ESYST 114 - Automated Systems

Approval Date:  Effective Term:

Department: ELECTRONIC SYSTEMS TECHNOLOGY
Division: Career Technical Education
Units: 4.00
Grading Option: Letter Grade
Transferability: CSU Transferable
Course is: AA/AS Degree
Repeatability:
Contact Hours per Term:
  Lecture/Discussion: 3.00
  Lab: 3.00
Associate Degree GE Applicability: No
Recommended Class Size: 35

Discipline/Minimum Qualifications:
Electromechanical, Electronics, Industrial Technology

Catalog Description:
Integrates the principles of manufacturing automation, including process and machine control, programmable logic controllers, robotics, part handling and assembly.

Schedule Description:
Integrates the principles of manufacturing automation, including process and machine control, programmable logic controllers, robotics, part handling and assembly.

Student Learning Outcome:
Lecture

1. Design or reverse engineer an automated system using electromechanical systems, robotics, automatic identification and data capture, and automated inspection techniques.

Lab

1. Construct an automated system using electromechanical systems, robotics, automatic identification and data capture, and automated inspection techniques.

Course Objectives:
Lecture:

1. Define sensors and actuators and describe how they are used as control system components in manufacturing.
2. Compare and contrast examples of numerically controlled machines and their manufacturing applications.
3. Identify industrial applications of robots and explain how robotics can improve manufacturing productivity and quality.
4. Define programmable logic controllers and explain their roles in manufacturing automation.
5. Describe different types of automated manufacturing systems, including material handling, storage and retrieval, assembly, and inspection.
6. Analyze different components and computer functions in a FMS and FMS applications in manufacturing industries.
7. Compare and contrast conventional measuring and gaging techniques with Coordinate Measuring Machines.

Lab:

1. Construct an integrated automation system using an electromechanical system and a robot.
2. Program an electromechanical system and a robot to function as an integrated system.
3. Add a bar code reader to an integrated automation system.
4. Add an inspection station to an integrated automation system.
5. Maintain, troubleshoot, and repair an integrated automation system.
6. Apply the flexibility tests to determine whether an automated system can be classified as a flexible manufacturing system (FMS).

Course Content Outline:

Lecture

1. Introduction to Automation
   1. Production Systems
   2. Automation in Production Systems
   4. Automation Principles and Strategies
   5. Basic Elements of an Automated System
   6. Advanced Automation Functions
   7. Levels of Automation
2. Hardware Components for Automation and Process Control
   1. Sensors
   2. Actuators
   3. Analog-to-Digital Converters
   4. Digital-to-Analog Converters
   5. Input/Output Devices for Discrete Data
3. Numerical Control
   1. Fundamentals of NC Technology
   2. Computer Numerical Control
<table>
<thead>
<tr>
<th>Section</th>
<th>Subsections</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.</td>
<td>Distributed Numerical Control</td>
</tr>
<tr>
<td>4.</td>
<td>Applications of NC</td>
</tr>
<tr>
<td>5.</td>
<td>Engineering Analysis of NC Positioning Systems</td>
</tr>
<tr>
<td>6.</td>
<td>NC Part Programming</td>
</tr>
<tr>
<td>7.</td>
<td>Coding for Manual Part Programming</td>
</tr>
<tr>
<td>8.</td>
<td>Part Programming with APT</td>
</tr>
<tr>
<td>4.</td>
<td>Industrial Robotics</td>
</tr>
<tr>
<td></td>
<td>1. Robot Anatomy and Related Attributes</td>
</tr>
<tr>
<td></td>
<td>2. Robot Control Systems</td>
</tr>
<tr>
<td></td>
<td>3. End Effectors</td>
</tr>
<tr>
<td></td>
<td>4. Sensors in Robotics</td>
</tr>
<tr>
<td></td>
<td>5. Industrial Robot Applications</td>
</tr>
<tr>
<td></td>
<td>6. Robot Programming</td>
</tr>
<tr>
<td></td>
<td>7. Robot Accuracy and Repeatability</td>
</tr>
<tr>
<td>5.</td>
<td>Discrete Control Using Programmable Logic Controllers and Personal Computers</td>
</tr>
<tr>
<td></td>
<td>1. Discrete Process Control</td>
</tr>
<tr>
<td></td>
<td>2. Ladder Logic Diagrams</td>
</tr>
<tr>
<td></td>
<td>3. Programmable Logic Controllers</td>
</tr>
<tr>
<td></td>
<td>4. Personal Computers Using Soft Logic</td>
</tr>
<tr>
<td>6.</td>
<td>Material Transport Systems</td>
</tr>
<tr>
<td></td>
<td>1. Introduction to Material Handling Equipment</td>
</tr>
<tr>
<td></td>
<td>2. Material Transport Equipment</td>
</tr>
<tr>
<td></td>
<td>3. Analysis of Material Transport Systems</td>
</tr>
<tr>
<td>7.</td>
<td>Storage Systems</td>
</tr>
<tr>
<td></td>
<td>1. Storage System Performance and Location Strategies</td>
</tr>
<tr>
<td></td>
<td>2. Conventional Storage Methods and Equipment</td>
</tr>
<tr>
<td></td>
<td>3. Automated Storage Systems</td>
</tr>
<tr>
<td></td>
<td>4. Engineering Analysis of Storage Systems</td>
</tr>
<tr>
<td>8.</td>
<td>Automatic Identification and Data Capture</td>
</tr>
<tr>
<td></td>
<td>1. Overview of Automatic Identification Methods</td>
</tr>
<tr>
<td></td>
<td>2. Bar Code Technology</td>
</tr>
<tr>
<td></td>
<td>3. Radio Frequency Identification</td>
</tr>
<tr>
<td></td>
<td>4. Other AIDC Technologies</td>
</tr>
<tr>
<td>9.</td>
<td>Introduction to Manufacturing Systems</td>
</tr>
<tr>
<td></td>
<td>1. Components of a Manufacturing System</td>
</tr>
<tr>
<td></td>
<td>2. Classification of Manufacturing Systems</td>
</tr>
<tr>
<td></td>
<td>3. Overview of the Classification Scheme</td>
</tr>
<tr>
<td>10.</td>
<td>Single-Station Manufacturing Cells</td>
</tr>
<tr>
<td></td>
<td>1. Single Station Manned Workstations</td>
</tr>
<tr>
<td></td>
<td>2. Single Station Automated Cells</td>
</tr>
<tr>
<td></td>
<td>3. Applications of Single Station Cells</td>
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<tr>
<td></td>
<td>4. Analysis of Single Station Cells</td>
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<tr>
<td>11.</td>
<td>Manual Assembly Lines</td>
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<tr>
<td></td>
<td>1. Fundamentals of Manual Assembly Lines</td>
</tr>
<tr>
<td></td>
<td>2. Analysis of Single Model Assembly Lines</td>
</tr>
<tr>
<td></td>
<td>3. Line Balancing Algorithms</td>
</tr>
</tbody>
</table>
4. Mixed Model Assembly Lines
5. Workstation Considerations
6. Other Considerations in Assembly Line Design
7. Alternative Assembly Systems

