**ELEC 82 Course Outline as of Fall 2024**

# CATALOG INFORMATION

Dept and Nbr: ELEC 82 Title: MECHATRONICS FUND
Full Title: Mechatronics Fundamentals
Last Reviewed: 4/10/2023

| Units | | Course Hours per Week | | Nbr of Weeks | Course Hours Total | |
|---|---|---|---|---|---|---|
| Maximum | 3.00 | Lecture Scheduled | 2.50 | 17.5 | Lecture Scheduled | 43.75 |
| Minimum | 3.00 | Lab Scheduled | 1.50 | 8 | Lab Scheduled | 26.25 |
| | | Contact DHR | 0 | | Contact DHR | 0 |
| | | Contact Total | 4.00 | | Contact Total | 70.00 |
| | | Non-contact DHR | 0 | | Non-contact DHR | 0 |

Total Out of Class Hours: 87.50 Total Student Learning Hours: 157.50

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|---|---|
| Title 5 Category: | AA Degree Applicable |
| Grading: | Grade Only |
| Repeatability: | 00 - Two Repeats if Grade was D, F, NC, or NP |
| Also Listed As: | |
| Formerly: | |

**Catalog Description:**
In this course, students will analyze and control systems that combine mechanical elements with electronic components using computers and/or microcontrollers. Topics include sensors, actuators, servo and stepper motors, and motor controllers.

**Prerequisites/Corequisites:**
Course Completion of ELEC 54C

**Recommended Preparation:**

**Limits on Enrollment:**

**Schedule of Classes Information:**
Description: In this course, students will analyze and control systems that combine mechanical elements with electronic components using computers and/or microcontrollers. Topics include sensors, actuators, servo and stepper motors, and motor controllers. (Grade Only)
Prerequisites/Corequisites: Course Completion of ELEC 54C
Recommended:
Limits on Enrollment:

Transfer Credit: CSU;
Repeatability: Two Repeats if Grade was D, F, NC, or NP

## ARTICULATION, MAJOR, and CERTIFICATION INFORMATION:

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|---|---|---|---|---|---|
| **AS Degree:** | **Area** | | | Effective: | Inactive: |
| **CSU GE:** | **Transfer Area** | | | Effective: | Inactive: |
| **IGETC:** | **Transfer Area** | | | Effective: | Inactive: |
| **CSU Transfer:** | Transferable | Effective: | Fall 2018 | Inactive: | |
| **UC Transfer:** | | Effective: | | Inactive: | |

**CID:**

**Certificate/Major Applicable:**
Both Certificate and Major Applicable

## COURSE CONTENT

**Student Learning Outcomes:**
At the conclusion of this course, the student should be able to:
1. Identify the different sensor types and measurands; force, temperature, distance, velocity, acceleration, pressure, flow, optical, and chemical.
2. Test and plot sensor data to obtain sensor characteristics.
3. Demonstrate the operation of servo and stepper motors.

**Objectives:**
At the conclusion of this course, the student should be able to:
1. Explain how sensor characteristics and signal conditioning affect a simple system.
2. Compare sensing of a measurand using sensors based on different physical effects.
3. Test and plot sensor data to obtain sensor characteristics.
4. Demonstrate the use of sensors to provide feedback to a control system.
5. Design a useful device containing a sensor or actuator and predict its behavior.
6. Utilize microcontrollers that use sensors as input and actuators as output.
7. Design a motor control system using servo and stepper motors.

**Topics and Scope:**

I. Introduction
   A. Classification of sensors and actuators
   B. Sensing and actuating strategies
   C. Transduction
   D. Evacuation
II. Performance Characteristics
   A. Input/output characteristics
   B. Accuracy and errors
   C. Frequency response and calibration
   D. Applications
III. Temperature Sensors

A. Thermistors
B. Resistance temperature sensors

IV. Optical Sensors
A. Photodiodes
B. Phototransistors
C. Photoresistors
D. Infrared

V. Magnetic Sensors
A. Proximity sensors
B. Hall sensors

VI. Mechanical Sensors
A. Accelerometers
B. Force sensors
C. Pressure sensors

VII. Acoustic Sensors

VIII. Chemical Sensors
A. Humidity
B. Moisture

IX. Motors as Actuators
A. Servo motors and controls
B. Stepper motors and controls

X. Interfacing Methods and Circuits
A. Bridge circuits
B. Interfacing to microprocessors
C. Data transmission
D. Power requirements
E. Noise and interference

XI. Interfacing to Microprocessors
A. General requirements for sensors and actuators
B. Input signal conditioning
C. Output signals: level, power, and isolation
D. Driving methods: direct drive and pulse width modulation (PWM)

XII. Laboratory Topics
A. Temperature and humidity sensors
B. Optical sensors
C. Magnetic sensors
D. Mechanical sensors
E. Acoustic sensors
F. Chemical sensors
G. Servo motors and controls
H. Stepper motors and controls
I. Interfacing to Arduino

**Assignment:**

Lecture-Related Assignments:
1. Reading (10-30 pages per week)
2. Homework assignment(s) (1-4)
3. Quizzes (2-6)
4. Final exam

Lab-Related Assignments:

1. Laboratory assignments (5-12) including demonstrating operation of a sensor-controlled motor
2. Lab reports (4-8)

**Methods of Evaluation/Basis of Grade:**

**Writing:** Assessment tools that demonstrate writing skills and/or require students to select, organize and explain ideas in writing.

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| Lab reports | Writing<br>20 - 50% |

**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

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| Homework assignment(s) | Problem solving<br>20 - 30% |

**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

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| Laboratory assignments | Skill Demonstrations<br>10 - 30% |

**Exams:** All forms of formal testing, other than skill performance exams.

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| Quizzes; final exam | Exams<br>20 - 40% |

**Other:** Includes any assessment tools that do not logically fit into the above categories.

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| None | Other Category<br>0 - 0% |

**Representative Textbooks and Materials:**
Fundamentals of Mechatronics. Jouaneh, Musa. Cengage Learning. 2013 (classic).