TAFT COLLEGE
West Kern Community College District

Prepared by: P. Blake
Reviewed by: G. Golling
Reviewed by: S. Aunai
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Engineering (ENGR) 1550 Computer Programming and Hardware Interface Controls (3 Units) CSU:UC

Prerequisite: Successful completion of Mathematics (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 strongly recommended

Total Hours: 40 hours lecture; 24 hours lab (64 hours total)

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 hardware. 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 hardware test equipment, data acquisition and mechanical sensors setup and user interface. C-ID: ENGR 220

Type of Class/Course: Transfer Degree Credit

Text: Palm III, William J. *Introduction to MATLAB® for Engineers*, 3 ed. New York: McGraw, 2011. Print.

Larsen, Ronald W. *Engineering with Excel*. 4th ed. Boston: Pearson, 2013. Print.

Moore, Holly. *MATHLAB for Engineers*.4th ed. Boston, Pearson, 2015. Print

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 and solve engineering-related problems.

Course Scope and Content (Lecture):

Unit I MATLAB & EXCEL – Basic Functions and User Interface
- A. Plotting Data and Customized Plots
- B. Calculating Statistics & 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 MATLAB & EXCEL 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

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

Unit V Matric Analysis and Visualization
- A. Size and Dimensionality
- B. Calculations
- C. Statistics
- D. Plotting
- E. Reshaping

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 Vector Plots
- A. Structures

B. Plotting
C. Color
D. Customization

Unit VIII Programming
A. Data I/O
B. Constructs
C. Logical Operations

Unit IX Errors
A. Round Off
B. Truncation
C. Uncertainty

Unit X Data Analysis
A. Correlation
B. Missing Data
C. Sorting and Searching
D. Curve Fitting
E. Structural Analysis
F. Regression Models
G. Solving Linear systems of Equations

Unit XI 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. Multimeters
B. Data Acquisition
C. Sensor Interface
D. 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 Data Acquisition with Sensors
- A. Setup
- B. Timing – Frequency
- C. Wiring

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

Activities Required Outside of Class:

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