Course Code	MTH510
Course Name	Advanced Linear Algebra
Credits	4
Course Offered to	UG/PG
Course Description	This course is designed to enhance the understanding of the principles underlying the subject and to prepare students to take more advanced courses in Mathematics and engineering (e.g. Machine learning, Advanced Matrix Theory, Algebraic Coding Theory).

Pre-requisites		
Pre-requisite (Mandatory)	Pre-requisite (Desirable)	Pre-requisite(other)
MTH 100 (for UG)		
*Please insert more rows if required		

Post Conditions*(For suggestions on verbs please refer the second sheet)				
CO1	**CO2**	**CO3**	**CO4**	**CO5**
Students are able to write down formal Mathematical proofs	Students are able to solve mathematical problems involving matrices using advanced linear algebra tools.	Students are able to classify matrices and linear operators defined on finite-dimensional vector spaces.	Students are able to solve mathematical problems based upon Bilinear algebra.	Students are able to determine best approximate solutions of inconsistent system of linear equations.

Weekly Lecture Plan			
Week Number	**Lecture Topic**	**COs Met**	**Assignment/Labs/Tutorial**
Week 1	Review of Fields, Finite Fields, vector spaces, Direct sum of subspaces, linear transformations (vector space homomorphisms), Definition of linear algebra, Matrix of a linear transformation and change of basis. Isomorphisms, Quotient spaces, Fundamental theorem of vector space homomorphism.	CO1-3	Tutorial Sheet I
Week 2	Linear functionals, Dual space, double dual, transpose of a linear transformation.	CO1-3	Tutorial Sheet II
Week 3-5	Eigenvalues and eigenvectors, Diagonalization, Simultaneous triangulation and simultaneous diagonalization.	CO1-3	Tutorial Sheets III-V
Week 6-8	The primary decomposition theorem, Generalized Cayley-Hamilton Theorem, Cyclic decomposition and the rational and Jordan canonical forms. Computation of invariant factors.	CO1-3	Tutorial Sheets VI-VIII

Week 9-11	Inner product spaces, unitary operators, spectral theorem for normal operators, polar decomposition.	CO1-3	Tutorial Sheets IX-XI
Week 12	Bilinear and quadratic forms, Symmetric and skew-symmetric bilinear forms.	CO 1 & 4	Tutorial Sheet XII
Week 13	Generalized inverse of a matrix and its applications.	CO 1, 2, 5	Tutorial Sheet XIII
Extra topics (for PhD and other interested students)	Non-negative matrices, Perron-Frobenius Theory. Courant-Fischer minimax and related theorems.	CO1-3	Seminar
*Please insert more rows if required			

Weekly Lab Plan			
Week Number	**Laboratory Exercise**	**COs Met**	**Platform (Hardware/Software)**
*Please insert more rows if required			

Assessment Plan	
Type of Evaluation	**% Contribution in Grade**
Quizzes	0.2
Minor Test	0.3
Major Test	0.5
*Please insert more row fo	

Resource Material	
Type	**Title**
Textbook	Hoffman and Kunze, Linear Algebra, Pearson.
Other suggested readings:	
	Horn and Johnson, Matrix Analysis, Cambridge University Press.
	Horn and Johnson, Topics in Matrix Analysis, Cambridge University Press.
	Zhang, Matrix Theory, Springer.
	Artin, Algebra, Prentice Hall.