COURSE OUTLINE: AMF106 - AUTOMATION SENSING

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

Course Code: Title	AMF106: AUTOMATION SENSING AND CONTROL
Program Number: Name	4069: AUTOMATED MANUFACT.
Department:	ROBOTICS GRADUATE CERTIFICATE
Semesters/Terms:	20F, 21W
Course Description:	Automated manufacturing systems are used across the world to produce high quality products at high speed and with great efficiency by using industrial programmable logic controllers (PLC) to interact with the real world rather than traditional methods. This course will introduce the student to the sensors and actuators that are used in automation systems so that the PLC may sense the conditions in and manipulate the physical world. Students will study a mix of discrete and analog sensors as well as electro-mechanical actuators of the hydraulic and pneumatic type. Through the use of simulation software and theory lectures, the student will be exposed to the control concepts and equipment used in hydraulic and pneumatic controls, basic PLC control including real world interfaces and lastly understanding the operation, correct application and integration of discrete, specialty and analog sensors. This course will require students to work independently in self-directed in lab activities.
Total Credits:	5
Hours/Week:	5
Total Hours:	75
Prerequisites:	There are no pre-requisites for this course.
Corequisites:	There are no co-requisites for this course.
This course is a pre-requisite for:	AMF205
Vocational Learning Outcomes (VLO's) addressed in this course: **Please refer to program web page for a complete listing of program outcomes where applicable.**	**4069 - AUTOMATED MANUFACT.** VLO 1 Solve automated manufacturing problems found in a typical industrial environment by applying engineering principles and decision-making strategies. VLO 3 Select and manage appropriate hardware and software for the creation of engineering designs. VLO 4 Identify and utilize manufacturing processes, rapid prototyping methods, and automation technologies to optimize product development. VLO 6 Configure, control, monitor, and evaluate automated manufacturing components and systems to improve automated manufacturing systems and maintain quality control measures in response to industry needs and requirements. VLO 7 Exercise professionalism, leadership, and effective communication in an industrial work setting to increase overall productivity and support a positive work environment. VLO 8 Ensure automation equipment is in compliance with established operating procedures, and occupational health and safety regulations.

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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 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 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:	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. The student must pass both the theory portion, the practical portion and demonstrate all labs in order 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.
Books and Required Resources:	Industrial Maintenance and Mechatronics by Shawn A. Ballee, Gary R. Shearer Publisher: Goodheart-Willcox ISBN: 978-1-63563-427-3
Course Outcomes and Learning Objectives:	

Course Outcome 1	Learning Objectives for Course Outcome 1
1. Understand and use	1.1 Develop an understanding and describe the advantages

simulation software.	and limitations of using simulation software. 1.2 Demonstrate the use of simulation software to simulate a physical environment. 1.3 Demonstrate the use of simulation software to simulate an electrical environment.
Course Outcome 2	**Learning Objectives for Course Outcome 2**
2. Understand hydrostatic and hydrodynamic characteristics of fluids.	2.1 Understand the characteristics of fluids such as weight, mass and specific gravity. 2.2 Understand and describe the relationship of force, pressure and area. 2.3 Describe hydrostatic pressure and understand methods of hydrostatic pressure measurement. 2.4 Describe the behavior of fluids (gasses) and calculate their properties under varying conditions. 2.5 Describe hydrodynamic flow and understand methods of flow measurement.
Course Outcome 3	**Learning Objectives for Course Outcome 3**
3. Understand the operation of electro-hydraulic and electro-pneumatic processes and their associated control equipment.	3.1 Describe the basic operation of a fluid power system. 3.2 Understand the symbols used in fluid power systems. 3.3 Describe the components that form a hydraulic power system. 3.4 Describe and understand the operation of hydraulic valves and hydraulic valve actuators. 3.5 Understand the characteristics and operation of hydraulic cylinders. 3.6 Describe the components that form a pneumatic system 3.7 Understand the characteristics and operation of pneumatic cylinders.
Course Outcome 4	**Learning Objectives for Course Outcome 4**
4. Understand basic PLC control concepts and interpret ladder logic programming.	4.1 Describe the origin of the ladder logic programming language. 4.2 Identify and explain the structure of a ladder logic program. 4.3 Identify and explain the operation of basic ladder logic instructions such as examine if closed, examine if open, output energize and timers. 4.4 Understand the input and output (I/O) section of the PLC.
Course Outcome 5	**Learning Objectives for Course Outcome 5**
5. Identify, describe the use of and integrate various discrete process automation sensors used in automated manufacturing systems.	5.1 Describe the operation and integration of contact based sensors such as limit switches. 5.2 Describe the operation and integration of non-contact based sensors such as proximity, capacitive and ultrasonic switches. 5.3 Describe the operation and integration of photo-electric based sensors such as photo-eyes. 5.4 Describe the operation and integration of hydraulic and pneumatic sensors such as pressure and flow switches. 5.5 Identify the symbols used in schematics to represent various discrete sensors.

Course Outcome 6	Learning Objectives for Course Outcome 6
6. Identify, describe the use of and integrate various analog process automation sensors used in automated manufacturing systems.	6.1 Describe the operation and integration of rotary speed/position sensors such as tachometers, encoders and resolvers. 6.2 Describe the operation and integration of linear position sensors such as LVDTs. 6.3 Describe the operation and integration of pressure and flow sensors such as differential pressure sensors. 6.4 Identify symbols used in schematics to represent various discrete sensors.

Evaluation Process and Grading System:

Evaluation Type	Evaluation Weight
Attendance and Quizzes	10%
Labs	30%
Practical Tests	20%
Written Test #1	20%
Written Test #2	20%

Date: December 1, 2020

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

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