

ENGI-160: PROGRAMMING WITH MATLAB FOR ENGINEERS AND SCIENTISTS

Engineering Courses Updates Fall 2023

Course

- ENGI-110: Introduction to Engineering
- ENGI-160: Programming With MATLAB for Engineers and Scientists
- ENGI-240: Properties of Materials
- ENGI-241: Engineering Mechanics: Statics
- ENGI-242: Circuits 1

Effective Term

Fall 2024

CC Approval

10/06/2023

AS Approval

10/10/2023

BOT Approval

10/19/2023

SECTION A - Course Data Elements

Send Workflow to Initiator

No

CB04 Credit Status

Credit - Degree Applicable

Discipline

Minimum Qualifications	And/Or
Engineering (Master's Degree)	

Subject Code

ENGI - Engineering

Course Number

160

Department

Engineering (ENGI)

Division

Science and Engineering (SE)

Full Course Title

Programming With MATLAB for Engineers and Scientists

Short Title

Prog w/MATLAB for Eng & Sci

CB03 TOP Code

0701.00 - *Information Technology, General

CB08 Basic Skills Status

NBS - Not Basic Skills

CB09 SAM Code

C - Clearly Occupational

Rationale

Last update more than 5 years ago. Changes were made to SLOs, content and textbooks.

SECTION B - Course Description

Catalog Course Description

This course teaches computer programming using the MATLAB's syntax, control, and data structures. It includes object oriented programming techniques, introduces numerical techniques for scientific and engineering applications, and emphasizes optimal programming practices. Various aspects of the software life-cycle, including design, documentation, implementation, debugging, testing, and maintenance are introduced. Case studies and software projects are significant parts of the course.

SECTION C - Conditions on Enrollment

Open Entry/Open Exit

No

Repeatability

Not Repeatable

Grading Options

Letter Grade Only

Allow Audit

Yes

Requisites

Prerequisite(s)

Completion of MATH-120 with a minimum grade of C.

Requisite Justification

Requisite Description

Course Not in a Sequence

Subject

Math

Course #

120

Level of Scrutiny

Required by 4-Year Institution

Explanation

Single Variable Calculus I Early Transcendentals listed as a required prerequisite on C-ID descriptor for Programming and Problem-Solving in MATLAB (ENGI 220)

SECTION D - Course Standards

Is this course variable unit?

No

Units

3.00000

Lecture Hours

36.00

Lab Hours

54.00

Outside of Class Hours

72

Total Contact Hours

90

Total Student Hours

162

Distance Education Approval**Is this course offered through Distance Education?**

Yes

Online Delivery Methods

DE Modalities	Permanent or Emergency Only?
Entirely Online	Permanent
Hybrid	Permanent
Online with Proctored Exams	Permanent

SECTION E - Course Content**Student Learning Outcomes**

Upon satisfactory completion of the course, students will be able to:	
1.	Apply numeric techniques and computer simulations to solve scientific- and engineering-related problems.
2.	Demonstrate understanding and use of fundamental data structures.
3.	Create and control simple plot and user-interface graphics objects in MATLAB.
4.	Design and document computer programs and analyses to communicate results, to facilitate evaluation and debugging, and to anticipate and resolve user errors.

Course Objectives

Upon satisfactory completion of the course, students will be able to:	
1.	Introduce the MATLAB software environment.
2.	Apply a variety of common numeric techniques to solve and visualize scientific- and engineering-related computational problems.
3.	Introduce common approaches, structures, and conventions for creating and evaluating computer programs, primarily in a procedural paradigm, but with a brief introduction to object-oriented concepts and terminology.
4.	Reinforce a structured, top-down approach to formulate and solve problems with MATLAB.

Course Content

1. Engineering Problem Solving Methodology
 - 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
2. Technical Computing Environment
 - a. MATLAB interactive workplace
 - b. MATLAB documentation, help, and resources
 - c. Common mathematical functions
 - d. Designing, editing, and executing scripts
3. Array Mathematics
 - a. Arrays: scalars, vectors, and matrices
 - b. Scalar and array operations
 - c. Visualization: 2D plotting
4. Mathematical Functions

- a. Complex numbers
- b. Polynomial functions and operations
- c. Random numbers
- d. Functions of two variables
- e. Visualization: 3D plotting
- f. User-written functions
5. Selection Programming Structure
 - a. Relational and logical operators
 - b. If statements
 - c. Else & elseif clauses
 - d. Relational and logical functions
6. Repetition Programming Structure
 - a. For loops
 - b. While loops
 - c. Switch-case construction
7. Text Programming
 - a. Character strings
 - b. String conversions
 - c. String functions
 - d. Display formatting
8. Linear Algebra and Matrices
 - a. Matrix operations
 - b. Matrix functions
 - c. Special matrices
9. Solutions to Systems of Linear Equations
 - a. Graphical interpretation
 - b. Solution by matrix division and matrix inverse
10. Interpolation and Curve Fitting
 - a. One-dimensional interpolation
 - b. Two-dimensional interpolation
 - c. Curve fitting
11. Data Analysis
 - a. Maximum and minimum
 - b. Sums and products
 - c. Mean and median
 - d. Sorting
 - e. Variance and standard deviation
 - f. Histograms
12. Numerical Analysis
 - a. Minimization
 - b. Zero finding
 - c. Integration
 - d. Differentiation
13. Symbolic Mathematics
 - a. Symbolic objects, variables and expressions
 - b. Operations of symbolic expressions
 - c. Differentiation and integration
14. Object Oriented Programming
 - a. MATLAB's graphical user interface objects
 - b. Object generation and parameter modification

Methods of Instruction

Methods of Instruction

Types	Examples of learning activities
Discussion	Work with team members to analyze problems and data to determine optimal use of MATLAB to solve problems. Design of algorithms.

