جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Programming with Matlab and Mathematica - AMCS 107

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	AMCS 107
Course Title	Programming with Matlab and Mathematica
Academic Semester	Summer
Academic Year	2016/2017
Semester Start Date	06/04/2017
Semester End Date	08/03/2017
Class Schedule (Days & Time)	09:00 AM - 12:00 PM | Mon Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Lajos Mihaly Loczi	lajos.loczi@kaust.edu.sa	+966542615174	4200-CU12, Level 4, Building 1, 1, Al-Khawarizmi (bldg. 1)	TBA
Maria Alexandra Gomes	Alexandra.Gomes@KAUST.EDU.SA	+966128080652		Available to students anytime I am in my office or email me for an appointment.

Teaching Assistant(s)

Name	Email
TBA	TBA

Course Information

Comprehensive Course Description	Both Mathematica and Matlab are powerful coding languages in science and engineering computing. This course is an application-oriented introduction to the two languages. The student will be exposed to simple math computations, modeling and simulation problems, data analysis and processing, as well as visualization techniques. For the Mathematica module: 1. Introduction to Mathematica and to the Wolfram Language (knowl- edge-based language, built-in support for real-world entities, Wolfram Alpha and the Wolfram Demonstrations Project). 2. Typesetting and presenting your work and data (2D typesetting and LaTeX output, 2D/3D charts, deploying interactive documents, 100+ supported file formats for import and export). 3. Numerical and symbolic computations (arbitrary-precision arithmetic and automatic precision tracking, dynamic interactivity). 4. Lists, strings, rules, patterns and pattern matching. 5. Different programming paradigms (procedural, functional and rule- based). 6. Graphics and image manipulation (the 30+ members of the plot family, pixels and voxels, the built-in image editor). 7. Linear and polynomial algebra. Exact and numerical optimization. Calculus and differential equations (analytic and numerical solutions of ODEs and PDEs). Plane and solid geometry. Probability and statistics (descriptive statistics, built-in support for 100+ distributions). For the Matlab module: 1. Starting with Matlab: arithmetic operations with scalars, display for- mats, elementary built-in functions, scalar variables. 2. Creating, manipulating and operating arrays. 3. Creating and running script files. Global variables. Input and output. 4. Two-dimensional plots. 5. Functions and function files. Local and global variables. Inline functions. 6. Programming in Matlab: relational and logical operators, conditional statements, loops and nested loops. 7. Polynomials and interpolation. Linear algebra 8. Applications in numerical analysis: solving a one-variable equation, optimization, integration and ordinary differential equations.
Course Description from Program Guide	This course gives an introduction to MATLAB and Mathematica. It is designed to give students fluency in these two (2) mathematical software. The course consists of interactive lectures with students doing sample programming problems in real time.
Goals and Objectives	The goal of AMCS107 is to introduce students to the fundamental com- mands and structure of Mathematica and Matlab. The course covers the basic syntax and semantics of the two languages, including basic data types, variables, control structures and functions or similar concepts, and visualiza- tion of results and processed data. The course is oriented towards scientific applications, with special emphasis on engineering. At the end of the course, the student is expected to 1. understand the fundaments of procedural and functional programming; 2. dominate both Mathematica and Matlab data types and structure; 3. be able to set up simple engineering problems such that they can be solved and visualized using basic codes in both languages; 4. be ready to use advanced coding in Mathematica and Matlab in their subsequent studies.
Required Knowledge	Undergraduate Calculus.
Reference Texts	For the Mathematica module: https://www.wolfram.com/language/elementary-introduction/ For the Matlab module: Essential MATLAB for Engineers and Scientists, 6th Edition, Brian Hahn; Daniel T. Valentine, Academic Press, Web ISBN-13: 978-0-12-805271-6, available through KAUST library.
Method of evaluation	**20.00**% - Course Project(s) **80.00**% - Quiz(zes)

Nature of the assignments	The final grade is given in a Satisfactory(S)/Unsatisfactory(U) system. To pass the course with a Satisfactory grade (S), the student should obtain at least 70%. Each of the two modules contributes equally to the final grade. During each module, there will be 5 in-class quizzes, each worth 8% (5x8%=40%). The duration of a quiz is about 20 minutes. At the end of the modules, each student will create a Mathematica project (for 10%) and a MATLAB project (for 10%), which they will present in the last class of the module.
Course Policies	Grades will be posted on the course Blackboard page. If you dispute your grade on any assessment, you may request a re-grade only within 48 hours of receiving the graded evaluation. The students are required to attend all lectures and to take notes. Students that do not show up for a quiz or final project should expect a zero in that assessment.
Additional Information	Class notices and course related information will be posted periodically on the AMCS107 e-mail list and website. Please check regularly for important information. Also, there may be impor- tant email communications, so it is important to monitor your email account on a daily basis.

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 06/05/2017 Thu 06/08/2017	Introduction to Mathematica and to the Wolfram Language. 2D typesetting and LaTeX output, 2D/3D charts, deploying interactive documents, file formats for import and export.
2	Mon 06/12/2017 Thu 06/15/2017	Numerical and symbolic computations. Lists, strings, rules, patterns and pattern matching.
3	Mon 06/19/2017 Thu 06/22/2017	Different programming paradigms: procedural, functional and rule-based. Graphics and image manipulation.
4	Mon 06/26/2017 Thu 06/29/2017	.
5	Mon 07/03/2017 Thu 07/06/2017	Linear and polynomial algebra. Optimization. Calculus and differential equations. Plane and solid geometry. Probability and statistics. Mathematica project presentation.
6	Mon 07/10/2017 Thu 07/13/2017	Starting with Matlab. Applications: heat transfer and compounded interest. Arrays. Applications: Electrical resistive network and motion of 2 particles. Script files. Applications: centroid of a composite area. 2D plots. Applications: piston-crack mechanism and electric dipole.
7	Mon 07/17/2017 Thu 07/20/2017	Functions and function files. Applications: exponential growth and decay and motion of a projectile. Programming in Matlab. Applications: flight of a model rocket and AC to DC converter.
8	Mon 07/24/2017 Thu 07/27/2017	Polynomials and interpolation. Applications: size of a capacitor and temperature dependence of viscosity. Linear algebra. Applications: forces in a truss and mechanical vibrations. Solving a one-variable equation. Application: the ideal gas equation. Optimization. Application: maximum view angle.
9	Mon 07/31/2017 Thu 08/03/2017	Numerical integration. Application: water flow in a river. ODE. Application: the mechanical pendulum. Matlab project presentation.
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Note

The instructor reserves the right to make changes to this syllabus as necessary.