Course Acronym:	CSCI
Course Number:	17
Descriptive Title:	Computer Programming in MATLAB
Division:	Mathematical Sciences
Department:	Computer Science
Course Disciplines:	Computer Science, Mathematics, and Engineering
Catalog Description:	This course is an introduction to computer programming and algorithm design using the MATLAB programming language. Students will be introduced to basic control structures, using arrays, matrices, and vectors, modeling, numerical analysis, and two- and three-dimensional graphing of scientific and engineering solutions.
Prerequisite:	Mathematics-190 with a minimum grade of C
Co-requisite:	
Recommended Preparation:	
Enrollment Limitation:	
Hours Lecture (per week):	3
Hours Laboratory (per week):	3
Outside Study Hours:	6
Total Course Hours:	108
Course Units:	4
Grading Method:	Letter Grade only
Credit Status:	Credit, degree applicable
Transfer CSU:	Yes
Effective Date:	Pending
Transfer UC:	Yes
Effective Date:	2020
General Education: ECC	
Term:	
Other:	
CSU GE:	
Term:	
Other:	
IGETC:	

Term:	
Other:	
Student Learning Outcomes:	**SLO #1 Software Development** Students, when given a specification for a program or program segment, will be able to design, code, test and document a solution in MATLAB. **SLO #2 Control Structures** Students will write MATLAB code that correctly uses control structures (and nested control structures) including conditionals (like "if"), loops (like "while" and "for") and user-defined functions. **SLO #3 Data Structures** Students will write MATLAB code that correctly uses basic data structures, including arrays, vectors, and matrices. **SLO #4 Modeling** Students will learn to use MATLAB as a tool, including its environment, syntax, and graphics capability, to model solutions for scientific, mathematical, and engineering problems, both in two and three dimensions.
Course Objectives:	1. Apply a top-down (sequential) methodology, as well as object-oriented design methodology, to develop computer algorithms into MATLAB programs. 2. Design modular MATLAB programs using functions. 3. Design and debug programs with interactive and formatted input and output. 4. Design and debug programs using control structures. 5. Demonstrate understanding and use of data structures (arrays, vectors, and matrices). 6. Use MATLAB effectively to analyze and visualize data through the implementation of two- and three-dimensional graphic solutions using numerical techniques.
Major Topics:	**I. INTRODUCTION TO MATLAB SOFTWARE ENVIRONMENT (6 hours, lecture)** 1. Starting MATLAB 2. Working in the Command Window 3. Basic operations (order of operations, formatted input and output, data files) 4. Outputting arithmetic and computational expressions **II. MATLAB BASIC DATA TYPES (6 hours, lecture)** 1. Pre-defined variables and keywords 2. Scalars and numbers 3. Variable naming rules 4. Assignment operator 5. Using MATLAB as a calculator **III. MATLAB CONTROL AND DATA STRUCTURES (6 hours, lecture)**

1. Selection structures
2. Looping structures
3. Arrays and mathematical operations on them
4. Vector analysis
5. Least-squares regression and linearization
6. Matrices and mathematical operations on them

IV. MATLAB FUNCTIONS (3 hours, lecture)

1. Learning about built-in functions
2. Application of built-in functions
3. Learning about user-defined functions
4. Development of user-defined functions

V. MATLAB SCRIPTS (3 hours, lecture)

1. What is a script?
2. How to write a script in MATLAB

VI. APPLICATIONS OF SCRIPTING IN MATLAB (15 hours, lecture)

1. Solving equation with one variable
2. Solving systems of linear equations
3. Finding minima or maxima of a function
4. Numerical differentiation and integration
5. Ordinary differential equations
6. Data interpolation
7. Series approximation and error
8. Gas equation solution
9. Recursion
10. Object-oriented programming
11. Water flow in a river
12. Car crash into a safety bumper

VII. 2-D AND 3-D GRAPHICS IN MATLAB (9 hours, lecture)

1. Using the PLOT command
2. Using the LINE command
3. Plot of a function
4. Formatting plots
5. Mesh and surface plots
6. Special graphics plots
7. Using the VIEW command

VIII. APPLICATIONS OF GRAPHICS IN MATLAB (3 hours, lecture)

1. Plotting Planck's black-body distribution law
2. Plotting R L C circuit
3. Using the VIEW command

IX. ERROR HANDLING IN MATLAB (3 hours, lecture)

1. Designing effective error handling strategies
2. Developing error handling in MATLAB

X. INTRODUCTION TO MATLAB SOFTWARE ENVIRONMENT (6 hours, lab)

1. Starting MATLAB
2. Working in the Command Window
3. Basic operations (order of operations, formatted input and output, data files)
4. Outputting arithmetic and computational expressions

XI. MATLAB BASIC DATA TYPES (6 hours, lab)

1. Pre-defined variables and keywords
2. Scalars and numbers
3. Variable naming rules
4. Assignment operator
5. Using MATLAB as a calculator

XII. MATLAB CONTROL AND DATA STRUCTURES (6 hours, lab)

1. Selection structures
2. Looping structures
3. Arrays and mathematical operations on them
4. Vector analysis
5. Least-squares regression and linearization
6. Matrices and mathematical operations on them

