Institute of Business Administration

Department of Mathematical Sciences

Course Outline

Course:	**Linear Algebra** (MTS203-MM3)
Semester:	Fall 2023
Time:	Fri., Sat., 10:00-11:15/11:30-12:45
Instructor:	Junaid Alam Khan
Email:	jakhan@iba.edu.pk
Office:	(MC Tabba Block 2nd Floor - Room # 230)

Pre-Requisite Course(s) (Dependency)

MTS101 Calculus-1 & Plane Geometry

Text Book

1. (CA) Linear Algebra, Lecture Notes by Cesar O. Aguilar.
2. (KS) Linear Algebra Step by Step by Kuldeep Singh, Oxford University Press.

Reference Books

1. Linear Algebra with Applications by Steven J. Leon, Pearson 9th Edition.
2. Elementary Linear Algebra by Howard Anton & Chris Rorres, 9th Edition. John Wiley, 2005.

Assessment Weights

Homework Assignments:	15%
Quizzes:	10%
Midterm exam	30%
Final Exam:	45%

Academic Misconduct

- Plagiarism of any sort and manifestation will fetch a recommendation to the Controller of Examinations for befitting action prejudiced against the student.
- In normal circumstances, the use of mobile phones, laptops, tablets, and handheld electronics is NOT allowed during any test / exam; and detection of such a device on the student during the exam constitutes a substantial case of academic misconduct.
- Please consult IBA's Student Code of Conduct, and rules and policies for more information in this regard.
- It is NOT upto the course instructor to partake in decision making for / against the students found involved in any academic malpractice, and the verdict of Disciplinary Committee will be binding in such cases.
- Hounding (pestering) the instructor for grade points (marks) after tests/exams may constitute a case of academic misconduct, and may be penalized. Therefore, any grievance with the awarded grade points may be taken up with IBA formally according to the rules and procedures of re-checking. (Consult a personnel from the office of the Controller of Examinations for further information in this regard).

Course objectives

To impart sophomore standard Linear Algebra to students majoring in Mathematics / Computer Science. Successful candidates are expected to be able to solve linear models arising from various applications. They are also expected to be capable of analyzing linear systems through various techniques and methods, and be familiar with diverse concepts such as singularity of linear systems, vector spaces, norms, eigensystems, orthogonality, and have working knowledge of some of their numerical counterparts.

Course Outline

Week	Topics	Book/chapter
1	Vectors in $\mathbb{R}^n$ (Euclidean Space)	KS sec 1.3, 1.4
	Arithmetic of Matrices and Vectors	CA lec 9, KS sec 1.3
	System of Linear Equations	CA lec 1
2	Row Reductions and Echelons forms	CA lec 2
	Matrix and Vector equation form of the system	CA lec 3 and 4
	Gauss Elimination and types of solution	KS 1.7
3	Rank and Nullity of a matrix	CA lec 2
	Existence and Uniqueness of Solution	CA lec 2
	Homogeneous Systems	CA lec 5.1
	The linear combination and Spanning Problem in $\mathbb{R}^n$	CA lec 3
4	Linear Independence in Euclidean Spaces	CA lec 6
	Spanning set, Basis set and dimension in Euclidean Spaces	KS sec 2.4
5	Linear Transformation between Euclidean Spaces	CA lec 7
	Matrix form of a Linear Transformation,	CA lec 8
6-7	Null Space and Column Space of a Matrix	CA lec 15.2
	Kernel and Range of a Matrix Transformation	CA lec 15.2
	The Rank-Nullity Theorem of a Matrix Transformation	CA lec 17
8	Invertible Matrices, Invertible Linear Transformation	CA lec 10,
	Determinant	CA lec 11
	Properties of Determinant	CA lec 12
9	Properties of Vectors $\mathbb{R}^n$	KS 2.1
	General Vector Spaces	CA lec 14, KS sec 3.1
	Subspace of a Vector Space	KS 3.2
10	Linear independence , Bases and Dimension	CA lec 16. KS sec 3.3,3.4
11	Linear Transformation on Vector spaces	CA lec 15
	The Rank and Nullity of a Linear map	KS sec 5.3
12	Coordinate System	CA lec 18
	Change of Basis	CA lec 19
13	Eigenvalues and Eigenvectors	CA lec 21
	The Characteristic Polynomial	CA lec 22
	Diagonalization	CA lec 23
14	Inner products and orthogonality	CA lec 20