Western Technical College

10620151 Advanced Motor Controls

Course Outcome Summary

Course Information

Description	This course provides the student with the opportunity to expand their knowledge of controls and control systems. VFDs will be introduced and applied for control of a three phase motor. Positioning systems using both stepper and servo drives are explored. Application of industrial equipment is emphasized and students are required to use and interpret equipment manuals to control and integrate the equipment.
Career Cluster	Manufacturing
Instructional Level	Associate Degree Courses
Total Credits	3.00
Total Hours	90.00

Types of Instruction

Instruction Type	Credits/Hours
Lecture	1 CR / 18 HR
Lab	2 CR / 72 HR

Course History

Last Approval Date	9/8/2015

Pre/Corequisites

Prerequisite	10620135 Basic Industrial Controls
Prerequisite	10620155 Industrial DC/AC 1
Pre/Corequisite	10804114 College Technical Math 1B

Textbooks

Industrial Automated Systems: Instrumentation and Motion Control - With CD. Copyright 2011. Bartelt, Terry. Publisher: Cengage Learning. **ISBN-13**:978-1-4354-8888-5. Required.

Learner Supplies

Scientific calculator (recommend T1-36x Solar). **Vendor:** Campus Shop. Required.

Core Abilities

1. Demonstrate ability to think critically.
Status *Active*

2. Demonstrate ability to value self and work ethically with others in a diverse population.
Status *Active*

3. Transfer social and natural science theories into practical applications.
Status *Active*

4. Use effective communication skills.
Status *Active*

5. Use technology effectively.
Status *Active*

Program Outcomes

1. Perform work safely
Type *TSA* ***Status*** *WIP*

Criteria

1.1. Follow Lock-out Tag-out safety procedures and practices to ensure proper start-up and shutdown of equipment
1.2. Follow Personal Protective Equipment requirement
1.3. Follow established safety policies and practices (e.g. OSHA, site specific)

2. Troubleshoot electrical and mechanical systems and devices
Type *TSA* ***Status*** *WIP*

Criteria

2.1. Verify proper operation or problem
2.2. Identify the cause of the problem: mechanical, electrical
2.3. Determine corrective action
2.4. Utilize appropriate test equipment

3. Repair electrical and mechanical systems
Type *TSA* ***Status*** *WIP*

Criteria

3.1. Utilize tools appropriate to the electromechanical field
3.2. Select replacement components
3.3. Configure replacement components
3.4. Install replacement components
3.5. Validate system performance

4. Communicate Technical Information
Type *TSA* ***Status*** *WIP*

Criteria

4.1. Interpret documentation of electro-mechanical devices and systems
4.2. Use field specific technical terminology in speaking and writing
4.3. Create electro-mechanical diagrams

4.4. Document problems and solutions
4.5. Interpret electro-mechanical diagrams

5. Integrate electrical and mechanical systems and devices
Type *TSA* ***Status*** *WIP*

Criteria
5.1. Identify required communication protocols
5.2. Configure electronic equipment for data communication compatibility
5.3. Configure sensors, controls and actuators for system compatibilit
5.4. Install required communications infrastructure
5.5. Verify communications between systems and devices

Course Competencies

1. Investigate DC motors.
Domain *Cognitive* ***Level*** *Analyzing* ***Status*** *Active*

Linked Core Abilities
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes
Perform work safely
Communicate Technical Information

Assessment Strategies
1.1. Written objective test
1.2. Skill demonstration
1.3. Written product

Criteria

Performance will meet expectations when:

1.1. you complete the written objective test and the performance demonstration at or above 70%.
1.2. you attend class regularly
1.3. you arrive for class on time
1.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives
1.a. Identify parts of various DC motors.
1.b. Explore operation of DC motors.
1.c. Explore power options for DC motors.
1.d. Explore voltage to speed ratio in a DC motor.
1.e. Explain torque generation in DC motors.

2. Connect DC motor to an electromechanical system.
Domain *Psychomotor* ***Level*** *Adapting* ***Status*** *Active*

Linked Core Abilities
Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use technology effectively.

