COURSE OUTLINE: RAA202 - PLC AND INTERFACING

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Course Code: Title	RAA202: PLC AND INTERFACING
Program Number: Name	4073: ROBOTICS & AUTOMATIO
Department:	ROBOTICS GRADUATE CERTIFICATE
Academic Year:	2022-2023
Course Description:	Students will develop a general understanding of PLC control, programming and interfacing as well as understand the hardware and software associated with the Allen Bradley ControlLogix 5000 platform. PLC programming techniques using computer-based software will be used to design and commission basic to intermediate PLC programs. Basic control theory associated with PLCs and connected equipment will be introduced to assist with lab assignment implementation. This course will require the student to work independently and/or in groups during lab times. The student will also be required to work independently on assigned work outside of class time and access information from help files, manuals, and internet as necessary to solve PLC related work problems. This is to prepare the student for PLC job related tasks.
Total Credits:	4
Hours/Week:	4
Total Hours:	60
Prerequisites:	RAA100
Corequisites:	There are no co-requisites for this course.
Vocational Learning Outcomes (VLO's) addressed in this course: Please refer to program web page for a complete listing of program outcomes where applicable.	**4073 - ROBOTICS & AUTOMATIO** VLO 1 Construct and evaluate robotic control programs for various scenarios against which to model the functionality and stability of automation systems. VLO 7 Formulate and use a variety of troubleshooting techniques on new and legacy electromechanical equipment, processes, systems and subsystems.
Essential Employability Skills (EES) addressed in this course:	EES 1 Communicate clearly, concisely and correctly in the written, spoken, and visual form that fulfills the purpose and meets the needs of the audience. EES 2 Respond to written, spoken, or visual messages in a manner that ensures effective communication. EES 3 Execute mathematical operations accurately. EES 4 Apply a systematic approach to solve problems. EES 5 Use a variety of thinking skills to anticipate and solve problems. EES 6 Locate, select, organize, and document information using appropriate technology and information systems. EES 7 Analyze, evaluate, and apply relevant information from a variety of sources. EES 8 Show respect for the diverse opinions, values, belief systems, and contributions of

	others.
	EES 9 Interact with others in groups or teams that contribute to effective working relationships and the achievement of goals.
	EES 10 Manage the use of time and other resources to complete projects.
	EES 11 Take responsibility for ones own actions, decisions, and consequences.
Course Evaluation:	Passing Grade: 50%, D

A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation. |
| **Other Course Evaluation & Assessment Requirements:** | The student must pass both the theory portion, the practical portion, demonstrate all labs and pass a minimum of one of the two practical tests to pass the course.

Smart watches, smart phones and similar devices are not allowed during tests or quizzes and must be removed. Smart phones are not acceptable for use as a calculator during a test or quiz.

Grade
Definition Grade Point Equivalent
A+ 90 - 100% 4.00
A 80 - 89%
B 70 - 79% 3.00
C 60 - 69% 2.00
D 50 - 59% 1.00
F (Fail)49% and below 0.00

CR (Credit) Credit for diploma requirements has been awarded.
S Satisfactory achievement in field /clinical placement or non-graded subject area.
U Unsatisfactory achievement in field/clinical placement or non-graded subject area.
X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.
NR Grade not reported to Registrar`s office.
W Student has withdrawn from the course without academic penalty. |
| **Books and Required Resources:** | Technicians Guide to Programmable Controllers by Terry Borden, Richard Cox
Publisher: Delmar Cengage Learning Edition: Sixth
ISBN: 978-1-111-54409-6 |
| **Course Outcomes and Learning Objectives:** | |

Course Outcome 1	Learning Objectives for Course Outcome 1
1. Identify basic programmable logic controller (PLC) hardware and software.	1.1 Recognize the major advantages of a typical PLC over conventional hardwired relay systems.
1.2 List the four major components of a typical PLC and describe the function of each.
1.3 Define the terms discrete and analog
1.4 Identify different types of programming devices.
1.5 Describe the I/O section of a PLC.
1.6 Define the terms interposing relay and optical isolation.
1.7 Describe how basic AC and DC input and output modules work.

Course Outcome 2	Learning Objectives for Course Outcome 2
2. Understand basic PLC ladder logic instructions, numbering systems and demonstrate wiring techniques for the Allen Bradley ControlLogix 5000 series PLC.	2.1 Describe the proper wiring connections for input and output devices and their corresponding I/O modules. 2.2 Explain why a hard-wire emergency-stop function is desirable. 2.3 Identify and compare wiring and schematic diagrams. 2.4 Describe the function of the PLC processor and identify the two distinct types of memory used in a PLC. 2.5 Understand decimal, binary, hexadecimal, binary coded decimal (BCD) numbering systems. 2.6 Explain the terms off-line and on-line programming. 2.7 Understand and use the examine ON, examine OFF, timer, counter, move, limit test, sequencer instructions and internal storage bit applications. 2.8 Describe basic programming techniques. 2.9 Describe the Force On and Force Off features and the hazards that could be associated with both.
Course Outcome 3	**Learning Objectives for Course Outcome 3**
3. Develop and demonstrate basic programming and configuration techniques for the Allen Bradley ControlLogix 5000 series PLC using computer-based programming software.	3.1 Demonstrate the ability to program and configure basic PLC hardware and functions offline. 3.2 Demonstrate the ability to program PLCs to control. 3.3 Demonstrate the ability to determine appropriate control equipment based on control requirements and specifications. 3.4 Demonstrate the ability to wire PLC inputs and outputs to field equipment. 3.5 Demonstrate the ability to add accurate and effective documentation to a PLC program.
Course Outcome 4	**Learning Objectives for Course Outcome 4**
4. Develop and demonstrate the ability to create basic programs to control various electrical equipment in the lab and run the programs.	4.1 Demonstrate the ability to download a program to a PLC from a PC. 4.2 Demonstrate the ability to upload a program to a PC from a PLC. 4.3 Demonstrate the ability to configure the PLC to run the program. 4.4 Demonstrate the ability to program basic PLC functions and edit programs online. 4.5 Demonstrate the ability to write a PLC program to control equipment such as motors, traffic lights, etc. based on control requirements and specifications. 4.6 Demonstrate the ability to create a basic human machine interface (HMI).
Course Outcome 5	**Learning Objectives for Course Outcome 5**
5. Develop and demonstrate the ability to connect to an online running automation system and troubleshoot programs.	5.1 Research using available information resources such the internet, reference manuals, handbooks, quick start guides, knowledge bases and help files to aid in selecting, installing, programming, commissioning, testing, and troubleshooting appropriate electrical equipment and components based on control requirements and specifications. 5.2 Test and troubleshoot PLC project related equipment,

	software, systems, and tasks. 5.3 Apply problem-solving techniques using computer systems and application software to resolve technical problems associated with PLC and HMI programs. 5.4 Select appropriate application software for troubleshooting programming and communication issues. 5.5 Demonstrate the ability to troubleshoot wiring to PLC I/O cards and field equipment.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Assignments and Quizzes	10%
Lab Demonstrations	15%
Practical Test 1	20%
Practical Test 2	25%
Written Test 1	15%
Written Test 2	15%

Date: August 15, 2022

Addendum: Please refer to the course outline addendum on the Learning Management System for further information.