SOUTHEAST COMMUNITY COLLEGE
CONSTRUCTION MANUFACTURING AND TECHNOLOGY DIVISION
Electrical/Electromechanical Technology Program
Revision Date: August 23, 2021

I. CATALOG DESCRIPTION

Course Number:	ELEC2614
Course Title:	Robotics and Integrated Automation
Prerequisite(s):	ELEC2534
Co-Prerequisite:	None
Catalog Description:	This course focuses on robotics, servo systems and the integration of automated equipment.
Credit Hours:	5.5
Class Hours:	45
Lab Hours:	113
Total Contact Hours:	158

II. COURSE OBJECTIVES: *Course will:*

A. Explain how to program different robots.
B. Illustrate how to connect and setup variable speed motor drives to be controlled by a PLC using hard wire connections.
C. Describe how to connect and setup variable speed motor drives to be controlled by another device using industrial communication protocols.
D. Illustrate how to connect and setup a Servo system to be controlled by a PLC using hard wire connections.
E. Describe how to connect and setup a Servo system to be controlled by another device using industrial communication protocols.
F. Examine how to connect and setup a Vision systems so that data can be transferred to another device using industrial communication protocols.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

A. Student Learning Outcomes: *Student will be able to:*
1. Program a Kawasaki Robot.
2. Program a Denso Robot.
3. Setup and wire a VFD to a PLC using an analog signal for speed control.
4. Setup and wire a VFD to a PLC using discrete inputs to control the speed.
5. Setup a VFD to be controlled by a PLC using Ethernet/IP.
6. Setup a VFD to be controlled by a Servo using Modbus TCP.
7. Setup a system that uses a PLC to control two servo axis utilizing discrete I/O connections.
8. Setup a system that uses a PLC to control a single servo axis utilizing Ethernet/IP.
9. Setup a system that uses one servo to control a second servo axis utilizing Modbus TCP.
10. Setup a PLC to control and read various pieces of data from a vision system using Ethernet/IP.
11. Setup a vision system to send positional information to a servo system utilizing Modbus TCP.

B. General Education Learning Outcomes (GELOs)
1. GELO #5: Analytical, Quantitative, and Scientific Reasoning

Outcome 3: Effectively develop strategies, algorithms, or experiments (or performing experiments) to better describe the systems or to solve the problems.

IV. CONTENT/TOPICAL OUTLINE

- **A.** Robotics
  - **1.** Goal Statement: The students will setup robots to perform various tasks.
    - **a.** Describe different types of robotic systems.
    - **b.** Describe different coordinate systems used on robots.
    - **c.** Describe programming methods of robots.
- **B.** Variable Frequency Drives
  - **1.** Goal Statement: The student will perform installation and integration of AC drives and test for effectiveness.
    - **a.** Describe the various methods of integrating variable frequency AC drives with other equipment.
    - **b.** Show differences of operation by using multiple brands of variable frequency AC drives.
- **C.** Stepper & Servo Motor Controls
  - **1.** Goal Statement: The students will perform installation; interface and setup procedures of stepper and servo motor controls used in industrial control systems.
    - **a.** Describe the characteristics and principals of operation of stepper and servo motor controls used in industrial control systems.
    - **b.** Servo applications and implementation.
    - **c.** Describe various interface options with servo systems.
    - **d.** Multi axis servo systems
- **D.** Industrial Communication
  - **1.** Describe different industrial communication protocols and methods.
    - **a.** RS232 and RS485
    - **b.** Ethernet
      - **1.** Modbus TCP
      - **2.** Ethernet/IP
      - **3.** EtherCAT
- **E.** Vision Systems
  - **1.** Describe the operation and application of a vision system.
  - **2.** Describe the interface option of various vision systems.
- **F.** Safety Guards
  - **1.** Describe various safety hardware that would be implemented with industrial work cells.
    - **a.** Physical barriers
    - **b.** Safety switches
    - **c.** Light curtains
    - **d.** Laser perimeter guards

V. INSTRUCTIONAL MATERIALS

- **A.** Required Text(s): Satori, Glenn J., Rehg, James A., *Industrial Electronics*
- **B.** Other Resources: Equipment manuals provided for lab experiments
- **C.** Supplies:
  - **1.** Three-ring Notebook
  - **2.** Three Ring Index Dividers
  - **3.** 3/16 Flat Screwdriver
  - **4.** No. 2 Phillips Screwdriver
  - **5.** Small Flat Screwdriver

6. Wire Strippers-Low Voltage Strippers (24-16 gauge) stranded
7. DMM

VI. METHODS OF PRESENTATION/INSTRUCTION

A. Methods of presentation typically include a combination of the following:
1. Lecture
2. Lab
3. Homework

VII. METHODS OF EVALUATION

A. Methods of evaluation, although determined by the individual instructor, traditionally includes a combination of the following:
1. Overall course grade shall consist of Theory grade and Lab grade

VIII. SPECIFIC COURSE REQUIREMENTS

A. A minimum grade of D is required.
B. Cheating within the Manufacturing Division: Any violation of academic integrity on assignments, quizzes, or tests will result in a grade of 0 on that assignment, quiz, or test. A second violation in any course after the initial infraction will result in a grade of F for that course. Any additional violations while in the program will result in a suspension from the program.
C. Credit by Examination: Credit for the course CANNOT be earned through Credit by Examination.