XIII. MATLAB FUNCTIONS (3 hours, lab)

1. Learning about built-in functions
2. Application of built-in functions
3. Learning about user-defined functions
4. Development of user-defined functions

XIV. MATLAB SCRIPTS (3 hours, lab)

1. What is a script?
2. How to write a script in MATLAB

XV. APPLICATIONS OF SCRIPTING IN MATLAB (15 hours, lab)

1. Solving equation with one variable
2. Solving systems of linear equations
3. Finding minima or maxima of a function
4. Numerical differentiation and integration
5. Ordinary differential equations
6. Data interpolation
7. Series approximation and error
8. Gas equation solution
9. Recursion
10. Object-oriented programming
11. Water flow in a river

	12. Car crash into a safety bumper **XVI. 2-D AND 3-D GRAPHICS IN MATLAB (9 hours, lab)** 1. Using the PLOT command 2. Using the LINE command 3. Plot of a function 4. Formatting plots 5. Mesh and surface plots 6. Special graphics plots 7. Using the VIEW command **XVII. APPLICATIONS OF GRAPHICS IN MATLAB (3 hours, lab)** 1. Plotting Planck's black-body distribution law 2. Plotting R L C circuit 3. Using the VIEW command **XVIII. ERROR HANDLING IN MATLAB (3 hours, lab)** 1. Designing effective error handling strategies 2. Developing error handling in MATLAB
Total Lecture Hours:	54
Total Laboratory Hours:	54
Total Hours:	108
Primary Method of Evaluation:	2) Problem solving demonstrations (computational or non-computational)
Typical Assignment Using Primary Method of Evaluation:	This program will calculate the perimeter and area of any arbitrary triangle. The user has the choice of three ways to give the input, namely 1) the length of all three sides, 2) the lengths of two sides and the measure of the included angle, or 3) the measures of two angles and the length of the included side. Once the user has entered the input, the program should perform the proper operations to calculate the lengths of all three sides of the triangle (a, b and c), the measures of all three angles (A, B and C), the perimeter of the triangle, and the area of the triangle. As you see in the diagram, side a lay opposite the angle A, side b lies opposite the angle B, and side c lies opposite the angles C. You must use functions to implement this program. Once you have finished, compare the types of inputs offered the user in your program. Which one took the least amount of code to solve? Which one took the greatest amount of code to solve? Write a short paragraph explaining why one approach required more code than the other. Write a second paragraph discussing the strengths and weaknesses inherent in offering user multiple input options.
Critical Thinking Assignment 1:	Design and write code to implement the function f(x) = x2 + 3 and find f(0). Plot the data for f(x) over x in range of x that covers all positive and negative quadrants.
Critical Thinking Assignment 2:	Given a defined set of data, use the built-in functions of MATLAB to save and then load the data using a loop. For each file you load in the loop, generate the plot for a best fit of the data.

Other Evaluation Methods:	Essay Exams, Homework Problems, Laboratory Reports, Multiple Choice, Quizzes
Instructional Methods:	Demonstration, Discussion, Lecture
If other:	
Work Outside of Class:	Answer questions, Problem solving activity, Required reading, Skill practice, Study, Written work (such as essay/composition/report/analysis/research)
If Other:	Writing computer programs
Up-To-Date Representative Textbooks:	Getting Started With MATLAB: An introduction for Scientists and Engineers. Rudra Pratap. Oxford University Press. 2016 (7th edition). ISBN-13: 978-0190602062 (Discipline Standard)
Alternative Textbooks:	
Required Supplementary Readings:	Sticklen, J., & Eskil, T.M. Introduction to Problem Solving with MATLAB, 2nd ed. (2006). Oxford University Press, ISBN13: 9780199767816 (Discipline Standard) MATLAB Programming. WIKIBOOKS. http://en.wikibooks.org/wiki/MATLAB_Programming
Other Required Materials:	
Requisite:	Prerequisite
Category:	communication or computation skill
Requisite course(s): List both prerequisites and corequisites in this box.	Mathematics-190
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	**Use MATLAB effectively to analyze and visualize data through the implementation of two- and three-dimensional graphic solutions using numerical techniques.** MATH 190 - Solve application problems using differential calculus. MATH 190 - Use computing software to solve calculus problems.
Requisite Skill:	
Requisite Skill and Matching Skill(s): Bold the requisite skill(s). If applicable	
Requisite course:	
Requisite and Matching skill(s):Bold the requisite skill. List the corresponding course objective under each skill(s).	
Requisite Skill:	Use of a computer and creating files on computer and saving them. Detailed mathematical skills.
Requisite Skill and Matching skill(s): Bold	

the requisite skill. List the corresponding course objective under each skill(s). If applicable	
Enrollment Limitations and Category:	
Enrollment Limitations Impact:	
Course Created by:	Satish Singhal
Date:	09/18/2019
Original Board Approval Date:	
Last Reviewed and/or Revised by:	Edwin Ambrosio
Date:	03/23/2023
Last Board Approval Date:	07/17/2023 effective FALL 2024