

Roll No. ....

**3008**

**B. Tech. 1st Semester (CSE)  
Examination – February, 2022**

**MATH - I (Calculus and LINEAR ALGEBRA)**

Paper : BSC-MATH-103-G

Time : Three Hours ]

[ Maximum Marks : 75

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt five questions in all, selecting one question from each Unit. Question No. 1 is compulsory. All questions carry equal marks.

1. (a) Prove that  $\beta(m, n) = \beta(n, m)$ .

(b) Compute  $\begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} d & -b \\ -c & d \end{bmatrix}$ .

(c) Find  $|A|$  where the matrix  $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix}$

(d) Let  $T : U \rightarrow V$  be a linear transformation the prove  $T(0_u) = 0_v$ , where  $0_u$  and  $0_v$  are zeros vectors in  $U$  and  $V$  respectively.

(e) Let  $T_1 : R^2 \rightarrow R^2$  and  $T_2 : R^2 \rightarrow R^2$  be linear transforms, then verify that  $T_1 T_2$  and  $T_2 T_1$  are well defined or not.

(f) Define inner products space.

**UNIT – I**

2. (a) Examine for extreme values of :

$$f(x, y) = 3x^2 - y^2 + x^3.$$

(b) Show that :

$$\log(x+h) = \log x + \frac{h}{x} - \frac{h^2}{2x^2} + \dots + (-1)^{n-1} \frac{h^n}{n(x+\theta h)^n}$$

3. (a) Find the volume of solid formed by revolution about x-axis of loop of the curve  $y = \left\{ \frac{ax^2 + x^2}{(a-x)} \right\}^{1/2}$ .

(b) Show that  $\beta(m, n) = \int_0^\infty \frac{y^{n-1}}{(1+y)^{m+n}} dy$

**UNIT – II**

4. (a) Solve following equations with the help of matrices :

$$x + y + z = 3, \quad x + 2y + 3z = 4, \quad x + 4y + 9z = 6$$

- (b) Show that vectors  $x_1 = (1, 2, 4)$ ,  $x_2 = (2, -1, 3)$ ,  $x_3 = (0, 1, 2)$  and  $x_4 = (-3, 7, 2)$  are C.D. and find relation between them.

5. (a) Using Gauss-Jordan method find inverse of matrix :

$$\begin{bmatrix} 8 & 4 & 3 \\ 2 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}$$

- (b) Solve the following equations by Cramer's rule  
 ~~$6x + y - 3z = 5$~~ ,  $x + 3y - 2z = 5$ ,  $2x + y + 4z = 8$ .

### UNIT - III

6. (a) If  $P(x)$  denotes the set of all polynomials in  $x$  over  $\mathbb{C}$  field  $F$ , then show that  $P(x)$  is a vector space over  $F$  with vector addition as polynomial's addition and scalar multiplication defined as product of polynomial by an element of  $F$ .

- (b) Examine the linear independence of the following vectors : <https://www.mdustudy.com>  
 $(1, 1, 1)$ ,  $(1, 2, 3)$ ,  $(0, 1, 2)$  in  $\mathbb{R}^3$ .

7. (a) Verify that, mapping  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^2$  defined by  $T(x, y, z) = (2x - 3y, 7y + 2z)$  is linear transformation.

- (b) Find a linear transformation  $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$  where range space is spanned by vectors  $(1, 2, 3)$ ,  $(4, 5, 6)$ .

### UNIT - IV

8. (a) Find eigen values and eigen vector of :

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

- (b) Show that matrix  $A = \begin{bmatrix} 1 & 2 \\ 0 & 1 \end{bmatrix}$  is not diagonalizable over the field  $\mathbb{C}$ .

9. Prove that every finite dimensional inner product space has an orthogonal basis.

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