Linked Program Outcomes
Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

2.1. Written objective test
2.2. Skill demonstration
2.3. Written product

Criteria

Performance will meet expectations when:

2.1. you complete the written objective test and the performance demonstration at or above 70%.
2.2. you attend class regularly
2.3. you arrive for class on time
2.4. you select the correct tools, equipment, insturments, materials, supplies
2.5. you perform all critical steps in the right order
2.6. you follow safety procedures
2.7. you wear personal protective equipment
2.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

2.a. Investigate schematic drawings for integration with the system.
2.b. Terminate with correct wires according to rubric created by instructor.
2.c. Strip wires correctly.
2.d. Secure wires at termination.
2.e. Demonstrate wire management protocols/ procedures identified by instructor.
2.f. Troubleshoot DC motor system operation.
2.g. Fix any problems identified.

3. Investigate single phase AC motors.

Domain *Cognitive* ***Level*** *Analyzing* ***Status*** *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

3.1. Written objective test
3.2. Skill demonstration
3.3. Written product

Criteria

Performance will meet expectations when:

3.1. you complete the written objective test and the performance demonstration at or above 70%.
3.2. you attend class regularly
3.3. you arrive for class on time
3.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives

3.a. Identify parts of various single phase AC motors.
3.b. Explore operation of single phase AC motors.
3.c. Explore power options for single phase AC motors.
3.d. Explore frequency to speed ratio in a single phase AC motor.
3.e. Explain torque generation in single phase AC motors.
3.f. Explore various starting configurations for single phase AC motors.

4. Demonstrate operation of single phase AC motors.

Domain *Psychomotor* ***Level*** *Practicing* ***Status*** *Active*

Linked Core Abilities

Demonstrate ability to think critically.

Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

4.1. Written objective test
4.2. Skill demonstration
4.3. Written product

Criteria

Performance will meet expectations when:

4.1. you complete the written objective test and the performance demonstration at or above 70%.
4.2. you attend class regularly
4.3. you arrive for class on time
4.4. you select the correct tools, equipment, insturments, materials, supplies
4.5. you perform all critical steps in the right order
4.6. you follow safety procedures
4.7. you wear personal protective equipment
4.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

4.a. Investigate schematic drawings for single phase AC motor operation.
4.b. Terminate with correct wires according to rubric created by instructor.
4.c. Strip wires correctly.
4.d. Secure wires at termination.
4.e. Demonstrate wire management protocols/ procedures identified by instructor.
4.f. Troubleshoot operation of single phase AC motor.
4.g. Fix any problems identified.

5. Investigate stepper motors.

Domain *Cognitive* ***Level*** *Analyzing* ***Status*** *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

5.1. Written objective test
5.2. Skill demonstration
5.3. Written product

Criteria

Performance will meet expectations when:

5.1. you complete the written objective test and the performance demonstration at or above 70%.
5.2. you attend class regularly
5.3. you arrive for class on time
5.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives

5.a. Identify parts of various stepper motors.

5.b. Explore operation of stepper motors.
5.c. Explore power options for stepper motors.
5.d. Explore frequency to speed ratio in stepper motors.
5.e. Explain torque generation in stepper motors.
5.f. Explore holding torque parameters for stepper motors.

6. Connect stepper motor to an electromechanical system.

Domain *Psychomotor* ***Level*** *Practicing* ***Status*** *Active*

Linked Core Abilities

Transfer social and natural science theories into practical applications.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

6.1. Written objective test
6.2. Skill demonstration
6.3. Written product

Criteria

Performance will meet expectations when:

6.1. you complete the written objective test and the performance demonstration at or above 70%.
6.2. you attend class regularly
6.3. you arrive for class on time
6.4. you select the correct tools, equipment, insturments, materials, supplies
6.5. you perform all critical steps in the right order
6.6. you follow safety procedures
6.7. you wear personal protective equipment
6.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

6.a. Investigate schematic drawings for integration with the system.
6.b. Terminate with correct wires according to rubric created by instructor.
6.c. Strip wires correctly.
6.d. Secure wires at termination.
6.e. Demonstrate wire management protocols/ procedures identified by instructor.
6.f. Program stepper motor drive.
6.g. Troubleshoot stepper motor system operation.
6.h. Fix any problems identified.

7. Investigate encoders and tachometers.

Domain *Cognitive* ***Level*** *Analyzing* ***Status*** *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

7.1. Written objective test
7.2. Skill demonstration

7.3. Written product

Criteria

Performance will meet expectations when:

7.1. you complete the written objective test and the performance demonstration at or above 70%.
7.2. you attend class regularly
7.3. you arrive for class on time
7.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives

7.a. Identify different types of encoders and tachometers.
7.b. Explore operation and function of encoders and tachometers.
7.c. Explore power and communication configurations to encoders and tachometers.
7.d. Explore voltage to speed ratio in a tachometer.

