MONROE COUNTY COMMUNITY COLLEGE

Course Outcome Summary

Required Program Core Course

ELEC 145 Instrumentation and Data Acquisition

Course Information

Division	**Applied Science and Engineering Technology**
Contact Hours	**90**
Total Credits	**4.0**

Prerequisites

ELEC 125
ELEC 132 Co-Requisite

Course Description

This course will provide students with the necessary background, theory and laboratory experience to utilize Windows-based computers, LabView software, interface hardware and software for data recording, analysis and on-line control of industrial processes. Multiple inputs and data logging, A/D conversion and various computer interface bus standards are discussed and implemented. This course also examines the characteristics and limitations of common electronic instruments. Topics covered include safety and lab techniques, op-amp circuits, AC and DC meters, digital multimeters, oscilloscopes, potentiometers and potentiometric bridges, transducers, signal-processing circuits, fiber optics and automatic test equipment.

This course is a required core course for students pursuing a degree **in**

Electrical Engineering Technology

Program Outcomes Addressed by this Course:

Upon successful completion of this course, students should be able to meet the program outcomes listed below:

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Develop and Demonstrate Problem Solving Skills
C. Develop a willingness to learn independently.
D. Develop and demonstrate effective wiring and laboratory skills.
E. Demonstrate Equipment/Instrumentation Competence
F. Develop and demonstrate Technical Documentation/Lab Report writing skills and the ability to comprehend Technical Documentation including Schematic Diagrams
G. Value Safety Training, Safe Work Practices and acknowledge Safety Standards
H. Utilize Virtual Instrumentation, Data Acquisition (LabView), CAI, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.

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Course Outcomes

1. Identify/Recognize how input resistance, capacitance and frequency limits accuracy of VOMs, DVMs, and oscilloscopes.

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2. Calculate precision and accuracy, and distinguish among the three types of linearity specifications. Calibrate a given instrument to specified accuracy.

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D. Develop and demonstrate effective wiring and laboratory skills.
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3. Identify/Recognize a suitable transducer for a given physical quantity and tell whether it is active or passive.

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4. Observe the essential disadvantage of ac induction motor speed control by voltage variation and the essential advantage of ac induction motor speed control by electronic (SCR) frequency variation and demonstrate wiring a 3-phase alternator and display its 3-phase ac output on an oscilloscope, wire a 3-phase transformer driving a 3-phase resistive load, and measure the line voltage and current, and the total system power using electronic wattmeters, Electronic/Rotary Phase Conversion

Applies to Program Outcome

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C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
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5. Demonstrate how to start a 3-phase induction motor with a manual disconnect switch, and show the relation between shaft rotational direction and phase winding connections to the 3-phase supply and attach a dynamometer to the shaft of an ac induction motor and take data to show the motor's

torque relationships to current, speed, efficiency, and power factor and practice correct wiring access to the following standard-labeled terminals of a 3-pole reversing motor starter: L1, L2, L3, T1, T2, T3, 2, 3, 4, 5, OL, X1, X2, Design and draw, in ladder-logic format, wire and test a single-station reversing 3-phase motor control circuit with and without manual switch interlocks

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
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C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
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6. Draw in ladder-logic format, wire and test a two-station, reversing 3-phase motor control circuit with directional indicator lights and with Jog/Run capabilities and design, draw in ladder-logic format, wire and test a two-motor, single-station time-delay induction motor control circuit and wire and run a synchronous motor with a dynamometer load to demonstrate the motor's leading current/voltage relationship, which makes the motor unique, and wire and test a 3-phase feeder driving both an induction motor and a synchronous motor to demonstrate power factor correction

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
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C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
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7. Demonstrate the possibility of ac induction motor speed control by a) voltage variation b) frequency variation and recognize a standard reversing motor-starter and the natural difficulties accompanying the starting process for a dc motor

