K.P. College Murliganj Madhepura
DR SHANKAR RAJAK
Asst. Professor
Department of Mathematics

Matrices

Time 10:50 to 1:20 PM
Semester – I
Date – 29/X/23

* Definition of Matrix :– A rectangular array of mn No (Real or Complex) or members of a field (Called elements) Containing m rows and n Columns is called a matrix of order m×n

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & & a_{2n} \\ \cdots & \cdots & \cdots & & \cdots \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mn} \end{bmatrix}_{m\times n}$$

and It is denoted by $[a_{ij}]$.

operations of Matrices or Types of Matrices

Matrices

- (I) Square Matrix
- (II) Rectangular Matrix
- (III) Row Matrix
- (IV) Column Matrix
- (V) Diagonal Matrix
- (VI) Scalar Matrix
- (VII) Unit Matrix
- Null Matrix or Zero Matrix
- Triangular Matrix

(I) Square Matrix :→ The Matrix $[a_{ij}]$ ($i = 1$ to m, $j = 1$ to n) is Called square if $m = n$, i.e if the No of row in a Matrix is equal to the No of Column in that Matrix

For Ex –

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}_{3\times 3}$$ is Square Matrix

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times 3}$$ is not a Square Matrix

(ii) Rectangular Matrix :- A $m \times n$ Matrix is called Rectangular Matrix of $m \neq n$ i.e the No of row is not equal to the No of column.

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}_{2\times3 \text{ ord}}$$

(iii) Row Matrix :- If a Matrix has only one row, the Matrix is called a row Matrices

Ex —

$$\begin{bmatrix} a_{11} & a_{12} & a_{13} \end{bmatrix}_{1\times3 \text{ ord}}$$

or

$$\begin{bmatrix} 1 & 2 & 3 \end{bmatrix}_{1\times3 \text{ ord}}$$

(iv) Column Matrix :- If a matrix has only one column, the Matrix is called a column matrix

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}_{3\times1 \text{ ord}} \quad \text{or} \quad \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}_{3\times1 \text{ ord}}$$

(v) Diagonal matrix :- A square Matrix is said to be a diagonal matrix.

Ex -
$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}_{3\times3 \text{ ord}}$$ is a diagonal Matrix

(vi) Scalar Matrix :- If all the elements of a diagonal Matrix are equal the Matrix is said to be a scalar matrix.

$$\begin{pmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 2 \end{pmatrix}_{3\times3 \text{ ord}}$$

(vii) Unit Matrix :- A diagonal matrix is said to be a unit matrix, if each of the diagonal element is equal to unity.

For Ex – $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}_{3\times3}$ is a unit matrix

or

$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}_{2\times2}$ order of unit matrix

(viii) Null (or zero) matrix :→ If all the elements of a matrix are zero, the matrix is called a Null matrix

For Ex – $\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}_{2\times2 \text{ ord}}$ or

$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}_{3\times3 \text{ ord}}$

(IX) Triangular Matrices :→ A square Matrix, in which all the element below its principal diagonal are zero is called an upper triangular Matrix.

Ex → $\begin{bmatrix} 1 & 4 & 5 \\ 0 & 2 & 6 \\ 0 & 0 & 3 \end{bmatrix}_{3\times3 \text{ ord}}$ is an upper triangular matrix

Ex – $\begin{bmatrix} 1 & 0 & 0 \\ 2 & 4 & 0 \\ 3 & 5 & 6 \end{bmatrix}_{3\times3 \text{ ord}}$ is a Lower triangular Matrix

Operation of Matrix Algebra

(i) addition of matrices

(ii) Scalar Multiplication of matrix (by a scalar)

and (iii) Multiplication of Matrices.

(i) Addition of Matrices or sum of Matrices

The sum of two matrices of the same order $A = [a_{ij}]$ and $B = [b_{ij}]$ and $C = [c_{ij}]$

$c_{ij} = a_{ij} + b_{ij}$

For Ex- let $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 & 1 \\ 6 & 5 & 4 \end{bmatrix}$

Hence A and B are conformal for addition

$\therefore \quad A+B = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} + \begin{bmatrix} 3 & 2 & 1 \\ 6 & 5 & 4 \end{bmatrix}$

$= \begin{bmatrix} 1+3 & 2+2 & 3+1 \\ 4+6 & 5+5 & 6+4 \end{bmatrix} = \begin{bmatrix} 4 & 4 & 4 \\ 10 & 10 & 10 \end{bmatrix}$

$A + 0 = A$

and $0 + A = A$

Multiplication of Matrix by a scalar

$A + A$ is denoted by $2A$

If $A = [a_{ij}]$ then $A+A = [2a_{ij}]$ thus $2A = [2a_{ij}]$

For Ex- If $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}$

then $10A = \begin{bmatrix} 10 & 20 & 30 \\ 40 & 50 & 60 \end{bmatrix} = A \cdot 10$

$|k a_{ij}| = k^n |a_{ij}|$

29/x/23