MECH 0044 - MECHATRONIC PROCESSES AND MATERIALS

Catalog Description

Formerly known as CIE 44
Hours: 72 (18 lecture, 54 laboratory)
Description: Application of tools and materials required for design, installation and repair of mechatronic systems. Each student fabricates a final project applying system-based mechatronic principles and skills. (CSU)

Course Student Learning Outcomes

- CSLO #1: Create precision metallic components using common machine tools and mechanical drawings.
- CSLO #2: Construct and evaluate control circuitry for electro-mechanical systems.
- CSLO #3: Assemble metal components into working systems.

Effective Term

Fall 2022

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

36

Total Student Learning Hours

108

Course Objectives

Lecture Objectives:
1. Explain the proper safety procedures and precautions related to mechatronic fabrication.
2. Compare and contrast the benefits and limitations of various mechatronic materials.
3. Select the proper method to measure the thickness, length, and width of material using precision measuring instruments.
4. Analyze an engineering drawing of a metal mechatronics fixture.
5. Analyze an engineering drawing for drilling and tapping various holes in a fixture.
6. Examine engineering specifications to install a HeliCoil to repair damaged threads.
7. Analyze an engineering drawing to locate holes to be punched in a fixture.
8. Investigate various welding methods.
9. Investigate correct soldering technique.
10. Critique various mechanical drive and bearing methods.
11. Critique various piping and tubing methods.
12. Analyze an engineering drawing of the mechanical components of the mechatronic system.
13. Analyze an engineering drawing of the electrical components of the mechatronic system.
14. Analyze an engineering drawing of the pneumatic components of the mechatronic system.
15. Analyze the code of the programmable controller device.
16. Analyze and diagnose the complete system behavior to meet product requirements.
Laboratory Objectives:
1. Demonstrate the proper method used to measure, record, layout and shear the thickness, length, and width of material using precision measuring instruments.
2. Construct a metal mechatronics fixture using a drill press, engine lathe and milling machine.
3. Construct a fixture from an engineering drawing requiring drilling and tapping various holes.
4. Execute the installation of a HeliCoil to repair damaged threads to proper engineering specifications.
5. Demonstrate proper use of hand tools such as files and hacksaws.
6. Apply the correct sealing compound to a fluid connection.
7. Analyze an engineering drawing and apply measuring technique to locate and punch a hole in the fixture.
8. Apply the correct locking compound to semi-permanently lock a fastener.
9. Demonstrate resistance welding.
10. Demonstrate correct soldering technique and assemble the controller electronics.
11. Demonstrate correct cabling technique to cable the controller electronics.
12. Construct the mechanical components of the mechatronic system.
13. Construct the electrical components of the mechatronic system.
14. Construct the pneumatic components of the mechatronic system.
15. Program and observe the behavior of the programmable controller device.
16. Construct the complete mechatronic system to meet product requirements.

General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

Articulation Information

- CSU Transferable

Methods of Evaluation

- Classroom Discussions
  - Example: Students will discuss consequences of failure to follow standard industry safety procedures.
- Problem Solving Examinations
  - Example: Students must analyze engineering drawings to calculate specific dimensions utilizing other provided dimensions. Grading based on industry standard.
- Projects
  - Example: Students must complete and submit a working semester project (robot arm), complying with all stated requirements.
- Reports

- Example: Students will compile and organize a portfolio of all mechanical and electrical information needed to complete the semester project to required performance standards.
- Skill Demonstrations
  - Example: Student must demonstrate safe and effective use of a hacksaw to accurately cut metal. Grading based on industry standard.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. After an instructor demonstration on proper drilling techniques, students will drill and tap holes in a sample metal plate. Students are expected to use proper techniques to drill and tap holes in metal in accordance with provided engineering drawing. Instructor will provide oversight of safety and proper technique.

Lecture:

1. Instruction is given on theory and application of soldering methods. Students are expected to actively participate in lecture. Students will work in groups to outline the steps of soldering.

Distance Learning

1. Instructor will present a lecture comparing common mechatronic drive systems. Students will utilize Computer Aided Design (CAD) software downloaded from the internet to simulate the operation of a motor-to-load drive power transfer mechanism. Instructor will review results and the student analysis of the drive system performance.

Typical Out of Class Assignments

Reading Assignments

1. Read the chapter that covers fasteners. Be prepared to discuss how to select an appropriate fastener for a given application. 2. Read the chapter on calipers and micrometers and be prepared to demonstrate the use of vernier and digital measurement tools.

Writing, Problem Solving or Performance

1. Analyze the performance of a complete mechatronic system, then develop and implement solutions to any issues found. 2. Fabricate a metal fixture that is compliant with the specifications listed on the engineering drawing.

Other (Term projects, research papers, portfolios, etc.)

1. Organize and maintain a course portfolio incorporating all pertinent documentation related to the required term project.

Required Materials

- Mechanical Trades Pocket Manual
  - Author: Thomas P. Davis
  - Publisher: Audel
  - Publication Date: 2004
  - Text Edition: 4th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Industrial Mechanics and Maintenance
  - Author: Larry Chastain
  - Publisher: Prentice Hall
  - Publication Date: 2008
  - Text Edition: 3rd
  - Classic Textbook?:
  - OER Link:
  - OER:
- Welding and Metal Fabrication
  - Author: Larry Jeffus
  - Publisher: Delmar Cengage Learning
  - Publication Date: 2011
  - Text Edition: 1st
  - Classic Textbook?:
  - OER Link:
  - OER:
- An Elementary Principles of Machining Operations
  - Author: Ganvir, Kanchan, et al
  - Publisher: LAP LAMBERT Academic Publishing
  - Publication Date: 2020
  - Text Edition:
  - Classic Textbook?:
  - OER Link:
  - OER:

Other materials and-or supplies required of students that contribute to the cost of the course.

Scientific calculator Computer data storage media