

Semester	TWO
Paper Number	HSTCR2041T
Paper Title	Algebra
No. of Credits	6
Theory/Composite	Theory
No. of periods assigned	Th: 6 Pr: NIL
Modules	Module 1: Units 1 & 2 (2 periods/week) Module 2: Units 3 & 4 (4 periods/week)
Course description/objective	<p><i>After completion of the course a student is expected to have an idea of</i></p> <ul style="list-style-type: none"> ○ Matrix algebra and determinants. ○ Theory of equations. ○ Vector spaces, subspaces, their dimensions and basis. ○ Rank of a matrix and systems of linear equations. ○ Characteristic roots and vectors along with the understanding of classification of quadratic forms. ○ Linear transformation in connection to matrices. <p><i>This course is expected to lay the foundations to the courses like Multivariate Analysis and Linear Model.</i></p>
Syllabus	<p>UNIT1: <i>Algebra of matrices</i> - A review, theorems related to triangular, symmetric and skew symmetric matrices, idempotent matrices, orthogonal matrices, singular and non-singular matrices and their properties. Trace of a matrix. Adjoint and inverse of a matrix and related properties, Partitioning of matrices and simple properties.</p> <p>[10L]</p> <p>UNIT 2: <i>Determinants of Matrices:</i> Definition, properties and applications of determinants for 3rd and higher orders, evaluation of determinants of order 3 and more using transformations. Symmetric and Skew symmetric determinants, Circulant determinants and Vandermonde determinants for nth order, Jacobi's Theorem. Product of determinants. Use of determinants in solution to the system of linear equations. [16L]</p> <p>UNIT 3: Vector spaces, Subspaces, sum of subspaces, Span of a set, Linear dependence and independence, dimension and basis, dimension theorem. Orthogonal vectors, Gram-Schmidt orthogonalization, ortho-complement space. Row space & column space of a matrix, Null space and nullity. [20L] Elementary matrices, row reduction and echelon forms, the matrix equations $Ax=b$, solution sets of linear equations.</p>

	<p>Applications of linear equations, inverse of a matrix. Rank of a matrix, row-rank, column-rank, standard theorems on ranks, rank of the sum and the product of two matrices. Characteristic roots and Characteristic vector, Properties of characteristic roots, Cayley Hamilton theorem, Quadratic forms: Classification & canonical reduction. Rank and Signature, Linear transformations. Applications of Linear Algebra in Statistics. [22L]</p> <p>UNIT 4: Theory of equations, statement of the fundamental theorem of algebra and its consequences. Relation between roots and coefficients of any polynomial equations. Solutions of cubic and biquadratic equations when some conditions on roots of equations are given. [10L]</p>	
List of Practical	NIL	
Reading/Reference Lists	<ol style="list-style-type: none"> 1. Hadley G.(2002): Linear Algebra. Narosa Publishing House (Reprint). 2. Searle S.R.(1982): Matrix Algebra Useful for Statistics. John Wiley & Sons. 3. Narayan Shanti (2004): A Textbook of Matrices, S Chand & Co Ltd. 4. Hoffman Kenneth, Kunze Ray (1978): Linear Algebra. Phi Learning Pvt Ltd. 	
Evaluation	CIA: 20 End Sem Exam: 80 Total : 100 Module 1: 25 Module 2: 55	
Paper Structure for End Sem	Short questions (5 marks each)	Long questions (15 marks each)
Module 1	2 out of 3	1 out of 2
Module 2	5 out of 8	2 out of 3