**El Camino College**
**COURSE OUTLINE OF RECORD – Approved**

## I. GENERAL COURSE INFORMATION

**Subject and Number:** **Computer Science 17**
**Descriptive Title:** **Computer Programming in MATLAB**
**Course Disciplines:** **Computer Science, Mathematics, and Engineering**
**Division:** **Mathematical Sciences**

**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.

**Conditions of Enrollment:**
**Prerequisite:** Mathematics 190

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|---|---|---|
| **Course Length:** | **X Full Term** | **Other (Specify number of weeks):** |
| **Hours Lecture:** | **3.00 hours per week** | **TBA** |
| **Hours Laboratory:** | **3.00 hours per week** | **TBA** |
| **Course Units:** | **4.00** | |

**Grading Method:** **Letter**
**Credit Status:** **Associate Degree Credit**

**Transfer CSU:** **X Effective Date:**
**Transfer UC:** **No**

**General Education:**
**El Camino College:**

**CSU GE:**

**IGETC:**

## II. OUTCOMES AND OBJECTIVES

**A. COURSE STUDENT LEARNING OUTCOMES (The course student learning outcomes are listed below, along with a representative assessment method for each. Student learning outcomes are not subject to review, revision or approval by the College Curriculum Committee)**

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.

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.

3. DATA STRUCTURES: Students will write MATLAB code that correctly uses basic data structures, including arrays, vectors, and matrices.

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.

The above SLOs were the most recent available SLOs at the time of course review. For the most current SLO statements, visit the El Camino College SLO webpage at http://www.elcamino.edu/academics/slo/.

**B. Course Student Learning Objectives (The major learning objective for students enrolled in this course are listed below, along with a representative assessment method for each)**

1. Convert algorithms to MATLAB programs.
   Written homework

2. Design modular MATLAB programs using functions.
   Laboratory reports

3. Design programs with interactive input and output.
   Laboratory reports

4. Design programs using control structures.
   Laboratory Reports

5. Design programs using arrays, vectors, and matrices.
   Laboratory Reports

6. Design and implement two- and three-dimensional graphic solutions
   Laboratory reports

**III. OUTLINE OF SUBJECT MATTER (Topics are detailed enough to enable a qualified instructor to determine the major areas that should be covered as well as ensure consistency from instructor to instructor and semester to semester.)**

| Lecture or Lab | Approximate Hours | Topic Number | Major Topics |
|---|---|---|---|
| Lecture | 6 | I | INTRODUCTION TO MATLAB SOFTWARE ENVIRONMENT<br>A. Starting MATLAB<br>B. Working in the Command Window<br>C. Basic operations<br>D. Outputting arithmetic and computational expressions |
| Lecture | 6 | II | MATLAB BASIC DATA TYPES<br>A. Pre-defined variables and keywords<br>B. Scalars and numbers<br>C. Variable naming rules<br>D. Assignment operator<br>E. Using MATLAB as a calculator |
| Lecture | 6 | III | MATLAB CONTROL AND DATA STRUCTURES<br>A. Selection structures<br>B. Looping structures<br>C. Arrays and mathematical operations on them<br>D. Vectors and mathematical operations on them<br>E. Matrices and mathematical operations on them |
| Lecture | 3 | IV | MATLAB FUNCTIONS<br>A. Learning about built-in functions<br>B. Application of built-in functions<br>C. Learning about user-defined functions<br>D. Development of user-defined functions |
| Lecture | 3 | V | MATLAB SCRIPTS<br>A. What is a script?<br>B. How to write a script in MATLAB |
| Lecture | 15 | VI | APPLICATIONS OF SCRIPTING IN MATLAB<br>A. Solving equation with one variable<br>B. Finding minima or maxima of a function<br>C. Numerical integration<br>D. Ordinary differential equations<br>E. Gas equation solution<br>F. Water flow in a river<br>G. Car crash into a safety bumper |
| Lecture | 9 | VII | 2-D AND 3-D GRAPHICS IN MATLAB<br>A. Using the PLOT command<br>B. Using the LINE command<br>C. Plot of a function<br>D. Formatting plots<br>E. Mesh and surface plots<br>F. Special graphics plots<br>G. Using the VIEW command |

