

ENGT 030: PLCS AND INDUSTRIAL CONTROLS I

Originator

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Justification / Rationale

Labor market indicators show that there are jobs available and an advisory panel recommended the course.

Effective Term

Fall 2019

Credit Status

Credit - Degree Applicable

Subject

ENGT - Engineering Technology

Course Number

030

Full Course Title

PLCs and Industrial Controls I

Short Title

PLC AND CONTROLS I

Discipline**Disciplines List**

Engineering Technology

Modality

Face-to-Face

Catalog Description

This course offers students the fundamentals of a Programmable Logic Controller (PLC). Students learn the basic parts of a PLC system, digital fundamentals, and PLC addressing.

Schedule Description

This course offers students the fundamentals of a Programmable Logic Controller (PLC).
Advisory: MATH 060 or ESYS 004

Lecture Units

2

Lecture Semester Hours

36

Lab Units

1

Lab Semester Hours

54

In-class Hours

90

Out-of-class Hours

72

Total Course Units

3

Total Semester Hours

162

Prerequisite Course(s)

Advisory: MATH 060 or ESYS 004

Required Text and Other Instructional Materials**Resource Type**

Book

Author

Petruzella, Frank D.

Title

Programmable Logic Controllers

Edition

5th

Publisher

McGraw-Hill Education

Year

2016

College Level

Yes

ISBN #

978-0073373843

Class Size Maximum

30

Entrance Skills

Ability to compute using the four basic operations.

Prerequisite Course Objectives

ESYS 004-Compute using the four basic operations of addition, subtraction, multiplication, and division on the rational numbers.

MATH 060-Compute using the four basic operations of addition, subtraction, multiplication, and division on the rational numbers in both fraction and decimal form.

MATH 060-Apply the basic operations to solve application problems that involve whole numbers, integers, and rational numbers.

Entrance Skills

Ability to convert units.

Prerequisite Course Objectives

ESYS 004-Convert units within the US and metric systems and between the US and metric system units using unit fractions.

ESYS 004-Use unit measure appropriately in applications.

MATH 060-Recognize and convert between units of measurements in the American and metric systems.

MATH 060-Use unit measure appropriately in applications.

Entrance Skills

Ability to perform math with fractions.

Prerequisite Course Objectives

ESYS 004-Convert between improper fractions, mixed numbers, and decimals.

ESYS 004-Use the fundamental property of fractions and prime factorizations to write equivalent fractions.

MATH 060-Apply methods of conversion between percents, decimals, and fractions.

Entrance Skills

Work with variables.

Prerequisite Course Objectives

MATH 060-Understand the concept of a variable and how a variable can be used to represent an unknown quantity.

MATH 060-Evaluate an algebraic expression via substitution of rational numbers and determine if a given value is a solution to an algebraic equation

Course Content

1. Introduction to programmable logic controllers
 - a. Parts of a PLC
 - b. Principles of operation
 - c. Modifying the operation
 - d. PLCs versus computers
 - e. PLC Size and Application
2. PLC Hardware components
 - a. The I/O section
 - b. Discrete I/O modules
 - c. Analog I/O modules
 - d. Special I/O modules
 - e. I/O specifications
 - f. The Central Processing Unit (CPU)
 - g. Memory design
 - h. Memory types
 - i. Programming terminal devices
 - j. Recording and retrieving data
 - k. Human Machine Interfaces (HMIs)
3. Number Systems and Codes
 - a. Decimal system
 - b. Binary system
 - c. Negative numbers
 - d. Octal system
 - e. Hexadecimal system
 - f. Binary Coded Decimal (BCD) system
 - g. Gray code
 - h. ASCII code
 - i. Parity bit
 - j. Binary arithmetic
 - k. Floating point arithmetic
4. Fundamentals of Logic
 - a. The Binary Concept
 - b. AND, OR, and NOT functions
 - c. Boolean algebra
 - d. Developing logic gate circuits from boolean expressions
 - e. Producing the boolean equation for a given logic gate circuit
 - f. Hardwired logic versus programmed logic
 - g. Programming word level logic instructions
5. Basics of PLC programming
 - a. Processor memory organization
 - b. Program scan
 - c. PLC Programming languages
 - d. Bit-level logic instructions
 - e. Instruction addressing

- f. Branch instructions
- g. Internal relay instructions
- h. Programming Examine If Closed and Examine If Open instructions
 - i. Entering the Ladder Diagram
 - j. Modes of operation
 - k. Connecting with analog devices
- 6. Developing Fundamental PLC Wiring Diagrams and Ladder Logic Programs
 - a. Electromagnetic Control Relays
 - b. Contactors
 - c. Motor starters
 - d. Manually operated switches
 - e. Mechanically operated switches
 - f. Sensors
 - i. Proximity sensor
 - ii. Magnetic Reed Switch
 - iii. Light sensors
 - iv. Ultrasonic sensors
 - v. Strain/weight sensors
 - vi. Temperature sensors
 - vii. Flow measurement
 - viii. Velocity and position sensors
 - g. Output control devices
 - h. Seal-in circuits
 - i. Electrical interlocking circuits
 - j. Latching relays
 - k. Converting relay schematics into PLC Ladder Programs
 - l. Writing a Ladder Logic Program directly from a Narrative Description
 - m. Instrumentation
- 7. Programming Timers
 - a. Mechanical timing relays
 - b. Timer instructions
 - c. On-delay timer instruction
 - d. Off-delay timer instruction
 - e. Retentive timer
 - f. Cascading timers

