Revised: Fall 2016

ETR 238

Industrial Electronics II

COURSE OUTLINE

Prerequisites:

Prerequisite: MTE 1, 2 and 3. Co-requisite: ELE 130, ELE 133, ELE 130 or ETR 113 or approval from Program Head.

Course Description:

Teaches techniques for conducting site surveys, installing system components, installing inverters and performing system sizing and system maintenance. Introduces different battery configurations, and charge controllers. Introduces safety, system design and layout, National Electric Code, Component Selection, wiring and installation techniques. Lecture 3 hours. Laboratory 3 hours. Total 6 hours per week.

Semester Credits: 4 **Lecture Hours: 3 Lab/Recitation Hours: 3**

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ETR 238,
Industrial Electronics II

Syllabus
Level 2, Course 4
Motor Control Technologies

Course Description

This course covers principles of motor control in part as a continuation of the SMSCP Level 1 course on Mechanical Components and Electric Drives. Even though this course builds on the concepts of the related Level 1 course, the Level 1 course is not a prerequisite; equivalent knowledge gained elsewhere will also suffice.

In the first part of the course, General Machine Operation, different types of braking and loads on a motor are addressed, as well as questions of improving motor efficiency and power. Different control techniques are then discussed, including different methods of starting a motor, controlling voltage and frequency, and the role of different sensors in relation to motor operation.

Troubleshooting techniques and an examination of the various causes of motor failure are discussed; preventive measures that can be taken in order to protect motors are also taught.

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Course Philosophy

This course is the fourth in a series of six courses which prepare students for certification as a Siemens Certified Mechatronic Systems Associate. The job profile for which the Level 2 certification prepares students is that of a technician who has a well-rounded understanding of the complex inter-relationships and inter-workings of a mechatronic system.

This course, as all courses within the Certification Program, is based upon a systems-oriented approach. Students learn about individual components and system characteristics within the context of an actual mechatronic system. At the beginning of this course, students should first be presented with a complex system. Ideally, this system is physically available at the educational institution and within the first class meetings should be visited by the students. By focusing on an actual system, students understand clearly why they are learning the subject material. This increases significantly the learning effect and promotes a fuller understanding of the material being learned. By viewing the system as a whole, learning retention is also increased, as the student experiences the components as part of a whole, rather than in isolation.

Of great importance is that the student is able to transfer the knowledge learned to a new system and is able to quickly familiarize himself with the new system.

This understanding leads to a better informed employee who has sufficient knowledge to make well-informed decisions about the running of the system upon which he or she is working.

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For this course in particular, students will be challenged to build on previous knowledge of electric drives (either acquired from the SMSCP Level 1 Course 2: Mechanical Components and Electric Drives or from equivalent electric drives course(s)) by not only looking at details of the various control and protection methods used in motors but also to see motors as parts of systems and as systems themselves.

Course Goals

Upon completion of the course, students should:

1. Understand the general principles of motors and machine operation.
2. Understand the importance of motor efficiency as well as various techniques to improve efficiency.
3. Understand motor notation symbology and control strategies, including voltage and frequency control.
4. Understand the role of motor control circuits in power electronics.
5. Understand how to protect motors and prevent motor failure.

Course Objectives

At the conclusion of this course, students will be able to:

1. Start a motor in the correct way, using the correct method.
2. Set up a motor control circuit
3. Use control logic programs in motor control contexts.
4. Set up sensors in order to give feedback to a control circuit.
5. Choose and install the correct safety devices for specific control circuits.

6. Detect and prevent possible malfunctions.

Course Prerequisites

Education and/or experience equivalent to SMSCP Level 1 Course 2: Mechanical Components and Electric Drives and SMSCP Level 1 Course 1: Electrical Components.

Course Content

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Required Materials:

None

Textbook:

Text: The text utilized for this course of study will be:

- Troubleshooting electrical/Electronic Systems 2009 by Mazur, 3rd Ed, Publisher American Tech Publishing, ISBN: 9780826917911

Tools: Scientific Calculator: TI, Casio, or HP, a must to be brought to class each session – know your calculator!

Course Objectives: At the end of the semester, the student will be able to:

1. To understand the basics of a process control loop
2. To discern the difference between the various types of process variables
3. To have an expanded understanding of basic electrical components and the basic terms used

in electricity as required for instrumentation
4. To identify basic passive components in AC circuits and understand their application in instrumentation.
5. To identify active devices and how they are used in instrument applications and the difference between analog and digital circuits
6. To differentiate the roles of pressure, flow, temperature, heat, humidity, density, viscosity and pH in process control
7. To understand a variety of sensors and the very important part they play in process control

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Topical Description:

Motor Control

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General Machine Operation

- Motor
- Generator
- Motor Loads
- Efficieny

Motor Control Techniques

- Symbology (Motors. Power Circuit, Control Circuits)
- Starting Methods
- Control Strategies
- Sensors / Encoders

Motor Failures and Protection

- Fuse / Circuit Breaker
- Thermal Protection
- Insulation
- Mechanical Failures
- Overload - Application Abuse

Stopping Methods - Mechanical Brakes

Learning Methodologies

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Notes to Instructors

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