Unit

1

MATRICES AND EIGEN VALUE PROBLEMS

❋ § 1.1. INTRODUCTION

The word 'Matrix' was used first of all by J. J. Sylvester in 1850. Then Arthur Caley developed the principles of matrices in 1858.

❋ § 1.1. (A) MATRIX (SOME ELEMENTARY CONCEPTS)

Definition. A system of mn numbers (real or complex) arranged in a rectangular array of m rows and n columns is called a matrix of order $m \times n$. It is also called $m \times n$ matrix.

Matrices are usually denoted by capital letters $A, B, C, X, Y, Z, \ldots$. If A is a $m \times n$ matrix, then it is represented in square brackets as follows :

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \cdots & \cdots & \cdots & \cdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix}_{m \times n}$$

Order of a matrix. If there are m rows and n columns in a matrix, then it is called a matrix of order $m \times n$; first factor i.e., m denotes the number of rows and second factor i.e., n denotes the number of columns.

It should be noted that it is not necessary that the number of rows be equal to number of columns, in the matrix, e.g.,

$$\begin{bmatrix} 3 & 5 & 7 \\ 9 & 10 & 11 \end{bmatrix}, \quad [7 \quad 8 \quad 9], \quad \begin{bmatrix} 1 \\ 2 \end{bmatrix}$$

are matrices of order $2 \times 3, 1 \times 3, 2 \times 1$ respectively.

Elements of a matrix. $a_{11}, a_{12}, \ldots, a_{mn}$ are called the elements of the matrix, a_{ij} is called the general element of the matrix and it is situated in i^{th} row and j^{th} column. First lower suffix i in a_{ij} always represents row and second lower suffix j represents column e.g.,

In $\begin{bmatrix} 3 & -2 & 5 \\ 4 & 7 & 9 \end{bmatrix}$, $a_{11} = 3, a_{12} = -2, a_{23} = 9$ etc.

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