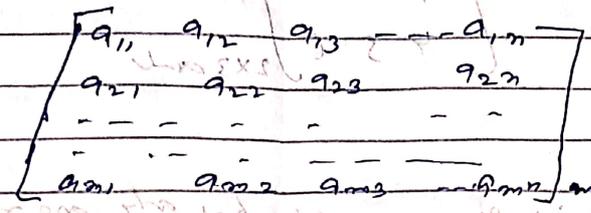


Matrices

Time 12:30 PM to 1:20 PM

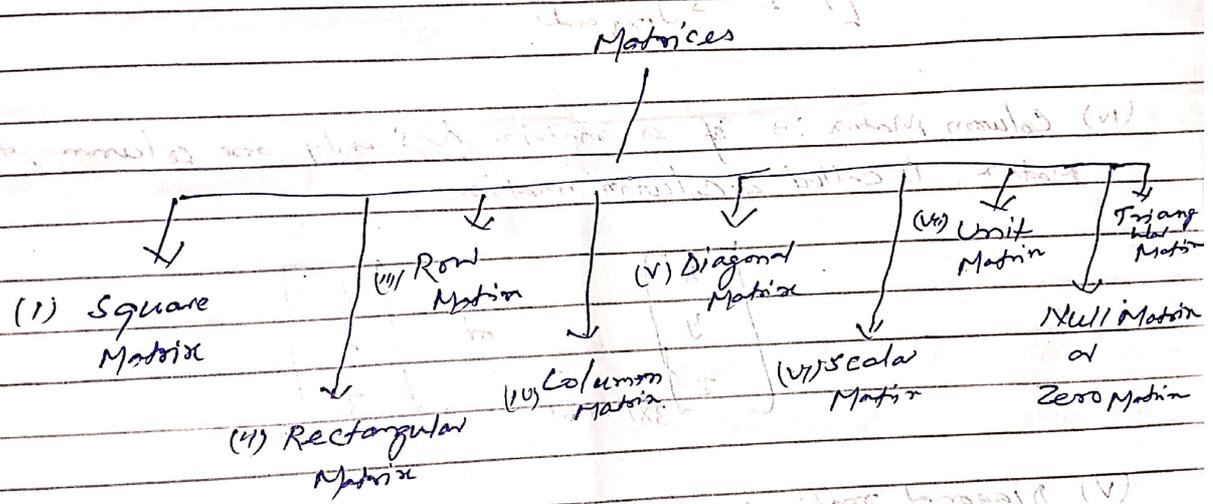
U.G. Semester - I, MII-I  
 Date - 30/11/23

\* Definition of matrix :- A rectangular array of mm No (Real or Complex) or members of a field (called elements) containing m rows and n columns is called a matrix of order  $m \times n$



and it is denoted by  $[a_{ij}]$

operations of Matrices or Types of Matrices



(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 rows in a matrix is equal to the no of columns in that matrix

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 if  $m \neq n$  i.e. the no. of row is not equal to the no. of columns.

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

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

EX -  $\begin{bmatrix} a_{11} & a_{12} & a_{13} \end{bmatrix}_{1 \times 3 \text{ ord}}$

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

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

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

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

EX -  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 3 \end{bmatrix}$  is a diagonal matrix  
 $3 \times 3 \text{ ord}$

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

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

(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 - 
$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$
 is a unit matrix  $3 \times 3$

For EX - 
$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$
 is a unit matrix  $2 \times 2$

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

For EX - 
$$\begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$$
 is a Null matrix  $2 \times 2$

For EX - 
$$\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$
 is a Null matrix  $3 \times 3$

(ix) Triangular Matrices :- A square matrix, in which all the elements below its principal diagonal are zero is called an upper triangular matrix.

EX - 
$$\begin{bmatrix} 1 & 4 & 5 \\ 0 & 2 & 6 \\ 0 & 0 & 3 \end{bmatrix}$$
 is an upper triangular matrix  $3 \times 3$

EX - 
$$\begin{bmatrix} 1 & 0 & 0 \\ 2 & 4 & 0 \\ 3 & 5 & 6 \end{bmatrix}$$
 is a lower triangular matrix  $3 \times 3$

## Operations 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

$$A = [a_{ij}] \text{ and } B = [b_{ij}] \text{ or } C = [c_{ij}]$$

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 conformable for addition

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

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

$$A+0 = A$$

$$\text{and } 0+A = A$$

Multiplication of Matrix by a scalar

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

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

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

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

$$(kA)_{ij} = k \cdot a_{ij}$$

Solve  
30/x/25