ILLINOIS VALLEY COMMUNITY COLLEGE

COURSE OUTLINE

DIVISION: Workforce Development Division

COURSE: ELE 1203; Motors and Controls II

Date: Summer 2014

Credit Hours: 2.5

Prerequisite(s): ELE 1202

Delivery Method:		
	☒ **Lecture**	**2 Contact Hours (1 contact = 1 credit hour)**
	☐ **Seminar**	**0 Contact Hours (1 contact = 1 credit hour)**
	☒ **Lab**	**1 Contact Hours (2 contact = 1 credit hour)**
	☐ **Clinical**	**0 Contact Hours (3 contact = 1 credit hour)**
	☐ **Online**	
	☐ **Blended**	

Offered: ☐ **Fall** ☒ **Spring** ☐ **Summer**

IAI Equivalent –***Only for Transfer Courses***-go to *http://www.itransfer.org*:

CATALOG DESCRIPTION:
Principles of operation and control of three-phase motors and generators are studied. Additional topics include: power and control wiring, forward-reverse and speed-control operations, AC variable frequency drives and dynamic and regenerative braking. Troubleshooting techniques will be emphasized throughout this course.

GENERAL EDUCATION GOALS ADDRESSED

[See the last page of this form for more information.]

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

☐ To apply analytical and problem solving skills to personal, social and professional issues and situations.
☐ To communicate orally and in writing, socially and interpersonally.
☐ To develop an awareness of the contributions made to civilization by the diverse cultures of the world.
☐ To understand and use contemporary technology effectively and to understand its impact on the individual and society.
☒ To work and study effectively both individually and in collaboration with others.
☐ To understand what it means to act ethically and responsibly as an individual in one's career and as a member of society.
☐ To develop and maintain a healthy lifestyle physically, mentally, and spiritually.
☒ To appreciate the ongoing values of learning, self-improvement, and career planning.

EXPECTED LEARNING OUTCOMES AND RELATED COMPETENCIES:

[Outcomes related to course specific goals.]

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

1. Create a working for control of an Induction Motor
   - Competency 1.1 Correctly identify and choose switches
   - Competency 1.2 Relate Digital and Analog control devices
   - Competency 1.3 Design and build a manual control
   - Competency 1.4 Design and build an Automatic control
   - Competency 1.5 Design a circuit to use Solid State Control Devices
2. Create a working control for reversing Motor Circuits
   - Competency 2.1 Design and build a circuit to reverse a DC Motor
   - Competency 2.2 Design and build a circuit to reverse an AC Motor
   - Competency 2.3 Design and build a circuit to reverse a 3-Phase Motor
3. Correctly select and use I/O controls
   - Competency 3.1 Wire and document usage of Relays
   - Competency 3.2 Wire and document usage of Photoeyes and Proxs
4. Correctly state the diffent levels of Power Distribution and Uses
   - Competency 4.1 State Power Plant levels
   - Competency 4.2 Explain Transmission level and tranformer issues
   - Competency 4.3 Explain Distribution levels, Uses and Safety
   - Competency 4.4 Explain the final step down levels, Delta, Wye, and uses
5. Apply apropriate methods of Reduce-Voltage Starting
   - Competency 5.1 Correctly part wind a motor
   - Competency 5.2 Use correct Solid state switches
   - Competency 5.3 Compare and contrast different starting methods
   - Competency 5.4 Correctly troubleshoot a motor circuit
6. Apply Accelerating and Decelerating Methods
   - Competency 6.1 Correctly wire and apply Brake systems
   - Competency 6.2 Compare a VFD, VT/VH and CH/VT System
   - Competency 6.3 Correctly design and wire a speed control circuit

7. Correctly use a quality tool for troubleshooting
   Competency 7.1 Explain Deming's 14 points
   Competency 7.2 Explain and use a troubleshooting chart
   Competency 7.3 Correctly utilize and explain a quality model

COURSE TOPICS AND CONTENT REQUIREMENTS÷

I. Polyphase Induction Motors

- A. Construction
  - 1. Squirrel cage
  - 2. Wound rotor
  - 3. Advantages - disadvantages
- B. Basics of Rotating Fields
- C. Induction Motor Principles
  - 1. Eddy currents
  - 2. Slip speed
  - 3. Rotor
  - 4. Induced EMF
  - 5. Stall torque
  - 6. Field construction
  - 7. Rotor construction
  - 8. Frequency considerations
- D. Running Characteristics
  - 1. No-load condition
  - 2. Half-load condition
  - 3. Measurement of slip
- E. Starting Methods
  - 1. Part winding start
  - 2. Wound rotor start
  - 3. Double-cage rotor line starting
- F. Classification of Induction Motors (NEMA)
  - 1. Normal
  - 2. General purpose
  - 3. High torque
  - 4. High resistance rotor
  - 5. Low torque-double cage
- G. Speed Control of Cast Iron Motors
  - 1. By changing frequency to stator
  - 2. By changing number of poles
  - 3. By reducing voltage on stator

II. Synchronous Motors

- A. Excitation
- B. Starting Methods
  - 1. D.C. motor method
  - 2. Field exciter method
  - 3. Induction motor method

4. Damper winding method
C. Starting Under Load
D. Effects of Armature Reaction
E. Power Factor Correction
F. Synchronous Motor Ratings
G. Synchronous Capacitors
H. Special Types of Synchronous Motors
1. Synchronous induction motor
2. Reluctance motors
3. Hysteresis motors
4. Sub-synchronous motors
5. Brushless synchronous motors

