Course Title: Linear Algebra (3-1-0-4)

Course Code: SC220

Semester and Year: Autumn 2022-23

Prerequisites: Discrete Mathematics , Calculus

Instructor's Name with email:

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Course Objectives: Vectors are an essential idea to understand numerous natural phenomena. Its application starts right from mechanics, electrostatics and magnetostatics. These applications use equations involving vectors. Such ideas are abstracted to study solutiuons of a system of linear equations in several variables. A general framework abstracting general properties of vectors is called the vector space. Once abstracted, these ideas unify several areas of physics, engineering and mathematics. This is essentially due to linear response approximation in most applications. Vector spaces help in understanding ideas in coding theory and cryptography for ICT students.

Suggested Textbook/references:

- Linear Algebra Done Right, Sheldon Axler, Springer
- Linear Algebra, Hoffman and Kunze, Pearson
- Linear Algebra and its Applications, David C. Lay, Pearson.

Evaluation Scheme: Two insemester exams (25% each), Final exam (40 %), Tutorials/ Quizzes (10%)

P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12
X	X	X	X								

Topic	Content	Number of Lectures
Linear Equations	**System of linear equations, elementary row operations, RREF, invertible matrices**	**4**
Vector Spaces	**Basic definitions and properties, subspaces, linear independence, basis and dimension, coordinates, direct sum of subspaces**	**8**
Linear Transformations	**Definition, matrix representation of linear transformations, invertible transformations, change of basis, fundamental subspaces, definition of rank and nullity, and the rank-nullity theorem. Dual spaces, inner product spaces, orthogonality, Gram-Schmidt orthogonalization, orthogonal (Fourier) expansions, orthogonal projections, rotations and reflections in real vector spaces.**	**12**
Eigen Values and Eigen Vectors	**Definition, characteristic polynomial, diagonalization and conditions, algebraic and geometric multiplicities, diagonalization of real symmetric matrices, solving differential equations by diagonalization, exponential of a matrix.**	**10**
Complex Vector Spaces	**Complex inner product, definition of adjoint, Hermitian and unitary matrices, normal matrices, spectral theorem and singular value decompositions.**	**6**