



**College of Micronesia – FSM  
P.O. Box 159  
Kolonia, Pohnpei**

**Course Modification Request**

<u>VEM 240 Industrial Wiring</u> Course Number and Title	<u>Technology and Trade</u> Department
<u>Same as above</u> Recommended Course Number and Title	<u>Same as above</u> Department

New Course Description:

This course is designed to introduce students to the fundamental concepts, principles, and devices involved in industrial control of motors. Students will also develop the skills necessary for wiring basic motor control and selecting the required pilot devices and safety components. Also includes troubleshooting motor circuitry and understanding Article 430 of NEC.

New Course Objective:

The students will develop the necessary skills for hands-on approach to wiring practices, operation, and troubleshooting of various control and power circuits utilized in the industrial control of motors.

Justification for Revising the Course:

To modify the existing course contents to directly focus on industrial wiring of motor control, more hands-on activities and enhancing the skill in troubleshooting using the new software.

Signed by Gardner Edgar  
Division Chairperson

\_\_\_\_\_  
Date

\_\_\_\_\_  
Chairperson, Curriculum Committee

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Date

\_\_\_\_\_  
President, COM – FSM

\_\_\_\_\_  
Date

<b>Official Use Only</b>
New Course Number and Title:



**College of Micronesia – FSM**

**P.O. Box 159  
Kolonia, Pohnpei**

**Course Outline Cover Page**

Industrial Wiring  
Course Title

VEM 240  
Department and Number

Course Description:

This course is designed to introduce students to the fundamental concepts, principles, and devices involved in industrial control of motors. Students will also develop the skills necessary for wiring basic motor control and selecting the required pilot devices and safety components. Students will also develop skills in troubleshooting motor circuitry and an understanding of Article 430 of NEC.

**Prepared by:** Cirilo Recana

**State:** Pohnpei Campus

	Hours per Week	No. Of Weeks	Total Hours	Semester Credits
Lecture	3/6	16/8	48	3
Laboratory	3/6	16/8	48	1
			Total Semester Credits:	4

<b>Purpose of Course</b>	Degree Requirement	<u>XX</u>
	Degree Elective	_____
	Advanced Certificate	_____
	Certificate	_____
	Remedial	_____
	Other (Apprenticeship)	<u>XX</u>

**Prerequisite Course(s):** Admission and VSP 121, VEM103, VEM104

\_\_\_\_\_  
**Signature, Chairman, Curriculum Committee**

\_\_\_\_\_  
**Date Approved by Committee**

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**Signature, President, COM-FSM**

\_\_\_\_\_  
**Date Approved by the President**



I. Course Objectives:

A. General Objective:

The students will develop the skills necessary for hands-on approach to wiring practices, operation, and troubleshooting of various control and power circuits utilized in the industrial control of motors.

B. Learning Outcomes: Upon successful completion of this course students will acquire the following basic knowledge and skills:

1. State the purpose and general principles of control components and circuits.
2. Identify pilot devices both physically and schematically and describe their operating principles.
3. Interpret motor control wiring, connection, and ladder diagrams.
4. Select and size contactors, relays and overload relays both physically and schematically and describe their operating principles.
5. Select timing relays for use in specific electrical motor control systems.
6. Connect motor controllers for specific applications with emphasis on safety practices and in accordance with National Electrical Code (NEC) requirements.
7. Troubleshoot control and motor control circuit for basic to intermediate level faults.

II. Outline of Content: This course contains:

1. Introduction to motor control components and circuits
  - Control definition
  - Manual and automatic control operation
2. Pilot devices and symbols
  - Contacts
  - Switches
  - Pushbuttons
  - Magnetic coils
  - Overload contact relays
  - Indicator lights
  - Other pilot devices and symbols
3. Line/Ladder Diagram
  - Power circuit
  - Control circuit
  - Connecting loads
  - Connecting control devices
  - Line numbering
4. Magnetic contactors, starters, control relays and overload protection.



