Course Code	Course title	L	T	P	J	C
MAT-3004	**Applied Linear Algebra**	3	2	0	0	4

Pre-requisite	MAT2002 Applications of Differential and Difference Equations	Syllabus Version
		1.0

Course Objectives (CoB):1,2,3

[1] understanding basic concepts of linear algebra to illustrate its power and utility through applications to computer science and Engineering.

[2] apply the concepts of vector spaces, linear transformations, matrices and inner product spaces in engineering.

[3] solve problems in cryptography, computer graphics and wavelet transforms

Course Outcome (CO): 1,2,3,4,5

At the end of this course the students are expected to learn

[1] the abstract concepts of matrices and system of linear equations using decomposition methods

[2] the basic notion of vector spaces and subspaces

[3] apply the concept of vector spaces using linear transforms which is used in computer graphics and inner product spaces

[4] applications of inner product spaces in cryptography

[5] Use of wavelet in image processing.

Student Learning Outcomes (SLO):	1,2,7

[1] Having an ability to apply knowledge of Mathematics in Science and Engineering

[2] Having a clear understanding of the subject related concepts and of contemporary issues

[7] Having computational thinking

Module:1	System of Linear Equations:	6 hours	CO: 1

Gaussian elimination and Gauss Jordan methods - Elementary matrices- permutation matrix - inverse matrices - System of linear equations - - LU factorizations.

Module:2	Vector Spaces	6 hours	CO: 2

The Euclidean space R^n and vector space- subspace –linear combination-span-linearly dependent-independent- bases - dimensions-finite dimensional vector space.

Module:3	Subspace Properties:	6 hours	CO: 2

Row and column spaces -Rank and nullity – Bases for subspace – invertibility- Application in interpolation.

Module:4	Linear Transformations and applications	7 hours	CO: 3

Linear transformations – Basic properties-invertible linear transformation - matrices of linear transformations - vector space of linear transformations – change of bases – similarity			
Module:5	**Inner Product Spaces:**	**6 hours**	**CO: 4**
Dot products and inner products – the lengths and angles of vectors – matrix representations of inner products- Gram-Schmidt orthogonalisation			
Module:6	**Applications of Inner Product Spaces**:	**6 hours**	**CO: 4**
QR factorization- Projection - orthogonal projections – relations of fundamental subspaces –Least Square solutions in Computer Codes			
Module:7	**Applications of Linear equations** :	**6 hours**	**CO: 5**
An Introduction to coding - Classical Cryptosystems –Plain Text, Cipher Text, Encryption, Decryption and Introduction to Wavelets (only approx. of Wavelet from Raw data)			
Module:8	**Contemporary Issues:**	**2 hours**	**CO: 3, 4, 5**
Industry Expert Lecture			
Text Book(s)			
1. Linear Algebra, Jin Ho Kwak and Sungpyo Hong, Second edition Springer(2004). (Topics in the Chapters 1,3,4 &5) 2. Introductory Linear Algebra- An applied first course, Bernard Kolman and David, R. Hill, 9th Edition Pearson Education, 2011.			
Reference Books			
1. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5th Edition, Academic Press(2016) 2. Applied Abstract Algebra, Rudolf Lidl, Guter Pilz, 2nd Edition, Springer 2004. 3. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003 4. Introduction to Linear Algebra, Gilbert Strang, 5th Edition, Cengage Learning (2015).			