The University of Jordan
School of Engineering
Electrical Engineering Department
2nd Semester – A.Y. 2020/2021

Course: **Computer Applications – 0933201 (1 Cr. – Required Course)**

Instructor: Prof. Mohammed Hawa
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Office Hours: Will be posted soon

Course website: http://www.hawa.work/201/

Catalog description: Computer packages for mathematical and symbolic manipulations (MATLAB, Mathematica). MATLAB variables, vectors and matrices. Built-in functions. Operator precedence. Matrix indexing. Complex numbers. Polynomials. Cells arrays. Structures. Script Files. User Input/Output. User defined functions. Local vs. global variables. Program writing skills. Flowchart versus pseudocode. Relational operators and conditional statements. Flow control structures and loops. Plotting. Figure annotations. Numerical solutions for various calculus problems: differentiation, integration, ordinary differential equations, etc. MATLAB symbolic engine. Using symbolic capabilities for liner algebra, calculus and other problems. Introduction to Simulink and its libraries. Simulating some engineering systems and finding solutions. Practical exercises.

Prerequisites by course: **IT** **1931102** Computer Skills for Scientific Faculties (pre-requisite)

Prerequisites by topic: Students are assumed to have a background in the following topics:
- Basic computer programming language skills, such as C/C++.
- Basic mathematics (linear algebra, vectors, calculus, differential equations).
- Basic electric circuit analysis techniques.

Textbook: **Introduction to MATLAB for Engineers by William J. Palm III, 3rd Edition, McGraw-Hill Education, 2011.**

References:

1. Essential MATLAB for Engineers and Scientists by Brian Hahn and Daniel T. Valentine, 6th edition, Academic Press, 2017.
2. MATLAB for Engineers by Holly Moore, 5th edition, Pearson, 2017.
3. Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers by Rudra Pratap, 7th edition, Oxford University Press, 2016.
4. MATLAB Programming with Applications for Engineers by Stephen J. Chapman, 1st edition, CL-Engineering, 2012.
5. An Engineers Guide to MATLAB by Edward B. Magrab, Shapour Azarm, Balakumar Balachandran, James Duncan, Keith Herold and Gregory Walsh, 3rd edition, Pearson, 2010.

6. Mastering MATLAB by Duane C. Hanselman and Bruce L. Littlefield, 1st edition, Pearson, 2011.
7. Modeling and Simulation in SIMULINK for Engineers and Scientists by Mohammad Nuruzzaman, 1st Edition, AuthorHouse, 2005.
8. Mastering Simulink by James B. Dabney and Thomas L. Harman, 1st edition, Pearson, 2003.

Schedule: 16 Weeks, 42 lectures (50 minutes each) plus exams.

Course goals: The overall objective is to introduce the student to solving engineering problems using computers and scientific programming packages, specifically MATLAB.

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student will: **[SO]**

1. Use MATLAB to solve computational problems and generate publishable graphics. **[1]**
2. Be able to use complex arithmetic and complex functions to describe applied problems. Describe complex numbers and functions in rectangular and exponential forms. Graph the magnitude and phase of complex functions. **[1]**
3. Be able to use matrix forms to describe and solve linear systems of equations and systems of differential equations. **[1]**
4. Determine the system of linear equations required to find the coefficients that define an interpolating function that matches a set of data samples. **[1]**
5. Be able to solve first and second order linear differential equations with constant coefficients both analytically and numerically. Use the MATLAB routine ODE23 to solve differential equations numerically. **[1]**
6. Compute the Fourier series and transform from their definition as integrals. **[1]**
7. Use the properties of linearity, time-shifting and time-scaling to compute the Fourier series/transform of complex functions from the Fourier series/transforms of simple functions. **[1]**
8. Use the Simulink simulation package to simulate some electric and electronic circuits. **[1]**

Course topics:

		Hrs
1.	Introduction to MATLAB and its use cases. Using the workspace to explore MATLAB features regarding ease of use and versatility. Entering commands. Using MATLAB help.	**2**
2.	General number formatting. Variables, Vectors and Matrices. Built-in MATLAB engineering functions. Matrix-related functions. Operator precedence. Matrix indexing: row and column versus linear versus logical indexing. Matrix versus element-by-elemtn operations.	**3**
3.	Solving a system of linear equations. The concept of vectorization and its use in speeding computations.	**2**
4.	Euclidean Vectors and their operations. Complex numbers. Polynomials. Cells arrays. Structures.	**2**
5.	Script Files. Header comments. User Input/Output commands. The concept of functions in MATLAB and how to build user defined functions. Local vs. global variables. Subfunctions. Inline functions and function handles. Importing data: text, Excel, images, audio, etc.	**3**

6.	Writing general-purpose programs in MATLAB. Flowchart versus pseudocode. Relational operators and conditional statements. Flow control structures and loops. Practical exercises.	**4**
7.	Plotting. The different plot types available. Figure annotations. Three dimensional plots.	**3**
8.	Using MATLAB buil-in functions to obtain numerical solutions for various calculus problems: differentiation, integration, ordinary differential equations, etc.	**2**
9.	MATLAB symbolic engine. Using symbolic notation to define and plot functions. Using symbolic capapilities for liner algebra, calculus and other problems. Introduction to MuPAD.	**2**
10.	Introduction to Simulink and its libraries. Simulating some engineering systems and finding solutions. Linking Simulink with the MATLAB workspace.	**2**

Ground rules: Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are not allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered cumulative. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessment & grading policy:

Assignments	10%	Quizzes	10%
First Exam	0%	Projects	10%
Midterm Exam	30%	Lab Reports	0%
Final Exam	40%	Presentation	0%
		Total	**100%**

Last Revised: March 2021