Linear Algebra - Fall 2024

Course Objectives

This course will introduce the students to the basic elements of linear algebra with a focus towards solving linear equations and matrix algebra. These concepts have several applications in computer science, e.g., graphs and networks, Markov matrices, computer graphics, cryptography, etc.

Faculty

Prof: Dr. Shankho Shubra Pal, Dr. Achal Agrawal
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When

Section 1 : Lectures: T - 10 to 11:55am, Th - 9am to 9:55am
Tutorial: W – 1 to 1:55pm, , Th - 10am to 10:55am
Section 2 : Lectures: M - 1 to 2:55pm, F – 3 to 3:55pm
Tutorial: Th – 4 to 4:55pm, F – 4 to 4:55pm

Course Outline

Sub Code	Subject	L (hrs)	T (hrs)	P (hrs)	CIE	ESE	Total	C
	Linear Algebra	3	2	0	50	50	100	4

Syllabus

Vectors and matrices; linear equations; elimination; vector spaces; orthogonality; determinants; eigenvalues and eigenvectors; singular value decomposition; complex matrices; Code Vectorization using matrices, Linear Algebra in Data Science

Prerequisites

None

Teaching Methodology

The class will be divided between three lecture hours and two tutorial hours every week. In the lecture hours, we will cover the concepts with some simple examples. In the tutorial, example

problems will be solved in detail to reinforce the learning in the lectures. We will additionally hold office hours to attend to individual concerns.

Textbook

Introduction to linear algebra, by Gilbert Strang, Wellesley-Cambridge Press, 2016 (fifth edition).

Additional References

https://math.mit.edu/~gs/linearalgebra/ila5/indexila5.html

Course Learning Outcomes

CL01: Understand the fundamental concepts of linear algebra
CL02: To solve linear equations using ideas from linear algebra
CL03: To understand the concept of vector space
CL04: To understand the complete solution to Ax=b
CL05: To understand the basics of matrix algebra
CL06: Applications of linear algebra

Weekly Session Plan

Week	Topics to be covered	Course Learning Outcomes Mapped
1	Introduction to vectors and matrices	CL01
2	Linear equations, the idea of elimination	CL02
3	Elimination using matrices, matrix operations	CL02
4	Elimination and factorization, transpose, and permutations	CL02
5	The notion of a vector space, null space	CL03
6	Complete solution to a linear equation	CL04
7	Independence, basis, dimension	CL03
8	Orthogonal spaces, least square approximations, Gram-Schmidt procedure	CL03 and CL04
9	Determinants, permutations, cofactors, Cramer's rule	CL04; CL05

10	Eigenvalues and eigenvectors of a matrix	CL05
11	Diagonalizing a matrix, symmetric matrices, positive definite matrices	CL05
12	Singular value decomposition	CL05
13	Code Vectorization and Image Manipulation using Linear Algebra	CL06
14	Linear Algebra in Data Science and Computer Graphics	CL06
15	Buffer Week	

Assessment Structure

- Continuous Assessment: 20 Marks
    - Assignments, quizzes and class participation
- Internal Assessment Tests (IA): 30 Marks
    - 3 IAs of 10 marks each
- End-Term Exam: 50 Marks