

**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

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:**

<b>AS Degree:</b>	<b>Area</b>	Effective:	Inactive:
<b>CSU GE:</b>	<b>Transfer Area</b>	Effective:	Inactive:

<b>IGETC:</b>	<b>Transfer Area</b>	Effective:	Inactive:
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<b>CSU Transfer:</b>	Transferable	Effective:	Fall 2018	Inactive:
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<b>UC Transfer:</b>		Effective:		Inactive:
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**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.

Lab reports	Writing 20 - 50%
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**Problem Solving:** Assessment tools, other than exams, that demonstrate competence in computational or non-computational problem solving skills.

Homework assignment(s)	Problem solving 20 - 30%
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**Skill Demonstrations:** All skill-based and physical demonstrations used for assessment purposes including skill performance exams.

Laboratory assignments	Skill Demonstrations 10 - 30%
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**Exams:** All forms of formal testing, other than skill performance exams.

Quizzes; final exam	Exams 20 - 40%
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**Other:** Includes any assessment tools that do not logically fit into the above categories.

None	Other Category 0 - 0%
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**Representative Textbooks and Materials:**

Fundamentals of Mechatronics. Jouaneh, Musa. Cengage Learning. 2013 (classic).