

Course Code	Course title	L	T	P	J	C
<b>MAT-3004</b>	<b>Applied Linear Algebra</b>	<b>3</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>4</b>
<b>Pre-requisite</b>	<b>MAT2002 Applications of Differential and Difference Equations</b>	<b>Syllabus Version</b>				
		1.0				
<b>Course Objectives (CoB):1,2,3</b>						
[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						
<b>Course Outcome (CO): 1,2,3,4,5</b>						
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.						
<b>Student Learning Outcomes (SLO):</b>		<b>1,2,7</b>				
[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						
<b>Module:1</b>	<b>System of Linear Equations:</b>	<b>6 hours</b>	<b>CO: 1</b>			
Gaussian elimination and Gauss Jordan methods - Elementary matrices- permutation matrix - inverse matrices - System of linear equations - - LU factorizations.						
<b>Module:2</b>	<b>Vector Spaces</b>	<b>6 hours</b>	<b>CO: 2</b>			
The Euclidean space $\mathbb{R}^n$ and vector space- subspace –linear combination-span-linearly dependent-independent- bases - dimensions-finite dimensional vector space.						
<b>Module:3</b>	<b>Subspace Properties:</b>	<b>6 hours</b>	<b>CO: 2</b>			
Row and column spaces -Rank and nullity – Bases for subspace – invertibility- Application in interpolation.						
<b>Module:4</b>	<b>Linear Transformations and applications</b>	<b>7 hours</b>	<b>CO: 3</b>			
Linear transformations – Basic properties-invertible linear transformation - matrices of						

linear transformations - vector space of linear transformations – change of bases – similarity			
<b>Module:5</b>	<b>Inner Product Spaces:</b>	<b>6 hours</b>	<b>CO: 4</b>
Dot products and inner products – the lengths and angles of vectors – matrix representations of inner products- Gram-Schmidt orthogonalisation			
<b>Module:6</b>	<b>Applications of Inner Product Spaces:</b>	<b>6 hours</b>	<b>CO: 4</b>
QR factorization- Projection - orthogonal projections – relations of fundamental subspaces –Least Square solutions in Computer Codes			
<b>Module:7</b>	<b>Applications of Linear equations :</b>	<b>6 hours</b>	<b>CO: 5</b>
An Introduction to coding - Classical Cryptosystems –Plain Text, Cipher Text, Encryption, Decryption and Introduction to Wavelets (only approx. of Wavelet from Raw data)			
<b>Module:8</b>	<b>Contemporary Issues:</b>	<b>2 hours</b>	<b>CO: 3, 4, 5</b>
Industry Expert Lecture			
	<b>Total Lecture hours:</b>	<b>45 hours</b>	
<b>Tutorial</b>	<ul style="list-style-type: none"> <li>A minimum of 10 problems to be worked out by students in every Tutorial Class</li> <li>Another 5 problems per Tutorial Class to be given as home work.</li> </ul>	<b>30 hours</b>	<b>CO: 3, 4, 5</b>
<b>Text Book(s)</b>			
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, 9 <sup>th</sup> Edition Pearson Education, 2011.			
<b>Reference Books</b>			
1. Elementary Linear Algebra, Stephen Andrilli and David Hecker, 5 <sup>th</sup> Edition, Academic Press(2016) 2. Applied Abstract Algebra, Rudolf Lidl, Guter Pilz, 2 <sup>nd</sup> Edition, Springer 2004. 3. Contemporary linear algebra, Howard Anton, Robert C Busby, Wiley 2003 4. Introduction to Linear Algebra, Gilbert Strang, 5 <sup>th</sup> Edition, Cengage Learning (2015).			
<b>Mode of Evaluation</b>			
Digital Assignments (Solutions by using soft skills), Continuous Assessments, Final Assessment Test			
Recommended by Board of Studies		03-06-2019	
Approved by Academic Council		No. 55	Date 13-06-2019