ENGR 6 Course Outline as of Fall 2024

CATALOG INFORMATION

Dept and Nbr: ENGR 6 Title: MATLAB FOR ENGINEERS
Full Title: Programming in MATLAB for Engineers
Last Reviewed: 12/12/2023

Units		Course Hours per Week		Nbr of Weeks	Course Hours Total	
Maximum	3.00	Lecture Scheduled	2.00	17.5	Lecture Scheduled	35.00
Minimum	3.00	Lab Scheduled	3.00	6	Lab Scheduled	52.50
		Contact DHR	0		Contact DHR	0
		Contact Total	5.00		Contact Total	87.50
		Non-contact DHR	0		Non-contact DHR	0

Total Out of Class Hours: 70.00 Total Student Learning Hours: 157.50

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

Catalog Description:
Students will solve engineering problems using the MATLAB computer programming environment. The course introduces the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Students will outline, write, test, and debug computer programs to solve engineering, physics, and mathematics problems and display results.

Prerequisites/Corequisites:
Completion of MATH 1B or higher (MATH)

Recommended Preparation:

Limits on Enrollment:

Schedule of Classes Information:
Description: Students will solve engineering problems using the MATLAB computer programming environment. The course introduces the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Students will outline, write, test, and debug computer programs to solve engineering, physics, and mathematics problems and

display results. (Grade or P/NP)
Prerequisites/Corequisites: Completion of MATH 1B or higher (MATH)
Recommended:
Limits on Enrollment:
Transfer Credit: CSU;UC.
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 2000	Inactive:
UC Transfer:	Transferable	Effective:	Fall 2000	Inactive:

CID:

Certificate/Major Applicable:
Major Applicable Course

COURSE CONTENT

Student Learning Outcomes:
At the conclusion of this course, the student should be able to:
1. Apply standard programming techniques to write, test, and debug MATLAB computer programs that complete engineering-related tasks.
2. Apply common numerical analysis techniques in MATLAB to analyze data from engineering-related problems.
3. Apply programming and collaboration skills to the completion of a group project with partially defined parameters.

Objectives:
At the conclusion of this course, the student should be able to:
1. Utilize methodical approaches to develop computer algorithms that perform engineering-related tasks.
2. Create, test, and debug sequential MATLAB programs to perform those tasks.
3. Solve engineering-related computational problems by applying common numerical analysis techniques and MATLAB engineering tools.
4. Create computer programs to analyze and visualize data with tables, charts, and graphs.
5. Demonstrate understanding and use of standard data structures and object-oriented programming techniques.
6. Document computer programs in a careful and complete manner in order to facilitate editing by another programmer.

Lab-Related Objectives (in addition to the objectives above):
7. Develop solution algorithms in a project-based environment with only partially defined project parameters.
8. Practice problem solving and project management skills, including effective collaboration in

culturally and gender diverse engineering teams.
9. Develop oral presentation skills.

Topics and Scope:

Lecture-Related Topics and Scope:
I. Overview of Computer Systems and the MATLAB Environment
- A. Compiled versus interpreted languages
- B. Procedural versus object-oriented programming
- C. MATLAB's interactive workspace
- D. MATLAB's documentation and help features

II. Basic Interpreted Code
- A. Variables
- B. Expressions
- C. Precedence of operations

III. Elementary Functions
- A. Math functions
- B. Logical functions
- C. Referencing functions

IV. Arrays
- A. Assigning
- B. Indexing
- C. Operations

V. Computational Problem-Solving Methodologies
- A. Problem definition and specifications
- B. Input and output information and variables
- C. Working a special case by hand
- D. Design and implementation of computer algorithm
- E. Test of algorithm

VI. Algorithm and Coding Practices
- A. Pseudocode
- B. Flowcharts
- C. Comments and documentation blocks

VII. Formatted Input and Output
- A. Input function
- B. Menu function
- C. Disp function
- D. Format strings

VIII. File Management
- A. MATLAB data files
- B. MATLAB program files
- C. MATLAB object files
- D. MATLAB figure files
- E. Non-MATLAB file reading

IX. Graphical Display
- A. Independent variable setup in one- and two-dimensions
- B. Two-dimensional plotting
- C. Three-dimensional surface plots
- D. Plot annotation expectations
- E. Manual annotation options
- F. Annotation functions

X. Selection Programming Structures

A. Relational and logical operators and functions
B. If statements with else & elseif
C. Switch-case construction
D. Lookup techniques
E. Logical Computation

XI. Repetition Programming Structures
A. For loops
B. While loops

XII. Functions
A. User-defined functions
B. Multiple input and output functions
C. Function handles
D. Random functions
E. MATLAB's numerical analysis functions

XIII. Recursion

XIV. Data Types
A. Strings and character arrays
B. Cell arrays
C. Structured arrays
D. Logical arrays
E. Graphical objects
F. User data structures

XV. Sorting Functions and Techniques

XVI. Object-Oriented Programming
A. Concepts
B. Terminology
C. Properties
D. Methods

XVII. Graphical User Interfaces (MATLAB Apps)
A. App components
B. App properties
C. App methods

XVIII. Numerical Analysis Techniques
A. Simulation
B. Optimization
C. Equations in one variable
D. Linear system solutions
E. Vector analysis
F. Data interpolation and extrapolation
G. Least-squares regression and linearization (optional)
H. Numerical differentiation and integration (optional)
I. Solving ordinary differential equations (optional)
J. Series approximation and error (optional)

Lab-Related Topics and Scope:

XIX. Interfacing to the External Environment

XX. Group Interaction Skills
A. Peer review and evaluation
B. Team member roles and behaviors
C. Cultural and gender diversity awareness

XXI. Presentation Skills

Assignment:

Lecture-Related Assignments:
1. Reading (15 pages per week)
2. Homework assignments using MATLAB (15-25)
3. Objective examinations (2-4) and a final

Lab-Related Assignments:
1. Lab exercises using MATLAB (10-15)
2. Group project(s) including presentation(s) (1-3)

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.

None, This is a degree applicable course but assessment tools based on writing are not included because problem solving assessments are more appropriate for this course.	Writing 0 - 0%

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

Homework assignments; lab exercises; group project(s) including presentation(s)	Problem solving 40 - 70%

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

None	Skill Demonstrations 0 - 0%

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

Objective examinations and a final	Exams 30 - 60%

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

None	Other Category 0 - 0%

Representative Textbooks and Materials:
MATLAB Programming for Engineers. 6th ed. Chapman, Stephen. Cengage Learning. 2020.
Introduction to MATLAB. Knoesen, Andrea. Zybook. 2016 (classic).
Introduction to MATLAB for Engineers. 5th ed. Palm, William. McGraw-Hill. 2022.
MATLAB: A Practical Introduction to Programming and Problem Solving. 6th ed. Attaway, Stormy. Butterworth-Heinemann. 2022.
Instructor prepared lab manual or workbook