School of Engineering and Natural Sciences / Computer Engineering (English)

2023 - 2024 Academic Year

LINEAR ALGEBRA

Syllabus

Course Description					
Name	**Code**	**Semester**	**T+A Hour**	**Credit**	**ECTS**
LINEAR ALGEBRA	COE2119550	Fall Semester	3+0	3	6

Prerequisites Courses	MATEMATİK I
Recommended Elective Courses	Introduction to Machine Learning, Introduction to Computer Vision
Language of Instruction	English
Course Level	First Cycle (Bachelor's Degree)
Course Type	Required
Course Coordinator	Assist.Prof. Cihan Bilge KAYASANDIK
Name of Lecturer(s)	Lect. Seçil TUNALI ÇIRAK, Assist.Prof. Cihan Bilge KAYASANDIK, Assist.Prof. Mustafa TÜRKBOYLARI
Assistant(s)	Teaching assistant
Aim	1. To provide the methods of solution of systems of linear equations and the applications of matrix and determinant.2. To introduce the basic concepts of vector space, basis, dimension, linear dependency required to understand, construct, solve and interpret data spaces.3. To give an ability to apply knowledge of mathematics on engineering problems
Course Content	This course contains; Preliminaries: Matrices and Systems of Linear Algebraic Equations: Definitions and Notation,Matrix Algebra and Terminology and Notation for Systems of Linear Equations ,Elementary Row Operations, Row Echelon Matrices, Reduced Row Echelon Matrices and Solving Systems of Linear Algebraic Equations,Gaussian Elimination and Gauss Jordan Elimination Methods, and The Inverse of a Square Matrix ,Gauss Jordan Method, Determinants and Adjoint Method ,Elementary Matrices, LU Factorization, Cramer Rule ,Vector Spaces: Definition of a Vector Space, Subspaces and Spanning Sets ,Linear Dependency and Independency, Bases and Dimension ,Row and Column Spaces and The Rank-Nullity Theorem ,Inner Product Spaces and Orthogonality ,Eigenvalue/Eigenvector Problem: Eigenvalues and Eigenvectors and Eigenspaces ,Application of Eigenvalues and Eigenvectors Factorization ,Diagonalization and Singular Value Decomposition, Pseudo-inverse Calculation ,Linear Transformations, The Kernel and Range of a Linear Transformation and Further Properties of Linear Transformations .

Course Learning Outcomes	**Teaching Methods**	**Assessment Methods**
1. Recognize arithmetic operations with matrices, properties of matrices, elementary row operations on matrices and determine row echelon form (REF) and reduced row echelon form (RREF) for matrices and rank of a matrix.	12, 14, 9	A, E
2. Calculate the solutions to the systems of linear equations from: Gaussian and Gauss-Jordan elimination method, the inverse of a matrix, Gauss-Jordan method, and find the value of determinant of a matrix.	12, 14, 9	A, E
4. Recognize the importance of the concepts of a vector space such as subspace, spanning set, linear dependency and independency, basis and dimension, row and column spaces, the Rank-Nullity theorem, inner product spaces and orthogonality.	12, 14, 9	A, E
5. Analyze eigenvalues and the corresponding eigenvectors and eigenspaces of the matrix, diagonalization and singular value decomposition, and pseudo-inverse of a matrix, and linear transformations and apply on engineering problems.	12, 14, 9	A, E
3. Analyze Adjoint Method to find the inverse matrix, elementary matrices, LU factorization and Cramer rule.	12, 14, 9	A, E

Teaching Methods	12: Problem Solving Method, 14: Self Study Method, 9: Lecture Method
Assessment Methods	A: Traditional Written Exam, E: Homework

Lecture Schedule

Sequence	**Topics**	**Preliminary Preparation**
1	Preliminaries: Matrices and Systems of Linear Algebraic Equations: Definitions and Notation	Book Chapter 3.1
2	Matrix Algebra and Terminology and Notation for Systems of Linear Equations	Book Chapters 3.2, 3.3
3	Elementary Row Operations, Row Echelon Matrices, Reduced Row Echelon Matrices and Solving Systems of Linear Algebraic Equations	Book Chapter 3.4
4	Gaussian Elimination and Gauss Jordan Elimination Methods, and The Inverse of a Square Matrix	Book Chapters 3.5, 3.6
5	Gauss Jordan Method, Determinants and Adjoint Method	Book Chapters 3.6, 4
6	Elementary Matrices, LU Factorization, Cramer Rule	Book Chapters 3.7, 4.3
7	Vector Spaces: Definition of a Vector Space, Subspaces and Spanning Sets	Book Chapters 5.1, 5.2, 5.3, 5.4
8	Linear Dependency and Independency, Bases and Dimension	Book Chapters 5.5, 5.6
9	Row and Column Spaces and The Rank-Nullity Theorem	Book Chapters 5.7, 5.8
10	Inner Product Spaces and Orthogonality	Book Chapters 5.9, 5.10
11	Eigenvalue/Eigenvector Problem: Eigenvalues and Eigenvectors and Eigenspaces	Book Chapters 6.5, 6.6
12	Application of Eigenvalues and Eigenvectors Factorization	Book Chapters 6.7, other sources
13	Diagonalization and Singular Value Decomposition, Pseudo-inverse Calculation	Book Chapters 6.7, other sources
14	Linear Transformations, The Kernel and Range of a Linear Transformation and Further Properties of Linear Transformations	Book Chapters 6.1, 6.2, 6.3, 6.4

Evaluation Methods	**Weight(%)**
Midterm Exam	30
General Exam	70

Resources
Differential Equations & Linear Algebra Second Edition, Stephen W. Goode. Prentice-Hall, Inc. 2000,1991.