12. Automated Production Lines
   1. Fundamentals of Automated Production Lines
   2. Applications of Automated Production Lines
   3. Analysis of Transfer Lines

13. Automated Assembly Systems
   1. Fundamentals of Automated Assembly Systems
   2. Quantitative Analysis of Assembly Systems

14. Cellular Manufacturing
   1. Part Families
   2. Parts Classification and Coding
   3. Production Flow Analysis
   4. Cellular Manufacturing
   5. Applications of Group Technology
   6. Quantitative Analysis in Cellular Manufacturing

15. Flexible Manufacturing Systems
   1. What is a Flexible Manufacturing Systems?
   2. FMS Components
   3. FMS Applications and Benefits
   4. FMS Planning and Implementation Issues
   5. Quantitative Analysis of Flexible Manufacturing Systems

16. Inspection Technologies
   1. Inspection Metrology
   2. Contact vs. Noncontact Inspection Techniques
   3. Conventional Measuring and Gaging Techniques
   4. Coordinate Measuring Machines
   5. Surface Measurement
   6. Machine Vision
   7. Other Optical Inspection Techniques
   8. Noncontact Nonoptical Inspection Technologies

Lab

1. Integrating an automation system with an electromechanical system and a robot.
2. Programming an electromechanical system and a robot to function as an integrated system.
   1. Timing process stages
   2. Controlling process stages
3. Adding a bar code reader to an integrated automation system.
4. Adding an inspection station to an integrated automation system.

Methods of Instruction:
Lab, Lecture:
Methods of Evaluation:
Exams/Tests/Quizzes
Problem Solving
Skill Demonstrations

Exams

Typical Assignments:

Reading:
Schematics for electronic circuits Text readings Flow charts

Writing, Problem Solving or Performance:
Integrate an electromechanical system and a robot into an automation system. Program an electromechanical system and a robot to function as an integrated system.

Other:

Required Materials Examples:
Book 1

Author: Mikell P. Groover

Title: Automation, Production Systems, and Computer-Integrated Manufacturing

Publisher: Pearson

Publication Date: 2008
Edition: 3rd

Course Preparation:

Prerequisite(s):
ESYST 111
ESYST 112
ESYST 113

Co-Requisite(s):
None

Recommended:
None

Document Content Review

Target Course Skills
Condition on Enrollment
Established
Faculty
Lee Hilliard Samuel Bolanos
Basic Content Review
Lecture 1. Evaluate the various applications of mechanical devices and their control circuits. 2. Evaluate applicable maintenance procedures and troubleshooting techniques for a given electromechanical system. 3. Define terms associated with motors, motor control servo systems, fluid power systems, pneumatic power systems, and mechanical drives. 4. Design a stepper motor control system. 5. Design a fluid power system. 6. Design a pneumatic power system. Lab 1. Demonstrate the importance of safety when working around industrial equipment including identifying various safety hazards. 2. Demonstrate the ability to identify and use basic hand and mechanical tool sets of the electromechanical industry. 3. Demonstrate an ability to read a diagram, assemble and disassemble systems and subsystems to perform maintenance, troubleshoot, and repair. 4. Construct a stepper motor control system. 5. Construct a fluid power system. 6. Construct a pneumatic power system.

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Basic Content Review
Lecture Discuss the mechanical considerations and drive methods for robotics Distinguish between different sensors used in robotic applications Classify robots by control methods Categorize computer hardware and software for robot systems Describe robot vision Compare and contrast different robot applications Lab Construct a simple industrial robot Interface the robot to the controller Program the robot Install various sensors on the robot

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Basic Content Review
Lecture 1. Compare and contrast the basic methods for controlling process machines and driven equipment in industry in terms of types, requirements, advantages, and disadvantages. 2. Compare and contrast analog devices and digital solid state devices used to control systems in industry. 3. Explain basic wiring requirements and code requirements for industrial control systems. 4. Describe the function of input devices used in industrial control systems. 5. Categorize the function of output devices used in industrial control systems. 6. Describe the function of programmable controller interface devices, processors, and programming devices. 7. Describe the number systems and codes used in programmable controller programming. 8. Design basic logic ladder diagram programs. Lab 1. Connect a programmable controller to an electromechanical system. 2. Develop a programmable controller program flow chart. 3. Program a programmable controller to perform a specific function. 4. Troubleshoot programmable controller connections. 5. Troubleshoot programmable controller programs.