ENGT M30: PROGRAMMABLE LOGIC CONTROLLERS

Originator
srelle

College
Moorpark College

Attach Support Documentation (as needed)
1- Advisory Committee Board Meeting.pdf

Discipline (CB01A)
ENGT - Engineering Technology

Course Number (CB01B)
M30

Course Title (CB02)
Programmable Logic Controllers

Banner/Short Title
Program. Logic Contrl. (PLCs)

Credit Type
Credit

Honors
No

Start Term
Fall 2022

Catalog Course Description
Examines fundamentals of Programmable Logic Controllers (PLCs), with an emphasis on introductory programming of PLCs. Focuses on problem analysis with solutions that integrate programming formats, auxiliary commands and functions, common programming languages, and popular software programs used with PLCs. Includes instructions on PLC architecture, installation, maintenance, troubleshooting, and repairs.

Taxonomy of Programs (TOP) Code (CB03)
0935.00 - *Electro-Mechanical Technology

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
B (Transferable to CSU only)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
C - Clearly Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
A - Primarily Developed Using Economic Development Funds

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
May be required

Faculty notes on field trips; include possible destinations or other pertinent information
Naval Base in Point Mugu or in Port Hueneme; local engineering companies

Grading method
(L) Letter Graded

Alternate grading methods
(O) Student Option- Letter/Pass
(E) Credit by exam, license, etc.
(P) Pass/No Pass Grading

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
35
Maximum Contact/In-Class Lecture Hours
35

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5

Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
87.5
Total Maximum Contact/In-Class Hours
87.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
70
Maximum Outside-of-Class Hours
70

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
ENGT M02

Entrance Skills

Entrance Skills
ENGT M02

Prerequisite Course Objectives
ENGT M02-demonstrate the operation of electronic lab equipment to test components and circuits by properly connecting and operating the following standard test equipment: power supplies, function generators, ammeters, voltmeters, ohmmeters, digital multimeters, and oscilloscopes.
ENGT M02-explain the operation of digital logic gates.
ENGT M02-identify the more commonly used integrated circuit families used in digital equipment and discuss their operation and characteristics.
ENGT M02-use Boolean algebra to express logic operations and minimize logic circuits in design.
ENGT M02-discuss the operation and application of counters, shift registers, and other combinational and sequential logic circuits.

Requisite Justification

Requisite Type
Prerequisite

Requisite
ENGT M02

Requisite Description
Course in a sequence

Level of Scrutiny/Justification
Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	explain the basic functions, operations, and architecture of Programmable Logic Controllers (PLCs).
2	program the PLC for a specified application or to achieve a specified outcome.
3	troubleshoot a malfunctioning PLC using analytical techniques learned in class.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	explain the basic functions, operations, and architecture of PLCs.
2	discuss the advantages and the disadvantages of using PLCs.
3	describe and demonstrate how the parts of the PLC system are connected electrically.
4	analyze problems representative of control system environments using PLCs.
5	demonstrate the installation, maintenance, and troubleshooting of PLCs and PLC modules.

Course Content

Lecture/Course Content

(10%) - PLC and Electrical Safety

- Power supply connections
- Input and output connections
- Communication connections that present a possible shock hazard

(10%) - Electrical Principles and PLCs

- PLC as an electrical part of a much larger electrical system
- Input devices (switches and sensors)
- Output components (motor starters and lights)
- How to install, maintain and troubleshoot
- Electrical properties
  - voltage
  - current
  - power
- Resistance

(10%) - Electrical Circuits and PLCs

- Symbols
- Ladder Logic Diagrams

(15%) - PLC Hardware

- Input section
- Output section
- Power supply
- Central processing unit
- Programming device

(10%) - PLC Programming Instructions
- Testing: Force Inputs & Outputs
- Troubleshooting: Tnd, Jmp & LBL

(10%) - Programming PLC Timers and Counters
- TON Timer Instruction
- TOF
- RTO
- CTU & CTD

(15%) - PLC and System Interfacing
- Networking
- Serial Communications

(10%) - PLC Installations and Start up
- Preparing the PLC
- PLC enclosures
- Electrical Noise
- Power Supplies
- Safety and wiring

(10%) - PLC and System Maintenance
- Hardware
- Software

Laboratory or Activity Content

(33.3%) - PLC Installations and Start up for Performing a Specified Function
- Preparing the PLC
- PLC enclosures
- Electrical Noise
- Power Supplies
- Safety and wiring

(33.4%) - PLC and System Communication, Maintenance, and Programming
- Hardware
- Software
- Programming
- System interface and communication

(33.3%) - Troubleshooting of PLCs
- Systematic elimination of various parts of a system or process to locate a malfunctioning part
- Examining ways to fix the malfunctioning part

