ENGR R148: PROGRAMMING AND PROBLEM-SOLVING IN MATLAB

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
ENGR - Engineering

Course Number (CB01B)
R148

Course Title (CB02)
Programming and Problem-Solving in MATLAB

Banner/Short Title
Programming in MATLAB

Credit Type
Credit

Start Term
Fall 2021

Co-listed (Same-as) Course(s)
MATH R148

Taxonomy of Programs (TOP) Code (CB03)

0901.00 - Engineering, General (requires Calculus) (Transfer)

SAM Priority Code (CB09)

E - Non-Occupational

Control Number

CCC000570318

Primary Minimum Qualification

ENGINEERING

Department

Math (2170)

Division

Oxnard Math/Science/HED/Athletics/PE

Catalog Course Description
This course utilizes the MATLAB environment to provide students with a working knowledge of computer-based problem-solving methods relevant to science and engineering. It introduces the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Examples and assignments in the course are drawn from practical applications in engineering, physics, and mathematics. Same as MATH R148.

Taxonomy of Programs (TOP) Code (CB03)
0901.00 - Engineering, General (requires Calculus) (Transfer)

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
2 - Not Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
35
Maximum Contact/In-Class Lecture Hours
35

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
87.5
Total Maximum Contact/In-Class Hours
87.5

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
70
Maximum Outside-of-Class Hours
70

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
157.5
Total Maximum Student Learning Hours
157.5

Minimum Units (CB07)
3
Maximum Units (CB06)
3

Prerequisites
MATH R120

Requisite Justification

Requisite Type
Prerequisite

Requisite
MATH R120

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Required by 4 year institution

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	Students will create, test, and debug sequential MATLAB programs, as well as programs that use object-oriented techniques, in order to achieve computational objectives.
2	Students will apply numeric techniques and computer simulations to analyze and solve engineering-related problems.

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Apply a top-down design methodology to develop computer algorithms.
2	Create, test and debug sequential MATLAB programs, as well as programs that use object-oriented techniques, in order to achieve computational objectives.
3	Apply numeric techniques and computer simulations to analyze and solve engineering-related problems.
4	Use MATLAB effectively to analyze and visualize data.
5	Demonstrate understanding and use of standard data structures.

Course Content

Lecture/Course Content

1. Overview of computer systems and the MATLAB environment
2. Variables, expressions, and order of operation
3. Elementary functions
4. Array definitions and operations
5. Computational problem-solving methodology
6. Pseudocode, flowcharts, and documentation
7. Formatted input and output
8. Data files
9. Plotting
10. Selection programming structures
11. Repetition programming structures
12. MATLAB functions and user-defined functions
13. Recursion
14. Data structures
15. Sorting and searching
16. Object-oriented programming
17. Graphical user interfaces (optional)

Numerical Analysis Techniques (embedded within topics above):

1. Solving systems of linear equations
2. Vector analysis
3. Data interpolation
4. Least-squares regression and linearization
5. Numerical differentiation and integration
6. Solving ordinary differential equations
7. Series approximation and error
8. Solving equations of one variable

9. Optimization (optional)
10. Stochastic simulation (optional)

Laboratory or Activity Content

1. Laboratory activities require students to explore and apply concepts covered in lecture portion of the course, and should reflect a variety of practical applications.
   a. data files
   b. plotting
   c. sorting and searching
   d. solving systems of linear equations
   e. data interpolation
   f. least-squares regression and linearization
   g. numerical differentiation and integration
   h. solving ordinary differential equations
   i. solving equations of one variable
   j. various applications in the STEM fields

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Problem solving exercises
Written expression

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Laboratory activities
Laboratory reports
Objective exams
Problem-Solving Assignments
Problem-solving exams
Quizzes

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Computer-aided presentations
Distance Education
Demonstrations
Instructor-guided interpretation and analysis
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

1. Computer aided presentation: The instructor will employ the computer to aid in the presentation of course materials which will include the direct usage and application of the MATLAB program.
2. Demonstrations: The instructor will demonstrate usage of the program as to properly convey syntax, applicable methods, and the application sound logic.
3. Distance Education: When applicable, recordings of lectures will be used to convey subject matter. Also, the use of discussion boards and virtual meetings will be used to impart course material and allow students to ask questions regarding the course and its material.
4. Instructor guided analysis: The instructor will work through various problems and exercises during class that explore a given system or notion in which the students will follow along, answering questions posed by the instructor. This will also serve as a forum for students to ask particular questions regarding the logic, methods, and syntax employed to produce certain effects regarding said exercise.
5. Laboratory activities: The lab portion of the class is embedded in the lecture as course material discussed by the instructor and exercises/activities are often done simultaneously.
6. Lecture: The instructor will deliver the course subject matter via in-person lectures to the students. For example, Matrix operations using MATLAB.

7. Small group activities: These may be employed in the form of group exercises in working through the production of a particular program that achieves a desired effect.

Representative Course Assignments

Writing Assignments

1. Students are expected to do weekly homework assignments based on the reading, maintain a laboratory journal, and write up laboratory reports in a format best used for communication.

Critical Thinking Assignments

1. Answering a wide array of homework, quiz, and exam questions requiring the analysis of a given physical system or circumstance in order to come to the correct conclusion and/or answer regarding the question and/or desired outcome. For instance, develop a program that produces the results of the magnitude and direction of the electric field due at 100 points due to 5 point charges positioned at various locations in a Cartesian coordinate system.

Reading Assignments

1. Regular textbook readings that reinforce the concepts discussed and/or demonstrated during the class meetings. These readings typically include programming principles and "how to", data tables, definitions, programming examples, and practical applications of programming.

Skills Demonstrations

None

Other assignments (if applicable)

None

Outside Assignments

Representative Outside Assignments

1. Assigned reading from the textbook typically amounting to one hour per week of reading.
2. Assigned problem solving and setup based homework that further investigates, explores, and utilizes the notions and processes discussed throughout the course. Typically, homework sets will require 3 hours to fully complete and will be due on a weekly basis.
3. Studying and preparing for quizzes and exams.

Articulation

Comparable Courses within the VCCCD

ENGR V14 - MATLAB: Programming and Problem Solving

District General Education

A. Natural Sciences

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Textbook

Description
Moore, H. (2018). *MATLAB for Engineers* (5th). Boston, Pearson

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Resource Type
Software

Description
MATLAB. MathWorks.

Distance Education Addendum

Definitions

Distance Education Modalities

Hybrid (51%–99% online)
Hybrid (1%–50% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class problem.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.
Other DE (e.g., recorded lectures)	Recordings of data acquisition and/or simulation use regarding a given lab experiment may be used.

Hybrid (51%–99% online) Modality:

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Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
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Other DE (e.g., recorded lectures)	Recordings of data acquisition and/or simulation use regarding a given lab experiment may be used.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
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Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Other DE (e.g., recorded lectures)	Recordings of data acquisition and/or simulation use regarding a given lab activity may be used.

Examinations

Hybrid (1%–50% online) Modality
Online
On campus

Hybrid (51%–99% online) Modality
Online
On campus

Primary Minimum Qualification
ENGINEERING

Review and Approval Dates

Department Chair
09/04/2020

Dean
09/04/2020

Technical Review
09/23/2020

Curriculum Committee
09/23/2020

Curriculum Committee
11/25/2020

CCCCO
MM/DD/YYYY

Control Number
CCC000570615

DOE/accreditation approval date
MM/DD/YYYY