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

I. CATALOG DESCRIPTION

Course Number:	ELEC2144
Course Title	Motors and Controllers
Prerequisite(s):	ELEC1217
Catalog Description:	An in-depth study into the operation, application, wiring and troubleshooting of a three-phase motor and the controls circuits used in industrial settings. Included are the use of start/stop stations, emergency stop systems, forward and reversing controls, timing devices and relays. Also, included is the study of various types of single phase motors and their particular uses, the use of fused disconnects, thermal overloads, NEMA starters and NEMA enclosures for proper design in given situations.
Credit Hours:	4
Class Hours:	30
Lab Hours:	90
Total Contact Hours:	120

II. COURSE OBJECTIVES: *Course will:*

A. Prepare the students for wiring various motor control circuits.
B. Provide instructions to the students as to how to design control circuits.
C. Have students wire various different control circuits.
D. Have students demonstrate their ability to design complex control circuits.

III. STUDENT LEARNING OUTCOMES AND GENERAL EDUCATION LEARNING OUTCOMES:

A. Student Learning Outcomes: *Student will be able to:*
- **1.** Identify the different types of 3-phase and single phase motors.
- **2.** Identify various motor starters and their designs.
- **3.** Wire various motor control operations and demonstrate that motor works properly.
- **4.** Construct common control systems from a given design.
- **5.** Design a control system from a written scenario.

B. General Education Learning Outcomes (GELOs)
- **1.** GELO #3: Critical Thinking and Problem Solving
  Outcome 1: Collect, identify, interpret and analyze data.

IV. CONTENT/TOPICAL OUTLINE

A. Overview of different types of single phase and three-phase motors
- **1.** Induction motor family
  - **a.** Three-phase
  - **b.** Single phase
- **2.** Synchronous motors
- **3.** Series/Universal

B. Principles of Motor Control
- **1.** Goal Statement: Students will state the purpose and general principles of electric motor control and state difference between manual and remote control.

a. Definitions

C. Fractional H. P. Manual Motor Starters

1. Goal Statement: Students will show how to match simple schematic diagrams with appropriate manual motor starters; and connect manual fractional horsepower motor starters for automatic and manual operation of manual motor starters and read and draw simple schematic diagrams.

a. Definitions
b. Schematics
c. Troubleshooting

D. Magnetic Line Voltage Starters

1. Goal Statement: Students will show how to identify common magnetic motor starters and overload relays; describe the construction and operating principles of magnetic starters, troubleshoot magnetic starters and select proper NEMA size and type starters for particular applications and sizes of motors.

a. Sizing overload relays
b. NEMA sizes of starters
c. NEMA types of enclosures

E. Control Pilot Devices

1. Goal Statement: Students will show how to recognize, draw the symbols of and learn the function of common pilot devices and wire circuits using common pilot devices.

a. Pushbuttons
b. Relays & contactors
c. Timing relays
d. Pressure switches
e. Float switches
f. Flow switches
g. Limit switches
h. Temperature switches

F. Circuit Layout, Connections & Symbols

1. Goal Statement: Students will show how to identify common electrical symbols used in motor control diagrams, draw an elementary line diagram using a wiring diagram as a reference, differences between 2 and 3 wire control, identify common terminal markings, read and use target tables, connect motor starters with 2 and 3 wire control, connect drum switches for reversing, interpret motor nameplate information and connect dual voltage motors.

a. 2-wire and 3-wire input devices such as limit, float, flow, pressure, temperature, and proximity switches
b. H O A control and Control/Timing relays
c. Counters
d. Solenoids
e. Multiple PB stations
f. Interlocking methods for reversing control
g. Sequence control
h. Time delay – low voltage release relay
i. 3-phase, dual voltage motor connections

G. Wiring Methods & Code Practice

1. Goal Statement: The student will demonstrate how to calculate branch circuit protection, wire size and heater size.

a. 3- phase dual speed motor connections
b. Branch circuit cond.

c. Heaters

H. Methods of Deceleration

1. Goal Statement: Students will describe the various methods of deceleration for AC motors, wire circuits for jogging and plugging and anti-plugging, and will demonstrate troubleshooting.

a. Jogging circuits

b. Plugging circuits

c. Electric braking

I. Developing Control Circuits

1. Goal Statement: Students will understand and demonstrate how to develop control circuits for given problems.

2. REMARKS: This work is to be completed outside of the classroom/lab hours.

J. Designing and Troubleshooting of Electrical Control Circuits

1. Goal Statement: Designing electrical control schematics and troubleshooting skills will be acquired by the student.

a. Students will spend approximately 4 hours in class and a minimum of 8 hours outside of class, designing 5 different electrical control schematics and sequences.

b. Students will spend approximately 4 hours in class, troubleshooting several electrical control circuits.

c. Students will spend approximately 4 hours in class, studying the advanced use of various pieces of test equipment in troubleshooting control circuits.

K. Laboratory

1. Goal Statement: The student will gain additional experience and knowledge in electrical control and troubleshooting by wiring 5 “real-world” control circuits from schematics. Each project, after the first, will become progressively more complex and timed. The student will then troubleshoot and repair 2 different “real-world” faults in a previously wired project.

V. INSTRUCTIONAL MATERIALS

A. Required Text(s): Herman, Steven L, *Electric Motor Control,* (Refer to CID and/or instructor for current edition)

B. Other Resources: Handouts

C. Supplies: Required tools (see tool list) and Scientific calculator

VI. METHODS OF PRESENTATION/INSTRUCTION

A. Methods of presentation typically include a combination of the following:

1. Lecture

2. Lab

3. Reading assignments

4. Homework – Design problems

VII. METHODS OF EVALUATION

A. Methods of evaluation, although determined by the individual instructor, traditionally includes a combination of the following:

1. Participation

2. Daily Assignments

3. Written exams/quizzes

4. Lab performance

5. Design ability

VIII. SPECIFIC COURSE REQUIREMENTS

A. A minimum grade of 60% 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.