Logic Controllers, 2nd Ed, Frank D. Petruzella, 1998, McGraw Hill.

SIMATIC S7-200 Programmable Controller System Manual, Siemens. Available in the lab.

**Course Objectives**

This course is designed to enable students to:

- State the major components and features of PLCs.
- Select the proper PLC for a given application.
- Differentiate between digital, analog, and intelligent I/O modules.
- Use a PLC instruction set and addressing modes to write IEC 1131-3 programs
- Program a PLC for various applications, including counters, timers, and process control applications.
- Interface I/O devices to a PLC.
- Install and configure a PLC.
- Differentiate between PLCs and robot controllers.

**Assessment**

	<b>Percentage</b>		<b>If</b>	<b>Grade</b>
Pop Quizes	5		$90 \leq \text{Total}$	A
Midterm 1	20		$80 \leq \text{Total} < 90$	B
Midterm 2	20		$70 \leq \text{Total} < 80$	C
Project	15		$60 \leq \text{Total} < 70$	D
Homework	5		$\text{Total} < 60$	F
Final exam	25			
<b>Total</b>	100			

**Topics covered:**

PLC principles of operation, PLC size and applications, the I/O section, discrete I/O modules, analog I/O modules, I/O specifications, the CPU, memory types and design, programming devices, number systems and codes, fundamentals of logic, the binary concept, basic logic functions, Boolean algebra, hard-wired vs. programmed logic, basics of PLC programming, processor memory organization, program scan, PLC programming languages, instruction addressing, internal relay instructions, modes of operation, examine if closed and examine if open instructions, manually and mechanically operated switches, transducers and sensors, output control devices, seal-in circuits, latching relays, programming PLC timers, on-delay and off-delay timers, retentive timers, programming PLC counters, up and down counters, master control and zone control instructions, jump instructions and subroutines, immediate input and output instructions, forcing external I/O addresses, data transfer instructions, data compare instructions, data manipulation programs, math instructions, sequencer instructions, shift register instructions, PLC installation and troubleshooting.

**Laboratory Exercises/Experiments:**

Lab 1 Introduction to lab equipment and Siemens PLC

Lab 2 Introduction to Siemens PLC software

Lab 3 Creating and debugging a PLC Program

Lab 4 Downloading and running a PLC program

Lab 5 PLC program using switches

Lab 6 PLC program using seal-in concept

Lab 7 PLC program using timers

Lab 8 PLC program using counters

Lab 9 PLC program using control instructions

Lab 10 PLC program using math instructions

Lab 11 PLC lab project

Lab 12 PLC lab project

Lab 13 PLC lab project

Lab 14 PLC lab project

**Prepared by:** Hesham Shaalan

**Date:** \_\_\_\_\_