ENGT 031: PLCS AND INDUSTRIAL CONTROLS II

Originator
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Justification / Rationale
Labor market indicators show that there are jobs available and an advisory committee recommended the course.

Effective Term
Fall 2019

Credit Status
Credit - Degree Applicable

Subject
ENGT - Engineering Technology

Course Number
031

Full Course Title
PLCs and Industrial Controls II

Short Title
PLC AND CONTROLS II

Discipline

Disciplines List
Engineering Technology

Modality
Face-to-Face

Catalog Description
In this course students learn to program a PLC for advanced sequencing operation. Students also learn to program timers and counters that are used in a PLC application, as well as to write a PLC program using advanced math and data functions. An introduction of SCADA systems and ControlLogix Controllers will also be given.

Schedule Description
In this course students learn to program a PLC for advanced sequencing operation.
Prerequisite: ENGT 030

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)
ENGT 030

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
Ladder schematic and ladder logic skills.

Prerequisite Course Objectives
ENGT 030-Analyze and interpret typical PLC timer ladder logic programs.
ENGT 030-Convert fundamental relay ladder diagrams to PLC ladder logic programs.
ENGT 030-Understand how ladder diagram language, Boolean language, and function chart programming language are used to communicate information to the PLC.
ENGT 030-Convert relay ladder schematics to ladder logic programs.
ENGT 030-Write and enter ladder logic programs.
ENGT 030-Convert fundamental relay ladder diagrams to Programmable Logic Controller ladder logic programs.

Entrance Skills
Programmable Logic Controller programming skills.

Prerequisite Course Objectives
ENGT 030-Write PLC programs directly from a narrative description.
ENGT 030-Describe the PLC program scan sequence.
ENGT 030-Convert relay ladder schematics to ladder logic programs.
ENGT 030-Program instructions that perform logical operations.
ENGT 030-Describe the Programmable Logic Controller program scan sequence.
ENGT 030-Write Programmable Logic Controller programs directly from a narrative description.

Entrance Skills

Math skills as applied to Programmable Logic Controllers.

Prerequisite Course Objectives

ENGT 030-Define the terms bit, byte, word, least significant bit (LSB), and most significant bit (MSB) as they apply to binary memory locations.
ENGT 030-Define the decimal, binary, octal, and hexadecimal numbering systems and be able to convert from one numbering or coding system to another.
ENGT 030-Describe the binary concept and the functions of gates.
ENGT 030-Draw the logic symbol, construct a truth table, and state the Boolean equation for the AND, OR, and NOT functions.

Course Content

1. Review of PLCs and Industrial Controls I
   a. Basics of PLC programming
   b. Wiring Diagrams & ladder logic programs
   c. Timers
2. Programming Counters
   a. Counter instructions
   b. Up-counter
   c. Down-counter
   d. Cascading counters
   e. Incremental encoder-counter applications
   f. Combining counter and timer functions
   g. High-speed counters
3. Program Control Instructions
   a. Program control
   b. Master control reset instruction
   c. Jump instruction
   d. Subroutine functions
   e. Immediate input and immediate output instructions
   f. Forcing external I/O addresses
   g. Safety circuitry
   h. Selectable timed interrupt
   i. Fault routine
   j. Temporary end instruction
   k. Suspend instruction
4. Data Manipulation Instructions
   a. Data manipulation
   b. Data transfer operations
   c. Data compare instructions
   d. Data manipulation programs
   e. Numerical data I/O interfaces
   f. Closed-loop control
5. Math Instructions
   a. Math Instructions
   b. Addition instruction
   c. Subtraction instruction
   d. Multiplication instruction
   e. Division instruction
   f. Other word-level math instructions
   g. File arithmetic operations
6. Sequencer and Shift Register Instructions
   a. Mechanical sequencers
   b. Sequencer instructions
   c. Sequencer programs

   d. Bit shift registers
   e. Word shift operations
7. PLC Installation Practices, Editing and Troubleshooting
   a. PLC Enclosures
   b. Electrical noise
   c. Leaky inputs and outputs
   d. Grounding
   e. Voltage variations and surges
   f. Program editing and commissioning
   g. Programming and monitoring
   h. Preventive maintenance
   i. Troubleshooting
      i. Processor module
      ii. Input malfunctions
      iii. Output malfunctions
      iv. Ladder logic program
   j. PLC programming software
8. Process Control, Network Systems, and SCADA
   a. Types of processes
   b. Structure of control systems
   c. On/Off control
   d. PID control
   e. Motion control
   f. Data Communications
      i. Data Highway
      ii. Serial communications
      iii. DeviceNet
      iv. ControlNet
      v. EtherNet/IP
      vi. Modbus
      vii. Fieldbus
      viii. PROFIBUS-DP
   g. Supervisory Control and Data Acquisition (SCADA)
9. ControlLogix Controllers
   a. Memory and Project Organization
   b. Bit-Level Programming
   c. Programming Timers
   d. Programming Counters
   e. Math, Comparison, and Move Instructions
   f. Function Block Programming

Lab Content

1. Event sequencing
2. Application development
3. PLC Timer instructions
4. PLC counter instructions
5. Program Control Instructions
6. Math and Data Move instructions

Course Objectives

	Objectives
Objective 1	List and describe the functions of Programmable Logic Controller counter instructions.
Objective 2	Analyze and interpret typical Programmable Logic Controller counter ladder logic programs.
Objective 3	Apply combinations of counters and timers to control systems.
Objective 4	Explain the function of subroutines.

Objective 5	Understand the basic operation of Programmable Logic Controller closed-loop control systems.
Objective 6	Create Programmable Logic Controller programs involving math instructions.
Objective 7	Apply combinations of Programmable Logic Controller arithmetic functions to processes.
Objective 8	Compare the operation of an event-driven and a sequence driven sequencer.
Objective 9	List and describe specific Programmable Logic Controller troubleshooting procedures.
Objective 10	Recognize and explain the functions of the control elements of a closed-loop control system.
Objective 11	Describe a typical Supervisory Control and Data Acquisition (SCADA) application.
Objective 12	Understand the differences between Programmable Automation Controllers (or PACs) and Programmable Logic Controllers (PLCs).

Student Learning Outcomes

	Upon satisfactory completion of this course, students will be able to:
Outcome 1	Setup a Programmable Logic Controller program for event sequencing.
Outcome 2	Program the Programmable Logic Controller to accept advanced math and data functions.
Outcome 3	Apply Combinations of counters and timers to control systems.

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 asked to perform work during 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 discuss their 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. During lab students will perform their lab work. At home, students will write their lab reports.	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 short answer written response. Students will also write their lab reports at home.	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 writeups

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
CCC000603620

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