Matrices & Determinants

Course Syllabus & Topic Map

2.1 Matrices

2.1.1 Recall the concept of

2.1.1(a) A matrix and its notation

2.1.1(b) Order of a matrix

2.1.1(c) Equality of two matrices

2.1.2 Know row matrix, column matrix, square matrix, rectangular matrix, zero/null matrix, diagonal matrix, scalar matrix, identity matrix

2.1.2(i) Row Matrix

2.1.2(ii) Column Matrix

2.1.2(iii) Square Matrix

2.1.2(iv) Rectangular Matrix

2.1.2(v) Zero/Null Matrix

2.1.2(vi) Diagonal Matrix

2.1.2(vii) Scalar Matrix

2.1.2(viii) Unit or Identity Matrix

2.1.3 Define upper and lower triangular matrix, transpose of a matrix, symmetric matrix and skew-symmetric matrix, Idempotent, Nilpotent, Involutory, Periodic, Hermitian matrix and Skew Hermitian matrix of order up to 4

2.1.3(i) Upper Triangular Matrix

2.1.3(ii) Lower Triangular Matrix

2.1.3(iii) Transpose of a Matrix

2.1.3(iv) Symmetric Matrix and Skew-Symmetric Matrix

2.1.3(v) Idempotent matrix

2.1.3(vi) Nilpotent matrix

2.1.3(vii) Involutory matrix

2.1.3(ix) Hermitian Matrix and Skew Hermitian Matrix

2.2 Algebra of Matrices

2.2.1 Carryout scalar multiplication, addition/ subtraction of matrices, multiplication of matrices with real and complex entries (3 by 3)

2.2.1(i) Scalar Multiplication of a Matrix

2.2.1(ii) Addition of Matrices

2.2.1(iii) Subtraction of Matrices

2.2.1(iv) Multiplication of Matrices

2.2.2 Show that commutative property:

2.2.2(i) Commutative property holds under addition i.e., A + B = B + A

2.2.2(ii) Commutative property does not hold under multiplication, in general

2.2.3 Verify that $(AB)^t = B^tA^t$ (3 by 3)

2.3 Determinants

2.3.1 Describe determinant of a square matrix, minor and cofactor of an element of a matrix

2.3.1(i) Determinant of a square matrix

2.3.1(ii) Minors and Cofactors of an element of a Matrix

2.3.2 Evaluate determinant of square matrix using cofactors

2.3.3 Define singular and non-singular matrices

2.3.3(a) Singular Matrix:

2.3.3(b) Non-Singular Matrix:

2.3.4 Describe the Adjoint of a square matrix and a diagonal matrix

2.3.4(a) Adjoint of square matrix

2.3.4(b) Adjoint of diagonal matrix

2.3.5 Use adjoint method to calculate inverse of a square matrix and verify

2.3.5.AdjointMethod Adjoint Method for computing A^{-1}

2.3.6 Verify the result $(AB)^{-1} = B^{-1} A^{-1}$

2.4 Properties of Determinants

2.4.1 State and verify the properties of determinants

2.4.1.Property1 Property 1

2.4.1.Property2 Property 2

2.4.1.Property3 Property 3

2.4.1.Property4 Property 4

2.4.1.Property5 Property 5

2.4.1.Property6 Property 6

2.4.1.Property7 Property 7

2.4.1.Corollary Corollary

2.4.1.Property8 Property 8

2.4.2 Evaluate the determinant without expansion (i.e., using properties of determinants)

2.5 Row and Column Operations

2.5.1 Describe the elementary row and column operations on matrices

2.5.1(a) Row operations on matrices:

2.5.1(b) Column operations on matrices

2.5.2 Define echelon and reduced echelon form of a matrix

2.5.2(a) Echelon form of a matrix

2.5.2(b) Reduced Echelon form of a matrix

2.5.3 Reduce a matrix to its echelon and reduced echelon form

2.5.4 Recognize the rank of a matrix

2.5.5 Use row operations to find the inverse and the rank of a matrix

2.6 Solving System of Linear Equations

2.6.1 Distinguish between homogeneous and non-homogeneous systems of linear equations in 2 and 3 unknowns

2.6.2 Solve a system of three homogeneous linear equations in three unknowns

2.6.3 Define a consistent and inconsistent system of linear equations and demonstrate through examples

2.6.4 Solve a system of 3 by 3 non-homogeneous linear equations using:

2.6.4(i) Matrix Inversion Method

2.6.4(i).Example Matrix Inversion Method Example

2.6.4(ii) Cramer's rule

2.6.4(ii).Example Cramer's Rule Example

2.6.4(iii) Gauss elimination method (echelon form)

2.6.4(iv) Gauss - Jordan Method (reduced echelon form)