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|---|---|---|---|
| Lecture | 3 | VIII | APPLICATIONS OF GRAPHICS IN MATLAB<br>A. Plotting Planck's black-body distribution law<br>B. Plotting R L C circuit<br>C. Using the VIEW command |
| Lecture | 3 | IX | ERROR HANDLING IN MATLAB<br>A. Designing effective error handling strategies<br>B. Developing error handling in MATLAB |
| Lab | 6 | X | INTRODUCTION TO MATLAB SOFTWARE ENVIRONMENT<br>A. Starting MATLAB<br>B. Working in the Command Window<br>C. Basic operations<br>D. Outputting arithmetic and computational expressions |
| Lab | 6 | XI | MATLAB BASIC DATA TYPES<br>A. Pre-defined variables and keywords<br>B. Scalars and numbers<br>C. Variable naming rules<br>D. Assignment operator<br>E. Using MATLAB as a calculator |
| Lab | 6 | XII | MATLAB CONTROL AND DATA STRUCTURES<br>A. Selection structures<br>B. Looping structures<br>C. Arrays and mathematical operations on them<br>D. Vectors and mathematical operations on them<br>E. Matrices and mathematical operations on them |
| Lab | 3 | XIII | MATLAB FUNCTIONS<br>A. Learning about built-in functions<br>B. Application of built-in functions<br>C. Learning about user-defined functions<br>D. Development of user-defined functions |
| Lab | 3 | XIV | MATLAB SCRIPTS<br>A. What is a script?<br>B. How to write a script in MATLAB |
| Lab | 15 | XV | APPLICATIONS OF SCRIPTING IN MATLAB<br>A. Solving equation with one variable<br>B. Finding minima or maxima of a function<br>C. Numerical integration<br>D. Ordinary differential equations<br>E. Gas equation solution<br>F. Water flow in a river<br>G. Car crash into a safety bumper |
| Lab | 9 | XVI | 2-D AND 3-D GRAPHICS IN MATLAB<br>A. Using the PLOT command<br>B. Using the LINE command<br>C. Plot of a function<br>D. Formatting plots<br>E. Mesh and surface plots<br>F. Special graphics plots<br>G. Using the VIEW command |

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|---|---|---|---|
| Lab | 3 | XVII | APPLICATIONS OF GRAPHICS IN MATLAB<br>A. Plotting Planck's black-body distribution law<br>B. Plotting R L C circuit<br>C. Using the VIEW command |
| Lab | 3 | XVIII | ERROR HANDLING IN MATLAB<br>A. Designing effective error handling strategies<br>B. Developing error handling in MATLAB |
| **Total Lecture Hours** | | **54** | |
| **Total Laboratory Hours** | | **54** | |
| **Total Hours** | | **108** | |

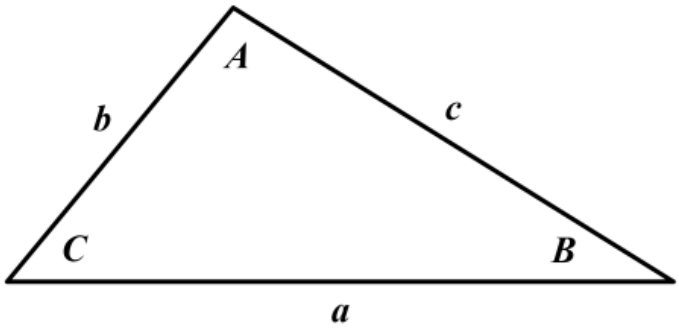
## IV. PRIMARY METHODS OF EVALUATION AND SAMPLE ASSIGNMENTS

### A. PRIMARY METHOD OF EVALUATION

Problem solving demonstrations (computational or non-computational)

### B. 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.

### C. COLLEGE LEVEL CRITICAL THINKING ASSIGNMENTS

1. Design and write code to implement the function $f(x) = x^2 + 3$ and find f(0). Plot the data for f(x) over x in range of x that covers all positive and negative quadrants.

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.

### D. OTHER TYPICAL ASSESSMENT AND EVALUATION METHODS

Essay Exams
Quizzes
Homework Problems
Laboratory Reports
Multiple Choice

## V. INSTRUCTIONAL METHODS

Lecture
Discussion
Demonstration

**Note: In compliance with Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973, and Sections 504 and 508 of the Americans with Disabilities Act, instructional delivery shall provide access, full inclusion, and effective communication for students with disabilities.**

## VI. WORK OUTSIDE OF CLASS

Study
Answer questions
Skill practice
Required reading
Problem solving activity
Written work (such as essay/composition/report/analysis/research)
Other (specify) **(writing computer programs)**

**Estimated Study Hours Per Week: 6**

## VII. TEXTS AND MATERIALS

### A. 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

### B. ALTERNATIVE TEXTBOOKS (title, author, publisher, year)

### C. REQUIRED SUPPLEMENTARY READINGS

Introduction to Problem Solving with MATLAB, second edition, Jon Sticklen and M. Taner Eskil. Oxford University Press. 2006 ISBN13: 9780199767816

MATLAB Programming. WIKIBOOKS. http://en.wikibooks.org/wiki/MATLAB_Programming

### D. OTHER REQUIRED MATERIALS

## VIII. CONDITIONS OF ENROLLMENT

### A. Requisites (Course and Non-Course Prerequisites and Corequisites)

| Requisites | Category and Justification |
|---|---|
| Course Prerequisite Mathematics-190 | Computation/Communication Skills |
| Non-Course Prerequisite | This course requires specific knowledge related to problem solving that is essential to successfully passing the course. If a person does not have this knowledge and the associated skills, either through previous work experience, they may not succeed in the course. |

