Reg. No.:

Name :

TERM END EXAMINATIONS (TEE) – August- September 2021

Programme	:	**B.Tech**	**Semester**	:	**Interim 2021-22**
Course Name	:	**Applied Linear Algebra**	**Course Code**	:	**MAT3002**
Faculty Name	:	**Dr. Md Abu Talhamainuddin Ansary**	**Slot / Class No**	:	**A11/** BL2021225000139
Time	:	**1½ hours**	**Max. Marks**	:	**50**

Answer ALL the Questions

Q. No.	Question Description	Marks

PART - A (30 Marks)

1 (a) Find the LU decomposition of

$$A = \begin{pmatrix} 4 & 1 & 1 \\ 1 & 4 & -2 \\ 3 & 2 & -4 \end{pmatrix}$$ 10

Choose $U_{11} = U_{22} = U_{33} = 1$

OR

(b) Consider two bases of R^3 as

$$B = \{(1,0,1),(0,1,0),(-1,0,1)\}$$ 10

$$C = \{(1,1,1),(0,1,1),(0,0,1)\}$$

Find the transition matrix from B coordinate to C coordinate.

2 (a) Consider two bases of R^2 as

$$B = \{(1,0),(\ 0,1)\}$$

$$C = \{(1,1),(-1,1)\}$$ 10

Suppose $T: R^2 \to R^2$ be a linear transformation defined by

$$T(x,y) = (3x - 4y, -x + 2y)$$

Show that the matrix representation of T with respect to B (A_{BB}) is similar to the matrix representation of T with respect to C (A_{CC}).

OR

(b) Consider the vector space P_n (set of all polynomials of degree $\leq n$).

Suppose $p, q \in P_n$, where 10

$$p = a_n x^n + a_{n-1}x^{n-1} + \cdots + a_1 x + a_0$$

$$q = b_n x^n + b_{n-1}x^{n-1} + \cdots + b_1 x + b_0$$

An inner product in P_n is defined by

$$\langle p, q\rangle = a_n b_n + a_{n-1}b_{n-1} + \cdots + a_1 b_1 + a_0 b_0$$

Show that $B = \{x^2 + 2x + 2, 2x^2 - 2x + 1, 2x^2 + x - 2\}$ forms an orthogonal basis of P_2.
Find the coordinate of p=$2x^2 - x + 1$ with respect to B.

3 (a) Consider the subspace of R^3 defined as

$$W = \{(x, y, z) \in R^3 |\ x + y - z = 0\}$$ 10

Express $x = (4, 3, 2)$ as $x = p + q$, where $p \in W$, and $q \in W^\perp$ (where $W^\perp$ is the orthogonal complement of W).

OR

(b) Find the QR-decomposition of

$$A = \begin{bmatrix} 2 & 1 \\ 1 & 1 \\ 2 & 1 \end{bmatrix}$$ 10

PART - B (20 Marks)

4 (i) Consider vector space $C[-1,1]$ (set of all real valued continuous functions in $[-1, 1]$). Justify whether 10

$$W = \left\{ f \in C[-1,1] \middle| \int_{-1}^{1} f(x)dx = 0 \right\}$$

forms a subspace of C[-1,1] or not.

(ii) Consider vector space $M_{3\times3}$ (set of all 3×3 matrices). Justify whether

$$W = \{A \in M_{3\times3} |\ \det(A) = 0\}$$

forms a subspace of $M_{3\times3}$ or not.

5 Using Gram-Schmidt method convert

$$B = \{(1, 1, 0), (1, 0, 1), (0, 1, 1)\}$$ 10

to an orthogonal basis of R^3.
Find the coordinate of (2, 4, 6) with respect to the orthogonal basis.

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