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

Course Syllabus: Linear Algebra - AMCS 151

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	AMCS 151
Course Title	Linear Algebra
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	04:00 PM - 05:30 PM | Mon Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Maria Alexandra Gomes	Alexandra.Gomes@KAUST.EDU.SA	+966128080652		Available to students anytime I am in my office (building 1, 4th floor, office 4303, library side) or email for an appointment.

Teaching Assistant(s)

Name	Email
TBA	TBA

Course Information

Comprehensive Course Description	Vectors and Matrices: Vectors and Linear Combinations. Dot Product and Distance. Matrices. Systems of Linear Equations: Elimination. Matrix Operations. Inverse Matrices. LU Factorization. Transposes and Permutations. Vector Spaces and Subspaces: Spaces of Vectors. Nullspace. Rank and Row Reduced Form. Complete Solution of Ax=b. Independence, Basis and Dimension. Fundamental Subspaces. Orthogonality: Orthogonality and Projections. Least Squares. Orthogonal Basis and Gram-Schimdt. Determinants: Properties of Determinants. Cofactors. Cramer's Rule and Cross Product. Eigenvalues and Eigenvectors: Eigenvalues. Diagonalization of a Matrix. Symmetric Matrices. Positive Definite Matrices. Similar Matrices. Singular Value Decomposition. Applications to Engineering: differential equations, graphs and networks, linear programming.
Course Description from Program Guide	This is a basic subject on matrix theory and linear algebra. Emphasis is given to topics that will be useful in other disciplines, including systems of equations, introduction to vector spaces, basis and dimension, rank of a matrix, determinants, eigenvalues and diagonalization, similarity, and positive definite matrices. Applications. Orthogonal and unitary matrices and transformations. Orthogonal projections, Gram-Schmidt procedure.
Goals and Objectives	The goal of the course is to provide the students with the fundamentals of linear algebra and its applications to engineering.
Required Knowledge	Pre-Calculus.
Reference Texts	Introduction to Linear Algebra, 5th International Edition, 2016, Author: Gilbert Strang, Wellesley-Cambridge Press.

Method of evaluation	**20.00**% - Homework /Assignments **40.00**% - Quiz(zes) **40.00**% - Final exam
Nature of the assignments	There are three components to the final grade: 6 quizzes, problem sets and final exam. The contribution of each component to the course grade is as follows: Quizzes -- 40% Problem Sets -- 20% Final Exam -- 40% The 6 quizzes have a duration of 30 minutes each and will be held at the beginning of the following lectures: Sept 5, 19; Oct 7, 21; Nov 7, 21. Only the 5 best quiz grades will be averaged to enter the final grade. The final exam will be held during lecture time on December, 5. Quizzes and final exam are closed book and closed notes. The students are allowed to bring one-sided A4 cheat sheet for the quizzes and final exam. Problem sets will be given as homework. The quizzes will be based on these sets. The grading is given in a Satisfactory(S)/Unsatisfactory(U) system. To pass the course the final grade should be at least 70%.
Course Policies	Students are expected to attend all classes, quizzes and final exam. Absences should be notified in advance and should comply with the university policies. Students that do not show up for a quiz or for the exam should expect a zero in that assessment except for exceptional cases (such as sick leave or other university/advisor approved activities). The students can discuss the homework problems in group but should work out the details individually. Identical homework will be considered as plagiarism and will be marked as zero. Late homework will not be graded except for exceptional cases (such as sick leave or other university/advisor approved activities). No calculators, mobile or laptop allowed during the quizzes and final exam.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 08/26/2019 Thu 08/29/2019	Course and lecturer introduction. Vectors and linear combinations. The geometry of linear equations. Elimination.
2	Mon 09/02/2019 Thu 09/05/2019	Multiplication of matrices. Inverses. Quiz 1. LU decomposition.
3	Mon 09/09/2019 Thu 09/12/2019	Transposes, symmetric matrices. Permutations and PU=LA. Vector spaces.
4	Mon 09/16/2019 Thu 09/19/2019	Column space and nullspace of a matrix. Quiz 2. Solving Ax=0.
5	Mon 09/23/2019 Thu 09/26/2019	Saudi National Day. Solving Ax=b. Linear independence, spanning a vector space, basis and dimension.
6	Mon 09/30/2019 Thu 10/03/2019	The four fundamental subspaces. Orthogonal vectors and subspaces.
7	Mon 10/07/2019 Thu 10/10/2019	Quiz 3. Projections onto subspaces. Projection matrices and least squares.
8	Mon 10/14/2019 Thu 10/17/2019	Orthogonal matrices and Gram-Schmidt. The properties of determinants.
9	Mon 10/21/2019 Thu 10/24/2019	Quiz 4. Determinant formulae and cofactors. Applications of determinants.
10	Mon 10/28/2019 Thu 10/31/2019	Mid-semester break. Eigenvalues and eigenvectors.
11	Mon 11/04/2019 Thu 11/07/2019	Diagonalization and powers of a matrix. Quiz 5. Differential equations and exponential of a matrix.
12	Mon 11/11/2019 Thu 11/14/2019	Symmetric matrices. Positive definite matrices.
13	Mon 11/18/2019 Thu 11/21/2019	Similar matrices. Quiz 6. Singular Value Decomposition.
14	Mon 11/25/2019 Thu 11/28/2019	Matrices in Engineering. Markov Matrices. Linear Programming.
15	Mon 12/02/2019 Thu 12/05/2019	Review. Final Exam.
16	Mon 12/09/2019	.

Note

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