

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:

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.

Lab reports

Writing
20 - 50%

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%

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

Laboratory assignments

Skill Demonstrations
10 - 30%

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

Quizzes; final exam

Exams
20 - 40%

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

None

Other Category
0 - 0%

Representative Textbooks and Materials:

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