8. Explain application of 3Ø motors in electromechanical systems.

Domain *Cognitive* ***Level*** *Evaluating* ***Status*** *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

8.1. Written objective test
8.2. Skill demonstration
8.3. Written product

Criteria

Performance will meet expectations when:

8.1. you attend class regularly
8.2. you complete the written objective test and the performance demonstration at or above 70%.
8.3. you arrive for class on time
8.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives

8.a. Explain programming applications of a VFD.
8.b. Explore available analog inputs and outputs for a VFD.
8.c. Explore available digital inputs and outputs for a VFD.
8.d. Explore electronic operation of a VFD.
8.e. Summarize modifications of VFD on 3Ø motor operation.
8.f. Investigate the theory of VFD operation.

9. Connect 3Ø motor to an electromechanical system.

Domain *Psychomotor* ***Level*** *Adapting* ***Status*** *Active*

Linked Core Abilities

Transfer social and natural science theories into practical applications.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

9.1. Written objective test
9.2. Skill demonstration
9.3. Written product

Criteria

Performance will meet expectations when:

9.1. you complete the written objective test and the performance demonstration at or above 70%.
9.2. you attend class regularly
9.3. you arrive for class on time
9.4. you select the correct tools, equipment, insturments, materials, supplies
9.5. you perform all critical steps in the right order
9.6. you follow safety procedures
9.7. you wear personal protective equipment
9.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

9.a. Investigate schematic drawings for integration with the system.
9.b. Terminate with correct wires according to rubric created by instructor.
9.c. Strip wires correctly.
9.d. Secure wires at termination.
9.e. Demonstrate wire management protocols/ procedures identified by instructor.
9.f. Program Variable Frequency Drive (VFD).
9.g. Troubleshoot 3Ø motor system operation.
9.h. Fix any problems identified.

10. Investigate servomotors.

Domain *Cognitive* ***Level*** *Analyzing* ***Status*** *Active*

Linked Core Abilities

Demonstrate ability to think critically.
Transfer social and natural science theories into practical applications.
Use effective communication skills.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Communicate Technical Information

Assessment Strategies

10.1. Written objective test
10.2. Skill demonstration
10.3. Written product

Criteria

Performance will meet expectations when:

10.1. you complete the written objective test and the performance demonstration at or above 70%.
10.2. you attend class regularly
10.3. you arrive for class on time
10.4. written product follows prescribed format, meeting criteria for all components

Learning Objectives

10.a. Identify parts of various servomotors.
10.b. Explore operation of servomotors.
10.c. Explore power options for servomotors.
10.d. Explore adjustments to speed in a servomotor.
10.e. Explain torque generation in servomotors.
10.f. Explore holding torque parameters in servomotors.

11. Connect servomotor to an electromechanical system.

Domain *Psychomotor* ***Level*** *Practicing* ***Status*** *Active*

Linked Core Abilities

Transfer social and natural science theories into practical applications.
Use technology effectively.

Linked Program Outcomes

Perform work safely
Troubleshoot electrical and mechanical systems and devices
Repair electrical and mechanical systems
Communicate Technical Information
Integrate electrical and mechanical systems and devices

Assessment Strategies

11.1. Written objective test
11.2. Skill demonstration
11.3. Written product

Criteria

Performance will meet expectations when:

11.1. you complete the written objective test and the performance demonstration at or above 70%.
11.2. you attend class regularly
11.3. you arrive for class on time
11.4. you select the correct tools, equipment, insturments, materials, supplies
11.5. you perform all critical steps in the right order
11.6. you follow safety procedures
11.7. you wear personal protective equipment
11.8. written product follows prescribed format, meeting criteria for all components

Learning Objectives

11.a. Investigate schematic drawings for integration with the system.
11.b. Terminate with correct wires according to rubric created by instructor.
11.c. Strip wires correctly.
11.d. Secure wires at termination.
11.e. Demonstrate wire management protocols/ procedures identified by instructor.
11.f. Program servomotor drive.
11.g. Troubleshoot servomotor system operation.
11.h. Fix any problems identified.