### B. Requisite Skills

| Requisite Skills |
|---|

### C. Recommended Preparations (Course and Non-Course)

| Recommended Preparation | Category and Justification |
|---|---|
| | |

### D. Recommended Skills

| Recommended Skills |
|---|
| 1. Use of a computer and creating files on computer and saving them.<br><br>2. Detailed mathematical skills. |

### E. Enrollment Limitations

| Enrollment Limitations and Category | Enrollment Limitations Impact |
|---|---|

**Course created by Edwin Ambrosia, Fall 2019**

**BOARD APPROVAL DATE: 12/16/2019**

**LAST BOARD APPROVAL DATE:**

**I. Course Delivery Method/s** (Check all that apply.)

☒ **Online:** Complete Section A: Online refers to courses offered fully (100%) online. All approved instructional contact hours are delivered through online interactions with no mandatory on campus class meetings or assessments.

☒ **Hybrid:** Complete Section B: Hybrid refers to courses being partially offered online. Some of the approved instructional contact hours are delivered through online interactions. The remaining contact hours are conducted through scheduled on campus class meetings and are noted in the schedule of classes.

**A. Online Delivery**

**1. Learning Management System (LMS)**

☒ Instructors agree to use the current College-approved Learning Management System.

**2. Methods of Regular Effective Contact Between Instructor and Students and Among Students**
(Check all that apply.)

☒ One-on-One Faculty-Student Communication, including office hours if required (through LMS, email, chat rooms, Zoom, telephone, texts, social media, etc.)

☒ Electronic Announcements (through LMS, email, blogs, text, social media, etc.)
☒ Timely Feedback and Comments on Student Work (through LMS, ECC Connect, email, etc.)
☒ Facilitated Group Discussions (through LMS, Zoom, chat rooms, social media, etc.)
☒ Collaborative Group Work (through LMS, GoogleDocs, etc.)
☐ Other (Please specify.)

**3. Methods of Evaluation**

☒Methods of Evaluation do NOT differ from those in the Course Outline of Record

☐ Methods of Evaluation listed in the Course Outline of Record are modified or supplemented. (Please explain.)

**4. Administration of Examinations**

☒ Electronic (through the LMS, proctored and/or un-proctored)

☐ Not applicable (Please specify)

☐Other (Please specify)

**5. Text/Supplemental Readings/Materials**

☒Texts, Supplemental Readings, and Materials do NOT differ from those listed in the Course Outline of Record

☐ Texts, Supplemental Readings, and Materials differ from those listed in the Course Outline of Record and are modified or supplemented. (Please explain.)

**6. Accommodations for Students with Disabilities and Instructional Delivery**

In compliance with ECC Board Policies 1600 and 3410, Title 5 California Code of Regulations, the Rehabilitation Act of 1973 – Sections 504 and 508, and the Americans with Disabilities Act, instructional delivery shall provide access, full inclusion, and effective communication for students with disabilities. Instructional delivery methods may include, but are not limited to, Braille/audiotape for print material, on-site interpreter/real-time transcription/live captioning for audio material, captioning for video material, alternative text for images, and captioning of audio information for electronic media materials (such as web and online).

☒ Instructors of the online version of this course will read and will comply with the Accommodations for Students with Disabilities and Instructional Delivery.

**B. Hybrid Delivery**

**1.** ☒ Instructors agree to use the current College-approved course management system.

**2. Methods of Regular Effective Contact Between Instructor and Students and Among Students**
(Check all that apply.)

☒ One-on-One Faculty-Student Communication, including office hours if required, (through email, chat rooms, Zoom, telephone, texts, social media, etc.)

☒ Electronic Announcements (through LMS, email, blogs, text, social media, etc.)

☒ Timely Feedback and Comments on Student Work (through LMS, ECC Connect, email, etc.)

☒ Facilitated Group Discussions (through LMS, Zoom, chat rooms, social media, etc.)
☒ Collaborative Group Work (through LMS, GoogleDocs, etc.)
☐ Other

**3. Methods of Evaluation**

☒Methods of Evaluation do NOT differ from those in the Course Outline of Record
☐ Methods of Evaluation listed in the Course Outline of Record are modified or supplemented. (Please explain.)

**4. Administration of Examinations**

☒ On Campus
☒ Electronic (through the LMS proctored and/or un-proctored)
☐ Not applicable (Please specify)
☐Other (Please specify)

**5. Text/Supplemental Readings/Materials**

☒Texts, Supplemental Readings, and Materials do NOT differ from those listed in the Course Outline of Record
☐ Texts, Supplemental Readings, and Materials differ from those listed in the Course Outline of Record and are modified or supplemented. (Please explain.)

**6. Accommodations for Students with Disabilities and Instructional Delivery**

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☒ Instructors of the hybrid version of this course will read and will comply with the Accommodations for Students with Disabilities and Instructional Delivery.