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Skills demonstrations

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Group projects
Individual projects
Laboratory activities
Laboratory reports
Objective exams
Performances
Problem-solving exams
Problem-solving homework
Quizzes
Skills demonstrations
Skills tests or practical examinations

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Class activities
Class discussions
Collaborative group work
Computer-aided presentations
Demonstrations
Field trips
Group discussions
Guest speakers
Instructor-guided interpretation and analysis
Instructor-guided use of technology
Internet research
Laboratory activities
Lecture
Practica
Problem-solving examples
Small group activities

Describe specific examples of the methods the instructor will use:

The instructor will use PowerPoint presentations, problem solving exercises, and demonstrations to explain the concepts of the course. The instructor will divide students into small groups of 2-4 students, task them with a design objective or a system maintenance and operational issue, then using concepts learned in the course guide them through the engineering design and troubleshooting process.

Representative Course Assignments

Writing Assignments

1. Compare and contrast a PLC to a typical personal computer system.
2. Use a simple relay ladder diagram to describe the basic sequence of an industrial operation that uses PLC, then translate the relay ladder diagram into a typical module interface and outline the basic sequence of operations of a PLC.

Critical Thinking Assignments

1. Design a PLC circuit with a specific function that will meet the design goals of an industrial operation.
2. Troubleshoot a faulty PLC and suggest repairs to restore its intended operation.

Reading Assignments

1. Read assigned chapters from the textbook to prepare for lectures and laboratory experiments which will reinforce the ability to recognize the various architecture, functions, and operations of PLCs, predict their performance analytically, and verify their function and operation experimentally.
2. Read scientific and technical journal articles relevant to advances in PLCs to expand understanding of their usage in various industrial operations.

Skills Demonstrations

1. Demonstrate the ability to install a PLC in a circuit that can perform a particular function according to the specifications of a laboratory simulated industrial operation.
2. Demonstrate the ability to troubleshoot a malfunctioning PLC using the appropriate testing tools.

Outside Assignments

Representative Outside Assignments

1. Prepare an oral presentation to explain the progression of thought and action, as prescribed by the Engineering Design Process, in designing, testing, and troubleshooting a PLC driven industrial operation.
2. Research on the Internet the evolution of computer based controllers and their use in today's industry.

Articulation

Equivalent Courses at other CCCs

College	Course ID	Course Title	Units
Bakersfield College	ELET B3	Programmable Logic Controllers	3
Cerritos College	NPD 104	Programmable Logic Controllers in New Product Development	3
Clovis Community College	MECH 5	Programmable Logic Controllers (PLCs)	3
College of Sequoias	ITEC 120	Programmable Logic Controllers	3
Glendale Community College	ECT 210	Programmable Logic Controllers	3
Fresno City College	EST 58	Programmable Logic Controllers	3
Diablo Valley College	ELECT 271	Programmable Logic Controllers	4

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable
Yes

CSU Baccalaureate List effective term:
FALL 2022

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

Area F: Ethnic Studies

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Classic Textbook
No

Description
Petruzella, Frank D. *Programmable Logic Controllers*, 5th ed., Mc Graw Hill, 2017.

Resource Type
Textbook

Classic Textbook
Yes

Description
Nule, Kiran and Seema Vishwakarma. *Introduction to Programmable Logic Controller and Ladder Logic.* Kindle ed., 2013.

Resource Type
Textbook

Classic Textbook
No

Description
Rabiee, Max. *Programmable Logic Controllers: Hardware and Programming*. 4th ed., Goodheart-Willcox Publisher, 2018.

Resource Type
Manual

Description
Rabiee, Max. *Programmable Logic Controllers: Hardware and Programming*. 4th ed., Goodheart-Willcox Publisher, 2018.

Resource Type
Software

Description
LogixPro 500 PLC Simulator Software. Developed by and available from The Learning Pit. www.thelearningpit.com (http://www.thelearningpit.com/).

Library Resources

Assignments requiring library resources
Writing, reading, critical thinking, outside assignments

Sufficient Library Resources exist
Yes

Example of Assignments Requiring Library Resources
Using Library's online or print resources conduct a research on the history of various control systems including steam driven systems, early electrical control systems with switches and contactors, mid-twentieth century electrical control systems with conventional hard-wired relays, and computer control systems, and discuss the limitations of each system which led to the development of the next system of controls.

Primary Minimum Qualification
ENGINEERING TECHNOLOGY

Review and Approval Dates

Department Chair
10/05/2021

Dean
10/05/2021

Technical Review
10/28/2021

Curriculum Committee
11/02/2021

DTRW-I
12/09/2021

Curriculum Committee
MM/DD/YYYY

Board
01/18/2022

CCCCO
MM/DD/YYYY

DOE/accreditation approval date
MM/DD/YYYY