TAFTCOLLEGE

Reviewed by: P. Blake
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Textbook update: Spring 2022
C & GE Update: April 21, 2022
Board approved: May 11, 2022
Semester effective:

Engineering (ENGR) 1550 Computer Programming and Problem Solving with Lab (3 Units) CSU: UC

Prerequisite: Successful completion of MATH 2100 Analytic Geometry and Calculus I with a grade of 'C' or better

Prerequisite knowledge/skills: Before entering the course the student should be able to

1. understand the use of functional notation,
2. plot and interpret graphs of functions,
3. differentiate algebraic, trigonometric, exponential, logarithmic and hyperbolic functions,
4. apply derivatives,
5. find the integrals of basic functions and
6. complete items 1-5 above by both hand computations and computer assisted

Advisory: Eligibility for English 1500 or 1501 strongly recommended

Hours and Unit Calculations:
32 hours lecture. 64 Outside-of-class hours. 48 Hours Lab. (144 Total Student Learning Hours) 3 Units

Catalog Description: This course utilizes engineering computing environments 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, data structures and interfacing with sensors. Examples and assignments in the course are drawn from practical applications in engineering, physics, and mathematics. Lab activities will include computer controls and integration with sensors and test equipment, data acquisition and analysis. C-ID: ENGR 220.

Type of Class/Course: Transfer Degree Credit

Text: Moore, Holly. *MATLAB for Engineers.* 5th ed. Boston, Pearson, 2018.

Course Objectives:

By the end of the course a successful student will be able to

1. Use computer engineering tools (MATLAB & EXCEL) effectively to analyze and visualize data,
2. Demonstrate understanding and use of standard data structures,
3. Apply a top-down design methodology to develop computer algorithms,
4. Create, test and debug sequential programs, as well as programs that use object-oriented techniques, in order to achieve computational objectives, and
5. Apply numeric techniques and computer simulations to analyze, optimize and solve engineering-related problems.

Course Scope and Content (Lecture):

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Unit I Basic Functions and User Interface
- A. Plotting Data and Customized Plots
- B. Calculating Best fit line
- C. Functions
- D. Variables, expressions, and order of operation
- E. Array Definitions
- F. Data Structure
- G. Help

Unit II Variables and Expressions
- A. Entering Commands
- B. Creating and Modifying Variables
- C. Character Variables

Unit III Processes and Programming
- A. Computational problem-solving methodology
- B. Pseudocode, flowcharts, and documentation
- C. Selection programming structures
- D. Repetition programming structures
- E. Object Oriented programming
- F. Scripting
- G. Logical Operations

Unit IV Vector Analysis and Visualization
- A. Calculations
- B. Plotting and annotating

Unit V Matrix Analysis and Visualization
- A. Size and Dimensionality
- B. Calculations
- C. Simultaneous Equation Solving

Unit VI Data I/O (Input/Output)
- A. Import from fixed structure files
- B. Import from spreadsheets and text delimited files
- C. Import from data acquisition systems
- D. File Output

Unit VII Multiple Axis Plots
- A. Structures
- B. Plotting
- C. Color
- D. Customization

Unit VIII Errors
- A. Round Off
- B. Truncation
- C. Uncertainty

Unit IX Data Analysis
- A. Correlation
- B. Missing Data

C. Sorting and Searching
D. Curve Fitting
E. Structural Analysis
F. Regression Models

Unit X Other Topics
A. Numerical Integration
B. Ordinary Differential Equations

Course Scope and Content (Lab):

Unit I Lab Orientation
A. Safety
B. Procedures
C. Notebook Techniques

Unit II Equipment Orientation
A. Data Acquisition
B. Sensor Interface
C. Calibration

Unit III Data Acquisition
A. Setup
B. Timing - Frequency
C. Wiring

Unit IV Data Analysis
A. Graphing
B. Analysis
C. Outliers
D. Trends

Unit V Statistical Analysis
A. Basic Functions
B. Variance
C. Trends
D. Curve Fitting

Unit VI Sensors
A. Capacitance
B. Proximity
C. UV
D. Magnetic
E. Temperature
F. Sonic

Unit VII Controls with Sensors
A. Response Time
B. Priority Loops
C. Logical Controls
D. False Positives

Activities Required Outside of Class:

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The students in this class will spend a minimum of 5 hours per week outside of the regular class time doing the following:

1. Reading, studying and preparing for tests, quizzes and performing hands-on work in the laboratory demonstrating capability to perform calculations and engineering problem solving techniques.
2. Completing lab assignments and homework

Methods of Instruction:

1. Lecture
2. Demonstrations and discussions
3. Lab exercises
4. Guest Speakers
5. Field Trips

Methods of Evaluation:

1. Quizzes
2. Examinations
3. Participation
4. Individual assignments and group exercises
5. Lab Practicals
6. Lab Notebooks

Laboratory Category: Extensive Laboratory

Pre delivery criteria: All of the following criteria are met by this lab.
1. Curriculum development for each lab.
2. Published schedule of individual laboratory activities.
3. Published laboratory activity objectives.
4. Published methods of evaluation.
5. Supervision of equipment maintenance, laboratory setup, and acquisition of lab materials and supplies.

During laboratory activity of the laboratory: All of the following criteria are met by this lab.
1. Instructor is physically present in lab when students are performing lab activities.
2. Instructor is responsible for active facilitation of laboratory learning.
3. Instructor is responsible for active delivery of curriculum.
4. Instructor is required for safety and mentoring of lab activities.
5. Instructor is responsible for presentation of significant evaluation.

Post laboratory activity of the laboratory: All of the following criteria are met by this lab.

1. Instructor is responsible for personal evaluation of significant student outcomes (lab exercises, exams, practicals, notebooks, portfolios, etc.) that become a component of the student grade that cover the majority of lab exercises performed during the course.
2. Instructor is responsible for supervision of laboratory clean up of equipment and materials.

Supplemental Data:

TOP Code:	090100: Engineering, General (requires
SAM Priority Code:	E: Non-Occupational
Distance Education:	Not Applicable
Funding Agency:	Y: Not Applicable(funds not used)
Program Status:	1: Program Applicable
Noncredit Category:	Y: Not Applicable, Credit Course
Special Class Status:	N: Course is not a special class
Basic Skills Status:	N: Course is not a basic skills course
Prior to College Level:	Y: Not applicable
Cooperative Work Experience:	N: Is not part of a cooperative work experience education program
Eligible for Credit by Exam:	E: Credit By Exam
Eligible for Pass/No Pass:	NO
Taft College General Education:	NONE
Discipline	Engineering