- Basic contactor operation
  - Contactors, control relays and overload relays
  - Motor starters
  - Control transformer
  - Ratings (IEC and NEMA)
5. Timing Relays
- Time delay
  - On-delay relay
  - Off-delay relay
6. Industrial control of motors
- Manual motor starter
  - Full-voltage starting or Direct-on-line (DOL)
  - Start/Stop circuit with relays and starters
  - Jogging circuits
  - Sequence control circuits
  - Reversing motor circuits
  - Reduced voltage starting
  - Article 430 of NEC
    - Branch and Feeder circuit conductors
    - Motor disconnects and grounds
    - Overload protection and raceways
7. Troubleshoot motor control circuit
- 8 Basic Level Faults
  - 8 Intermediate Level Faults

III. Required Textbook:

Electrical Level 3, NCCER 2002 Revision  
Prentice Hall, Inc. Upper Saddle River, New Jersey

IV. Required Course Materials:

1. Instructor:
  - a. Classroom with whiteboard or chalkboard
  - b. Laboratory equipment with tools of the trade
  - c. Overhead projector, transparencies
2. Student:
  - a. Handouts provided by instructor
  - b. Ring binder
  - c. College ruled note sheet, pencil or pen

V. Reference Materials:

- Instructor's Handouts
- Siemens STEP 2000 Basics of Control Components
- Simutech Multimedia, Electrical Troubleshooting Series

VI. Instructional Cost: None anticipated at the present.



VII. Methods of Instruction:

1. Lecture
2. Demonstration/Practical Activities
3. Computer Aided Instruction

VIII. Evaluation:

Final Grade for this course will be based on meeting the course requirements.

There is no credit-by-examination for this course.

IX. Attendance:

The COM-FSM Attendance Policy will apply.

X. Academic Honesty:

The COM-FSM Academic Policy will apply.

XI. Assessment Criteria:

Learning Outcome 1: State the purpose and general principles of control components and circuits.

- Assessment Criteria:
- a. describe control circuit components
  - b. differentiate manual to automatic control operation

Assessment Method: Oral questioning  
Short answer questions

Learning Outcome 2: Identify pilot devices both physically and schematically and describe their operating principles.

- Assessment Criteria:
- a. Identify and describe the function of contacts.
  - b. Familiarize with the construction and function of switches used in control components.
  - c. Familiarize with pushbutton control station.
  - d. Identify types of magnetic coils used in control circuit.
  - e. Familiarize with physical and schematic overload contact relays.
  - f. Familiarize with other pilot devices used in control circuit components of a motor.

Assessment Method: Oral questioning  
Short answer test  
Expose to actual object

Learning Outcome 3: Interpret motor control wiring, connection, and ladder diagrams.

- Assessment Criteria:
- a. Identify from diagram the power circuit and control circuit.



- b. Differentiate control circuit from power circuit in the diagram.
- c. Differentiate two-wire to three-wire circuit.
- d. Read and interpret variations on motor control circuits.

- Assessment Method:
- a. Short quiz on symbols
  - b. Oral questioning
  - c. Control circuit reading

Learning Outcome 4: Identify contactors and relays both physically and schematically and describe their operating principles.

- Assessment Criteria:
- a. Describe the operating principle of contactors, relays and magnetic starters.
  - b. Describe function of magnetic starter, contactor, relays and overload relays in motor control circuits.
  - c. Identify magnetic starter, contactor and relays their schematic symbols and physical construction.
  - d. Differentiate ratings of magnetic starters and contactors according to application.

- Assessment Method:
- a. Short answer test
  - b. Class discussion
  - c. Exposure to actual object

Learning Outcome 5: Select timing relays for use in specific electrical motor control systems.

- Assessment Criteria:
- a. Identify types of timing relays its construction and parts.
  - b. Identify physical and schematic symbols for timing relays contact.
  - c. Select timing relays according to needed application.

- Assessment Method:
- a. Oral questioning
  - b. Short answer test

Learning Outcome 6: Connect motor controllers for specific applications in accordance with NEC requirements.

- Assessment Criteria:
- a. Identify control components to use for motor control circuit.
  - b. Design and analyze motor control circuit based on the given application.
  - c. Wire a motor control circuit based on given ladder diagram.
  - d. Troubleshoot motor control center.
  - e. Determine branch circuit protective device
  - f. Size motor disconnecting devices and raceways

- Assessment Method:
- a. Diagramming test
  - b. Hands-on test/Performance test
  - c. Short answer test



Learning Outcome 7: Troubleshoot motor control circuit using electrical troubleshooting skills series.

Assessment Criteria: a. Troubleshoot motor control for basic level faults.  
b. Troubleshoot motor control for intermediate level faults.

Assessment Method: a. Diagramming test  
b. Simutech software students progress report

**Note: Students must have a grade of 80% in written and 100% practical/performance test to satisfactorily pass the course.**