Experiments	Apply numeric techniques and computer simulations to solve scientific and engineering problems.
Lab	Apply a top-down, modular, and systematic approach to design, write, test, and debug sequential MATLAB programs to achieve computational objectives.
Lecture	Lecture topics are listed in the course content section.
Group Work	Design of algorithms. Applications for MATLAB. Final Comprehensive Group Project (Examples: Pattern Recognition, Image Analysis/Identification, Floor Mapping).

Instructor-Initiated Online Contact Types

Announcements/Bulletin Boards
 Chat Rooms
 Discussion Boards
 E-mail Communication
 Video or Teleconferencing

Student-Initiated Online Contact Types

Chat Rooms
 Discussions
 Group Work

Course design is accessible

Yes

Methods of Evaluation

Methods of Evaluation

Types	Examples of classroom assessments
Exams/Tests	Multiple Choice, Completion, Short Answer, and Programming. Final Exam -- Multiple Choice, Completion, Short Answer, and Programming
Projects	Final Comprehensive Group Project (Examples: Pattern Recognition, Image Analysis/Identification, Floor Mapping). Analysis of scientific- and engineering-related problems. Programming to achieve computational objectives. Apply numeric techniques and computer simulations to solve scientific and engineering problems.
Simulation	Apply numeric techniques and computer simulations to solve scientific and engineering problems.
Lab Activities	Analysis of scientific- and engineering-related problems. Programming to achieve computational objectives. Apply numeric techniques and computer simulations to solve scientific and engineering problems.

Assignments

Reading Assignments

Assigned readings and elective readings as needed for to further understanding of topics covered in lecture and lab.

Examples:

Read specific section of the textbook, read an assigned article, use the internet to research a specific function of a MATLAB directive/command.

Writing Assignments

Development of algorithms for problem solving. Documentation and description of MATLAB programs/scripts.

Other Assignments

Use MATLAB to analyze and visualize data, apply numerical techniques and computer simulations to solve scientific and engineering problems.

SECTION F - Textbooks and Instructional Materials

Material Type

Textbook

Author

Daniel T. Valentine and Brian H. Hahn

Title

Essential MATLAB for Engineers and Scientists

Edition/Version

8th

Publisher

Academic Press

Year

2022

ISBN #

9780323995481

Material Type

Textbook

Author

William Palm

Title

MATLAB for Engineering Applications

Edition/Version

5th

Publisher

McGraw Hill

Year

2023

ISBN #

9781264908097

Proposed General Education/Transfer Agreement

Do you wish to propose this course for a UC Transferable Course Agreement (UC-TCA)?

Yes

Course Codes (Admin Only)

ASSIST Update

No

CB00 State ID

CCC000593468

CB10 Cooperative Work Experience Status

N - Is Not Part of a Cooperative Work Experience Education Program

CB11 Course Classification Status

Y - Credit Course

CB13 Special Class Status

N - The Course is Not an Approved Special Class

CB23 Funding Agency Category

Y - Not Applicable (Funding Not Used)

CB24 Program Course Status

Program Applicable

Allow Pass/No Pass

No

Only Pass/No Pass

No

Reviewer Comments

Stacey Howard (showard) (Thu, 28 Sep 2023 17:52:53 GMT): Added anticipated Fall 2023 effective date as no rearticulation required.

Stacey Howard (showard) (Thu, 28 Sep 2023 18:25:31 GMT): Selected anticipated fall 2023 begin date as no rearticulation required for existing CSU/UC transferability. No matching C-ID descriptor currently.

Stacey Howard (showard) (Thu, 28 Sep 2023 18:26:38 GMT): Correction on last comment: Anticipated fall 2024 implementation.

Stacey Howard (showard) (Thu, 28 Sep 2023 18:45:37 GMT): ENGI 160 - Anticipated Fall 2024 begin date of COR update ok as no rearticulation for CSU/UC transferability required. Changed term from fall 2025 to 2024. Please add "group" to term or final project. Highly recommended to add this as UC Davis will not articulate this course for any applicable major agreement in ASSIST without inclusion of a group term project. Thank you!

Stacey Howard (showard) (Thu, 28 Sep 2023 19:21:38 GMT): ENGR 242 - Suggestion addition of Differential Equations (C-ID MATH 240) as co-requisite. Previous C-ID denial due to missing co-req as per C-ID ENGR 260 descriptor and reviewer.

Stacey Howard (showard) (Thu, 28 Sep 2023 19:58:57 GMT): ENGI 240 - Anticipated fall 2024 implementation ok as CSU/UC rearticulation is not required.

Stacey Howard (showard) (Thu, 28 Sep 2023 20:10:50 GMT): ENGR 241 - Anticipated begin date of fall 2024 ok as CSU/UC rearticulation not required. C-ID ENGR 130 submission expired. Resubmission required.