



Course Outline

2026-2027 Catalog

ENGR 2 - Programming and Problem-Solving in MATLAB

Catalog Description

Transfer Status: CSU/UC

Prerequisite: MATH C2210 or MATH C2210E

Unit(s): 3.00

Lecture: 34.00 Contact hours/68.00 Out of class hours/102.00 Total hours/2.00 Unit(s)

Lab: 51.00 Contact hours/0.00 Out of class hours/51.00 Total hours/1.00 Unit(s)

Total: 85.00 Contact hours/68.00 Out of class hours/153.00 Total hours/3.00 Unit(s)

Course Description: This course utilizes the MATLAB environment and commercial electronic spreadsheets to provide students with a working knowledge of computer-based problem-solving methods relevant to science and engineering. It introduces the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Examples and assignments in the course are drawn from practical applications in engineering, physics, and mathematics. (C-ID ENGR 220).

Objectives

Upon successful completion of this course, the student should be able to:

1. Apply a top-down design methodology to develop computer algorithms.
2. Create, test and debug sequential MATLAB programs, as well as programs that use object-oriented techniques, in order to achieve computational objectives.
3. Apply numeric techniques and computer simulations to analyze and solve engineering-related problems.
4. Use MATLAB effectively to analyze and visualize data.
5. Demonstrate understanding and use of standard data structures.

Course Content

Topic Titles / Suggested Time Topic

Lecture

<u>Topics</u>	<u>Lec Hrs</u>
Variables, expressions, and order of operation	3.00
Elementary functions, including: Vector analysis	2.00
Array definitions and operations including: Solving equations of one variable	2.00
Computational problem-solving methodology, including:	4.00
1. Solving systems of linear equations	
2. Numerical Differentiation and Integration	
3. Solving ordinary differential equations	
Pseudocode, flowcharts, and documentation	2.00
Formatted input and output	2.00
Data Files, including: Least-squares regression and linearization	2.00
Plotting, including: Data Interpolation	2.00
Selection programming structures	2.00
Repetition programming structures, including: Series approximation and error	2.00
MATLAB Functions and user-defined functions	2.00
Recursion	2.00
Data structures	2.00
Sorting and searching	2.00
Object-oriented programming, including: Optimization	2.00
Graphical User Interfaces	1.00
Total Hours:	
	34.00

Lab

<u>Topics</u>	<u>Lab Hrs</u>
Introduction to MATLAB: Menus and the Toolbar. Problem-Solving Methodologies: Solving linear equations, systems of linear equations, plotting. Calculate area and volume of given geometric shapes	3.00
Solving Calculus problems using numerical methods: numerical integration	3.00
Interface between MATLAB and physical world: I/O. Programming Arduino with MATLAB and SIMULINK	3.00

Topics	Lab Hrs
Arrays and matrix operations: vectors and displacement	3.00
Introduction to SIMULINK: basic toolbox library. Solving problems using a graphic workflow	3.00
Solving Calculus problems using numerical methods: differential equations	3.00
Solving Calculus problems using numerical methods: numerical differentiation	3.00
Functions and m-files: built-in and user-made functions	3.00
Programming with MATLAB: Debugging MATLAB Programs	3.00
Programming with MATLAB: programming with "for" loop	3.00
Programming with MATLAB: programming with "while" loop	3.00
Advanced Plotting with MATLAB: Plotting (x,y) Functions	3.00
Least-squares method (Regression): MATLAB Basic Fitting interface	3.00
Advanced Plotting with MATLAB: Three-Dimensional Plots	3.00
Solving Linear Algebraic Equations by Matrix methods	3.00
User-defined function: scripts and subfunctions and debugging	3.00
Solving engineering problems: I/O functions	3.00

Total Hours: 51.00

Methods of Instruction

- A. Class Activities
- B. Demonstrations
- C. Homework: Students are required to complete two hours of outside-of-class homework for each hour of lecture
- D. Lecture

Methods of Evaluation

- A. Exams/Tests
- B. Homework
- C. Lab Projects

Examples of Assignments

Reading Assignments

1. Read chapter on plotting in MATLAB and be prepared to discuss plotting options.
2. Read a code of a flawed recursive function and create a report of the errors.

Writing Assignments

1. Write a user-defined function that calculates the square root of the first n integers and share with the class.
2. Compute the sum of the first n integers and show your work.

Out-of-Class Assignments

1. Write the code that will find the function that fits the given data, and then plot the function and share with the class.
2. Given an engineering related problem requiring a numerical solution, utilize MATLAB to obtain solution and include in your lab manual.

Recommended Materials of Instruction

Palm, W. (2022). MATLAB for Engineering Applications. *McGraw Hill*, 5th. 9781264144044.

Moore, Holly. (2023). MATLAB for Engineers. *Pearson Education, Inc.*, 6th. 9780137627981.

Other Learning Materials

MATLAB and Simulink Student or full Suite.

Minimum Qualifications

Engineering (Masters Required)

Physics/Astronomy (Masters Required)

Computer Science (Masters Required)

Created/Revised by: Bryant, Jennifer

Date: 02/26/2024