III. Three Phase Alternators

A. Construction
1. Armature
2. Field
B. Advantages of Stationary Armature Revolving Field Construction
1. Increased armature tooth strength
2. Reduced armature reactance
C. Comparison of Excitation Techniques
D. Reactive Loading
E. Synchronous Impendance Test
1. Open circuit
2. Short circuit

IV. Power Distribution Systems

V. Solid-State, Electronic Control Devices

VI. Electro-Mechanical and Solid-State Relays

VII. Photoelectric and proximity control and applications.

VIII. AC Reduced Voltage Starters

IX. Accelerating and Decelerative Methods and Circuits

X. Preventive Maintenance and Troubleshooting

XI. Quality

INSTRUCTIONAL METHODS:

1. Laboratory work
2. Demonstrations
3. Lecture - discussion
4. Reading assignments
5. Homework
6. Quizzes
7. Team Work
8. Socratic Method
9. Oral and Written Reports

INSTRUCTIONAL MATERIALS:

Electrical Motor Controls, 5nd edition. Rockis, Gary and Glen Mazur, American Technical Publishers, Inc..

Lab Manual

WWW searches

STUDENT REQUIREMENTS AND METHODS OF EVALUATION:

The student must meet the objectives of the course stated previously.

Laboratory reports must be completed as directed and receive an evaluation for accuracy of 70% or more using criteria set forth in the laboratory directions.

Required assignments:	Methods of Evaluation:
Mandatory lab attendance	Team projects
Weekly lab assignments	Short quizzes
Assigned reading	Midterm exams
Lab practical exams	Completion of homework assignments
Final exam	Midterm, final, and lab final exams
Tests	Written and Oral Reports

Laboratory work and Projects	40%
Written tests,quizzes and Reports	40%
In class feedback	10%
Homework assignments	10%

OTHER REFERENCES

Library
Internet sites
Product Vendors
Other Instructors

Course Competency/Assessment Methods Matrix

ELE 1203 - Motors and Controls II	**Assessment Options**																															
For each competency/outcome place an "X" below the method of assessment to be used.	**Assessment of Student Learning**	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	**Direct/ Indirect**	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D							
Competency 1.1 Correctly identify and choose switches					X		X	X	X						X												X	X			X
Competency 1.2 Relate Digital and Analog control devices					X		X	X	X						X												X	X			X
Competency 1.3 Design and build a manual control					X		X	X	X						X												X	X			X
Competency 1.3 Design and build a manual control					X		X	X	X						X												X	X			X
Competency 1.5 Design a circuit to use Solid State Control Devices					X		X	X	X						X												X	X			X
Competency 2.1 Design and build a circuit to reverse a DC Motor					X			X	X						X												X	X			X
Competency 2.2 Design and build a circuit to reverse an AC Motor					X			X	X						X												X	X			X
Competency 2.3 Design and build a circuit to reverse a 3-Phase Motor					X			X	X						X												X	X			X
Competency 3.1 Wire and document usage of Relays					X			X	X						X												X	X			X
Competency 3.2 Wire and document usage of Photoeyes and Proxs					X			X	X						X												X	X			X

ELE 1203 - Motors and Controls II	Assessment Options																																
For each competency/outcome place an "X" below the method of assessment to be used.	**Assessment of Student Learning**	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	**Direct/ Indirect**	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D							
Competency 4.1 State Power Plant levels								X	X																			X				X
Competency 4.2 Explain Transmission level and tranformer issues								X	X																			X				X
Competency 4.3 Explain Distribution levels, Uses and Safety								X	X																			X				X
Competency 4.4 Explain the final step down levels, Delta, Wye, and uses								X	X																			X				X
Competency 5.1 Correctly part wind a motor					X			X	X						X													X	X			X
Competency 5.2 Use correct Solid state switches					X			X	X						X													X	X			X
Competency 5.3 Compare and contrast different starting methods					X			X	X						X													X	X			X
Competency 5.4 Correctly troubleshoot a motor circuit					X			X	X						X													X	X			X
Competency 6.1 Correctly wire and apply Brake systems					X			X	X						X													X				X
Competency 6.2 Compare a VFD, VT/VH and CH/VT System					X			X	X						X													X				X

ELE 1203 - Motors and Controls II	Assessment Options																															
For each competency/outcome place an "X" below the method of assessment to be used.	**Assessment of Student Learning**	Article Review	Case Studies	Group Projects	Lab Work	Oral Presentations	Pre-Post Tests	Quizzes	Written Exams	Artifact Self Reflection of Growth	Capstone Projects	Comprehensive Written Exit Exam	Course Embedded Questions	Multi-Media Projects	Observation	Writing Samples	Portfolio Evaluation	Real World Projects	Reflective Journals	Applied Application (skills) Test	Oral Exit Interviews	Accreditation Reviews/Reports	Advisory Council Feedback	Employer Surveys	Graduate Surveys	Internship/Practicum /Site Supervisor Evaluation	Licensing Exam	In Class Feedback	Simulation	Interview	Written Report	Assignment
Assessment Measures – Are direct or indirect as indicated. List competencies/outcomes below.	**Direct/ Indirect**	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	I	I	I	I	D	D						
Competency 6.3 Correctly design and wire a speed control circuit					X			X	X						X												X				X
Competency 7.1 Explain Deming's 14 points					X			X	X						X												X				X
Competency 7.2 Explain and use a troubleshooting chart					X			X	X						X												X				X
Competency 7.3 Correctly utilize and explain a quality model					X			X	X						X												X				X