Alanya Alaaddin Keykubat University | Rafet Kayış Faculty of Engineering
Mechanical Engineering Department

SYLLABUS

Code/Name	MCE 210 / Linear Algebra
Type	Required
Credit/ECTS	3/5
Hour per Week	3 (3+0+0)
Level/Year	Undergraduate/2
Semester	Spring
Classroom	A103
Content	Introduction to Linear algebra. Systems of Linear Equations. Matrices. Solving Linear Systems. Determinants and their properties. Vector Spaces. Inner Product Spaces. Linear Transformations. Eigenvalues and Eigenvectors.
Prerequisites	
Textbooks	***Primary*** Bernard Kolman, David R. Hill, Elementary Linear Algebra with Applications (9th Edition), Pearson, 2007. ***Supplementary*** S. Lipschutz and M. Lipson, Linear Algebra (6th Edition), Schaum's Outline Series, McGraw-Hill Education, 2018.
Objectives	● To introduce the concepts of linear algebra to engineering students and to give information about the applications of these concepts in engineering fields. ● To gain the ability to use linear algebra concepts and techniques for mathematical modeling of real-world problems. ● To gain the ability to look at an engineering problem from a linear perspective and to solve it with matrix operations after expressing the problem with matrix algebra.
Course Outcomes	In this course you will be able to: CO1 The ability to express systems of linear equations as matrices and to solve systems of linear equations by the techniques and methods linear algebra, CO2 The ability to explain the concept of matrix and its properties, to perform operations on matrices and to represent some engineering problems as a matrix, CO3 The ability to explain the concept of determinant and calculate determinants of matrices, CO4 The ability to explain the concept of vectors and operate on vectors, CO5 The ability to explain the concept of linear transformation and its properties, CO6 The ability to explain the concepts of eigenvalues and eigenvectors and to find the eigenvalues and eigenvectors of a matrix.

Weekly Schedule of Topics

W	Topic
1	Introduction to linear algebra. Systems of linear equations and their properties.
2	The concept of matrix and its properties. Matrix Operations.
3	Representation of linear systems as a matrix. Coefficients Matrix. Augmented Matrix. Algebraic properties of matrix operations.
4	Some special matrices and their properties.
5	Inverse of a matrix and regular (invertible) matrices. Echelon Form of a Matrix. Elementary row (column) operations. Row (column) equivalent matrices. Solving Linear Systems (by using the Gaussian Elimination Method, the Gauss-Jordan Reduction Method). Some applications of Linear Equation Systems. Elementary Matrices. Finding the inverse of a matrix if it exists.

6	Determinants and their properties. Determinant calculation by triangulation method. Definitions of minor and cofactor concepts. Determinant calculation by cofactor expansion.
7	Detection of the existence of the inverse of a matrix by its determinant. Adjoint of a matrix. Cramer's rule.
8	Real Vector Spaces. Vectors in the plane and in three-dimensional space. The sum of vectors. Multiplication of vectors by scalars. Vector Spaces. Subspaces.
9	The concept of span and the spanning set of a vector space. Linear Independence. Basis and Dimension. Base and dimension of the solution space of homogeneous systems. Rank of a matrix.
10	Linear Operator. Linear Transformation. The standard matrix representing a linear transformation. Kernel of a Linear Transformation. Image of a linear transformation. Matrix of a linear transformation.
11	Length and Direction in two- and three-dimensional real space. The length of a vector. The distance between two vectors. Direction cosines. Law of cosines. Standard inner product. Dot product. Orthogonal (perpendicular) vectors. Unit vectors. Cross (Vector) Product in three-dimensional real space.
12	Inner Product Spaces. Orthogonal and Orthonormal set. The Gram–Schmidt orthonormalization process.
13	The concepts of Eigenvalues and Eigenvectors. Characteristic Polynomial of a matrix.
14	Diagonalization and Similar Matrices. Diagonalization of Symmetric Matrices.

Professional Contribution	In general, the ability to express a real-world problem with linear algebra concepts and to analyze a problem expressed with linear algebra concepts by the techniques and methods of linear algebra.

Contribution to Program Outcomes*

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	5	4	3	3	4	0	0	1	0	1	3
CO2	5	4	3	3	4	0	0	1	0	1	3
CO3	5	4	3	3	4	0	0	1	0	1	3
CO4	5	4	3	3	4	0	0	1	0	1	3
CO5	5	4	3	3	4	0	0	1	0	1	3
CO6	5	4	3	3	4	0	0	1	0	1	3

* Contribution Level | 0: None | 1: Very Low | 2: Low | 3: Medium | 4: High | 5: Very High

Special Conditions	-
Requirements	-
Course Policy	● According to ALKU Undergraduate Education - Teaching and Examination Regulation; **70% attendance** in theoretical courses is **mandatory**. Students who cannot meet these conditions cannot take the end-of-term exam (final exam) and are given a letter grade of **DZ**.
Cheating & Plagiarism	● According to ALKU Undergraduate Education - Teaching and Examination Regulation; the exam of a student who attempts to cheat, cheats or assists in cheating, has someone else take the exam instead of him/herself, or takes the exam in someone else's place is considered invalid and necessary legal action is taken against him/her.
Evaluation	Midterm 40% Final Exam 60% Total 100%
Rubric	According to ALKU Undergraduate Education - Teaching and Examination Regulation; Success grade evaluation is carried out according to the relative evaluation system by taking into account the distribution of grades and the class average, together with the raw success grade, and the general success level of the class. Students who do not take the end-of-term exam (final exam) are given a grade of **FF**.

Instructor

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