MOHAWK VALLEY COMMUNITY COLLEGE

UTICA AND ROME, NEW YORK

ELECTRICAL MACHINERY AND CONTROLS 1

ET230

CATALOG DESCRIPTION:

### ET230 AC Motors 7 Controls C-3 P-4 Cr-5

This course is intended for the heating, refrigeration, and air condition technicians. It provides HVAC students with theory and practicum in motors and controls, networking protocols, and automated building systems. The course has a blend of theory and practice suitable for vocational-technical students or industry practitioners who wish to upgrade their backgrounds. Electrical principles, components, meters, schematics, and systems are discussed and applied to modern small and large scale installations. Prerequisite: ET102 Technical Electricity 2 or permission of the Dean for Mathematics, Engineering, Physical Sciences, and Applied Technology

Prerequisite: ET111 or permission of the Department Head

Co-requisite: MA106 Technical Mathematics 2 Or permission of instructor

Student learning outcomes:

Upon completion of this course, the student will be able to:

* The student will understand the principles involved in AC motors operations.
* The student will construct, analyze and operate various motor control circuits
* The student will be able to identify, troubleshoot and repair a transformer energized motor control circuit.
* The student will construct various single and three phase motor control circuits and identify control functions.
* The student will be able program AC & DC motor drives
* The student will design & troubleshoot complex motor control circuitry

DETAILED COURSE OUTLINE:

1. Safety Practices for HVAC (3 periods)

1. Overview
2. Shocks and good health
3. First Aid & CPR
4. Protecting Electrical Circuits
5. Lock out Tag Out
6. Fire Safety
7. Short Circuits
8. Fire Extinguishers

# 2. Fundamentals of Electricity

(3 periods)

1. Overview
2. Voltage, Current, resistance
3. Basic Parts
4. OHMS Law
5. Calculations involving OHMS law
6. Fundamental Circuits

# 3. Electrical Circuits

(3 periods)

1. Switches
2. Relays
3. Series Connections
4. Parallel Connections
5. Loads
6. Heating Elements
7. Solving for Current, and Voltage
8. Air Conditioning Systems and Voltages
9. Troubleshooting

4. Meters and Tools For HVAC (3 periods)

1. The VOM Meter
2. Magnetic Theory
3. Solenoids
4. Measuring Milli Amps
5. Reading Current with Clamp on Meter
6. Meg ohm meters
7. Wrenches for HVAC
8. Conduit Bending
9. Tools and Tool Belts

# 5. Interpretation and Application of Simple Wiring Diagrams

(3 periods)

1. Overview
2. Electrical Symbols
3. Thermostats
4. Controls for Heating
5. Electrical Systems for HVAC
6. HVAC Loads

# 6. Push Buttons & Control Stations

(4 periods)

1. Converting Ladder Diagrams to Wiring Diagrams
2. Reading Ladder Diagrams
3. Package Air Conditioners
4. Window Air Conditioners
5. Refrigeration Systems
6. Electrical Wiring

7. Magnetism, Alternating Current and Power Distribution (5 periods)

1. Magnetic Theory
2. Electromagnets
3. Cores
4. Reversing Magnetic Polarity
5. Peak & RMS
6. Capacitance
7. True & Apparent Power

TEST (1 Period)

8. Installing HVAC Systems (3 periods)

1. Wiring Sizes and Voltage Drops
2. Transformers
3. Step up & Step Down
4. VA Ratings
5. Delta Wye
6. Three Phase

9. Single Phase Motors (3 periods)

1. Overview
2. The Rotor
3. The Stator
4. The Start Winding
5. End Plates
6. Locked Rotor Torque
7. Centrifugal Switch
8. Start Windings
9. Speed Changes

10. Single Phase Hermetic Compressors (3 periods)

1. Hermetic Compressors
2. Basic Parts
3. Current relay
4. Hot Wire Relay
5. Capacitor Start
6. Theory of Operation
7. CSCR Compressor
8. Troubleshooting

11. Three Phase Open Motors and Compressors (3 periods)

1. Overview
2. The three phase compressor
3. Wiring
4. Controls
5. Changing Connections

12. Relays, Contacts, Solenoids, and Motor Starters (3 periods)

1. Overview
2. Pull in and hold current
3. NEMA Ratings
4. Sizing for motors
5. Fuses
6. Reversing Valves
7. Contactor Control
8. Solid State Starters

13. Thermostats, Pressure Control, and Timers (3 periods)

1. Overview
2. Sensing Temperature
3. Bimetal Elements
4. Programmable Thermostats
5. Pressure Controls
6. Oil Pressure Switches
7. The Fan Switch
8. Timer Circuits

14) Controls for Gas, Electric, and Oil Heating Systems (1 period)

1. Overview
2. Gas Furnace Controls
3. The Main Parts
4. Igniter Circuits
5. Direct Spark Igniters
6. The Gas Valve
7. The oil heating system
8. Boilers

LABORATORY EXPERIMENTS:

Students should submit technical reports for the laboratory exercises. Appropriate graphs,

tables, and subsequent analysis are expected along with proper spelling and grammar.

1. Safety Procedures, Lab Introduction
2. The AC Motor, Description and End Plate, Introduction to components
3. Ladder Diagrams and first wiring
4. Single Phase start Stop circuit
5. Single Phase start Stop circuit with latching
6. Single Phase start Stop circuit with latching from two locations with latch
7. Timers
8. Photosensors Switches
9. Three Phase Motors
10. Reversing Three Phase Motors
11. Three phase motor circuits from two locations
12. Proximity Switches
13. Frequency drives
14. Advanced Frequency Drives
15. CAT 5 Cables