Lab Content

1. Introduction to PLC
2. Basic PLC Programming
3. Discrete I/O interface
4. PLCs and Relays
5. PLC Motor Control
6. PLCs and Switches
7. PLCs and Sensors
8. Timers
9. Introduction to PLC troubleshooting

Course Objectives

	Objectives
Objective 1	Define what a programmable logic controller (PLC) is and list its advantages.
Objective 2	Outline the basic sequence of operation for a Programmable Logic Controller.
Objective 3	Describe the basic circuitry and applications for discrete and analog Input/Output (I/O) modules, and interpret typical I/O and CPU specifications.
Objective 4	Explain Input/Output addressing.

Objective 5	Define the decimal, binary, octal, and hexadecimal numbering systems and be able to convert from one numbering or coding system to another.
Objective 6	Describe the binary concept and the functions of gates.
Objective 7	Draw the logic symbol, construct a truth table, and state the Boolean equation for the AND, OR, and NOT functions.
Objective 8	Convert relay ladder schematics to ladder logic programs.
Objective 9	Program instructions that perform logical operations.
Objective 10	Describe the Programmable Logic Controller program scan sequence.
Objective 11	Write and enter ladder logic programs.
Objective 12	Identify the functions of electromagnetic control relays, contactors, and motor starters.
Objective 13	Compare sequential and combination control processes.
Objective 14	Convert fundamental relay ladder diagrams to Programmable Logic Controller ladder logic programs.
Objective 15	Write Programmable Logic Controller programs directly from a narrative description.

Student Learning Outcomes

Upon satisfactory completion of this course, students will be able to:

Outcome 1	Verbally explain how a Programmable Logic Controller system works and detail the function of each of the various modules installed.
Outcome 2	Operate Programmable Logic Controller software commands such as: file open, file save, print, set up header and footer, enable forces, upload and download
Outcome 3	Set up the Programmable Logic Controller software for ladder logic programming.

Methods of Instruction

Method	Please provide a description or examples of how each instructional method will be used in this course.
Discussion	Students will discuss the material during lecture and lab.
Laboratory	Laboratory will be used to gain a hands-on understanding of the material presented in lecture.
Lecture	Lecture will provide a theoretical introduction and explanation of the material being covered.
Participation	Students will be asked questions during lecture and lab.

Methods of Evaluation

Method	Please provide a description or examples of how each evaluation method will be used in this course.	Type of Assignment
Mid-term and final evaluations	Students will be tested through Canvas to determine their understanding of the material.	In Class Only
Group activity participation/observation	During lab students will work in teams to perform and solve the lab report. Students will also discuss their lab findings with their lab mates.	In Class Only
Laboratory projects	Laboratory projects and findings will be evaluated to gain a better understanding for the students' comprehension of the material. Students will perform the lab during lab hours. Students will write their findings in a report at home.	In and Out of Class
Student participation/contribution	Students will be evaluated by their participation in both lecture and lab.	In Class Only
Tests/Quizzes/Examinations	Quizzes and Exams will include multiple choice questions.	In Class Only
Written homework	Homework will be assigned via Canvas and some questions will require a a short answer written response. Written lab reports will also be assigned and turned in.	Out of Class Only

Assignments

Other In-class Assignments

1. Take notes
2. Lab work
3. Lab notebook
4. Quizzes
5. Exams
6. Discussion

Other Out-of-class Assignments

1. Reading assignments
2. Writing assignments
3. Lab write-ups

Grade Methods

Letter Grade Only

MIS Course Data**CIP Code**

15.0000 - Engineering Technology, General.

TOP Code

092400 - Engineering Technology, General

SAM Code

C - Clearly Occupational

Basic Skills Status

Not Basic Skills

Prior College Level

Not applicable

Cooperative Work Experience

Not a Coop Course

Course Classification Status

Credit Course

Approved Special Class

Not special class

Noncredit Category

Not Applicable, Credit Course

Funding Agency Category

Not Applicable

Program Status

Not program-applicable

Transfer Status

Transferable to CSU only

Allow Audit

No

Repeatability

No

Materials Fee

No

Additional Fees?

No

Files Uploaded**Attach relevant documents (example: Advisory Committee or Department Minutes)**

EngrTech Advisory 02-27-18 Minutes and Handouts.pdf

Approvals**Curriculum Committee Approval Date**

11/09/2018

Academic Senate Approval Date

11/29/2018

Board of Trustees Approval Date

12/14/2018

Chancellor's Office Approval Date

3/20/2019

Course Control Number

CCC000603619

Programs referencing this courseEngineering Technology AS Degree (<http://catalog.collegeofthedesert.eduundefined?key=209>)Industrial Automation Certificate of Achievement (<http://catalog.collegeofthedesert.eduundefined?key=212>)