Applies to Program Outcome

Applies to Program Outcome

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C. Develop and Demonstrate Problem Solving Skills.
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8. Recognize motor-control circuits presented in ladder-logic format and the necessity for multi-station control of a motor and recognize the need to temporarily insert current-limiting resistor(s) in the armature path during motor acceleration and the elegant electric/magnetic braking schemes for a dc motor, contrasted with the crude mechanical braking idea and recognize the efficiency advantage of an SCR-based motor-drive circuit versus a variable-resistance armature control circuit and measure the winding resistances of a dc motor (armature, shunt field winding, and a series field winding)

Applies to Program Outcome

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C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
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9. Practice using an analog ammeter to demonstrate the inrush starting current problem of a dc motor that is started by the across- the-line method; and demonstrate the elimination of the inrush problem when a dc motor is started under reduced- voltage "soft-start" conditions and demonstrate

the relationship between direction of shaft rotation and polarization of armature voltage for a dc motor

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
F. Demonstrate Equipment/Instrumentation Competence
G. Develop and demonstrate Technical Documentation/Lab Report writing skills and the ability to comprehend Technical Documentation including Schematic Diagrams

10. Practice design, draw in ladder-logic format, wire and test a single-station, reversing motor control circuit, with directional indicator lights and design, draw in ladder-logic format, wire and test a two-station, non-reversing motor control circuit with indicator lights

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
F. Demonstrate Equipment/Instrumentation Competence
G. Develop and demonstrate Technical Documentation/Lab Report writing skills and the ability to comprehend Technical Documentation including Schematic Diagrams

11. Practice design, draw in ladder-logic format, wire and test a two-station, reversing, Jog/Run motor control circuit, with directional indicator lights and design, draw in ladder-logic format, wire and

test a two-motor, single-station time-delay motor control circuit **Applies to Program Outcome**

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
F. Demonstrate Equipment/Instrumentation Competence
G. Develop and demonstrate Technical Documentation/Lab Report writing skills and the ability to comprehend Technical Documentation including Schematic Diagrams

12. Practice design, draw in ladder-logic format, wire and test a two-motor, two-station time-delay motor control circuit and wire and test a current-limiting starting circuit, with field-failure protection and overload protection and wire the circuit and display and explain the waveforms of an SCR power-control circuit for an incandescent lamp
Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
F. Demonstrate Equipment/Instrumentation Competence
G. Develop and demonstrate Technical Documentation/Lab Report writing skills and the ability to comprehend Technical Documentation including Schematic Diagrams

13. Demonstrate the process of flashing the field of a dc generator

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
F. Demonstrate Equipment/Instrumentation Competence
G. Develop and demonstrate Technical Documentation/Lab Report writing skills and the ability to comprehend Technical Documentation including Schematic Diagrams

14. Demonstrate building and testing various AC and DC motor speed control circuits including SCR and TRIAC control circuits as well as Variable Frequency Drives

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
F. Demonstrate Equipment/Instrumentation Competence
G. Develop and demonstrate Technical Documentation/Lab Report writing skills and the ability to comprehend Technical Documentation including Schematic Diagrams

15. Demonstrate wiring and testing a rotating field single phase AC alternator, and a three phase AC alternator

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
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16. Demonstrate wire and test a three phase circuit containing a delta to delta transformer and repeat for a delta to wye transformer

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
E. Develop and demonstrate effective wiring and laboratory skills.
F. Demonstrate Equipment/Instrumentation Competence
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17. Demonstrate the operation of Stepper and Servo Motors.

Applies to Program Outcome

A. Acquire and apply technical expertise in the areas of Circuit analysis, Analog electronics, Digital electronics, Microprocessors, and Communication systems.
B. Utilize Virtual Instrumentation, Data Acquisition, Schematic Capture and Test and Applications software packages to refine skills and to analyze and design various electronic circuits.
C. Develop and Demonstrate Problem Solving Skills.
D. Develop a willingness to learn independently.
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