### ENGR 6 Course Outline as of Summer 2021

# **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	<b>Course Hours Total</b>	
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:**

Engineering problem solving using the MATLAB computer programming environment. It introduces the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Students outline, write, test, and debug computer programs to solve engineering, physics, and mathematics problems and display results.

### **Prerequisites/Corequisites:**

Completion of MATH 1A or higher (MATH)

### **Recommended Preparation:**

### **Limits on Enrollment:**

### **Schedule of Classes Information:**

Description: Engineering problem solving using the MATLAB computer programming environment. It introduces the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Students 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 1A 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: CSU GE:	Area Transfer Area	L		Effective: Effective:	Inactive: Inactive:
<b>IGETC:</b>	Transfer Area	l		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 objectives (in addition to the objectives above):

- 7. Develop solution algorithms in a project-based environment with only partially defined project parameters.
- 8. Practice collaborative problem solving and project management skills including peer review and evaluation.
- 9. Develop oral presentation skills.

# **Topics and Scope:**

- I. Overview of Computer Systems and the MATLAB Environment
  - A. Compiled vs. interpreted languages
  - B. Procedural vs. 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 set-up in 1 and 2 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

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 and Searching
  - A. Bubble sort
  - B. Insertion sort
  - C. Lookup techniques
- XVI. Object-Oriented Programming
  - A. Concepts
  - B. Terminology
  - C. Properties
  - D. Methods
- XVII. Graphical User Interfaces
  - A. MATLAB's graphical user interface objects
  - B. Object generation and parameter modification
  - C. Graphical user interface activation
- XVIII. Numerical Analysis Techniques
  - A. Linear system solutions
  - B. Vector analysis
  - C. Data interpolation
  - D. Least-squares regression and linearization
  - E. Numerical differentiation and integration
  - F. Solving ordinary differential equations
  - G. Series approximation and error
  - H. Solving equations in one variable
  - I. Optimization
  - J. Simulation

Lab Topics and Scope (in addition to the topics above):

XIX. Interfacing to the External Environment

XX. Group Interaction Skills and Peer Review and Evaluation

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 projects including presentations (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.

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

Homework Assignments, Lab Exercises, Group Projects

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

None

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

Exams and Final

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

None

# **Representative Textbooks and Materials:**

MATLAB an Introduction with Applications. 5th ed. Gilat, Amos. Wiley. 2015 Introduction to MATLAB. Knoesen, Andrea. Zybook. 2016 Introduction to MATLAB for Engineers. 3rd ed. Palm, William. McGraw-Hill. 2011 (classic)

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	Writing 0 - 0%
	Problem solving 40 - 70%
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	Skill Demonstrations 0 - 0%
	Exams 30 - 60%
	Other Category 0 - 0%