

New Course Form

MET 160 Rotating Electrical Machines 4

Originator: Kenny Keith **Status:** Approved **Date Created:** 02/01/2013

Department: MET: Mechatronics **Submitted:** 02/05/2013 **Completed:** 02/27/2013

To ACETS:

Course Prefix: MET

Course Number: 160

Course Title: Rotating Electrical Machines

Cross-listing: No

**Cross-listing
information:**

**Semester for
Implementation:** Fall

**Year of
Implementation:** 2013

Course Type: Required Transfer Vocational

Credit Hours: 4

Transfer Course: BAS-articulation discussions are underway

**Course Catalog
Description:** This course covers the principles, application, troubleshooting and maintenance of rotating electrical motors and electronic motor drives as used in industry.

Rationale: An electrician, industrial maintenance technician or mechatronics technician will be faced with motors and variable speed drive applications in a variety of machines and processes such as CNC machining centers, packaging machines, fans, and pumping systems. This course provides the skills and knowledge necessary to troubleshooting rotating electrical devices in an industrial environment such as electronics, automotive, food, pharmaceuticals, consumer goods, packaging, metals, mining & materials, pulp & paper, chemicals, water & wastewater, refining and energy.

**Total Lecture
Contact Hours** 3
per Week:

**Total Lab
Contact Hours** 3
per Week:

**Total Contact
Hours:** 90

Load Factor: 5.1

Requisites: Yes

Prerequisites: MET 130 Industrial Electrical Systems

Co-requisites:

Mode of Instructional Delivery: (1) Traditional classroom instruction (3) Hybrid: internet with live lab (5) Laboratory

If "other" mode of instruction, specify:

Library Resources: N/A

Assessment of Student Learning - Methods: (1) Written Examinations (5) Demonstration of Skills

IF "other" assessment, specify:

Recommend Course Enrollment: 15

Credit by Examination: No

Literacy/ Critical Inquiry Component: N/A

Ethnic/ Gender Awareness: N/A

Sustainability: Yes

Sustainability (explanation):

COURSE TOPICS: Topics include various types of single and three phase AC motors, various types of DC motors, reduced voltage starting, braking, DC electronic drives, and AC variable frequency and vector drives. The course builds upon principles and applications covered in Industrial Electrical Systems and is a building block for the course Robotics and Motion Control.

COURSE OUTCOMES:

1. Describe basic safety rules for working with electrical rotating machinery under 600 volts
2. Apply basic safety rules for working with electrical rotating machinery under 600 volts
3. Describe the operation, function, wiring and schematic symbols for DC series, DC shunt and DC Compound motors
4. Connect, operate and reverse these motors
5. Calculate both electrical and mechanical motor speeds, torques, and load
6. Measure motor speeds, torques, and loads making both electrical and mechanical measurements
7. Calculate motor power and efficiency for DC motors
8. Plot torque, speed, power and efficiency for DC motors

9. Analyze torque, speed, power and efficiency for DC motors
10. Describe the performance characteristics for different motor types
11. Describe AC waveforms, frequency, apparent power, power factor, effective voltage, peak voltage, single phase and three phase power
13. Measure AC waveforms, frequency, apparent power, power factor, effective voltage, peak voltage, single phase and three phase power
14. Demonstrate the ability to connect, operate, reverse, measure and graph the performance characteristics of single phase split phase, capacitor start, capacitor run, and capacitor start-run motors; and of three phase single voltage, dual voltage, wye and delta squirrel cage motors
15. Describe the operation and function of motor braking by plugging, electromechanical braking, DC injection braking and dynamic braking
16. Demonstrate the ability to connect, operate and troubleshoot the various braking methods
17. Describe the operation and function of resistor, autotransformer and part winding motor starting
18. Demonstrate the ability to connect, operate and troubleshoot the various reduced voltage/current starters
19. Describe the operation and function of multi-phase AC power generators and transformers in combinations of wye and delta configurations for power distribution
20. Demonstrate the ability to connect, operate and make measurements on various combinations of three phase transformer configurations
21. Describe the function and operation of silicon controlled rectifiers (SCR) and how they may be applied for motor speed control
22. Demonstrate the ability to connect, operate and measure performance characteristics of motors operating with full and half wave SCR control using an oscilloscope
23. Describe the function, operation and construction of DC spindle drives, axis drives and pulse width modulation drives; the role of current, voltage, and velocity feedback from a tachometer in DC drives; and the set up and calibration of DC drives
24. Demonstrate the ability to connect, calibrate and operate each type of drive monitoring the internal and external feedback signals and output with an oscilloscope
25. Describe how DC motors operate and may be controlled using armature and field control
26. Demonstrate the ability to operate DC motors operate and may be controlled using armature and field control
27. Demonstrate the ability to select proper test equipment and troubleshoot the various types of DC motors and drives
28. Describe the operation and function of variable frequency AC drives
29. Demonstrate the ability to configure and operate variable frequency AC drives to control starting, stopping, speed, torque, acceleration, deceleration, boost, and braking
30. Troubleshoot drive faults and parameters and systems incorporating variable frequency AC drives
31. Describe the function, operation and construction of AC vector drives, AC induction motors and inverter-duty motors

- 32. Describe how vector control is accomplished and the role of current and encoder feedback in an AC vector drive
- 33. Demonstrate the ability to connect, configure, operate and measure parameter of with an oscilloscope
- 34. Troubleshoot vector drives
- 35. Describe the function, operation and construction of AC axis drives and 3 phase DC brushless motors
- 36. Demonstrate the ability to connect, calibrate, operate, trace and measure signals with an oscilloscope
- 37. Troubleshoot AC axis drives

Proposer: Kenny Keith