



VIT

Vellore Institute of Technology
(Deemed to be University under section 3 of U.G. Act, 1956)

SLOT: C2+TC2+TCC2

WINTER SEMESTER 2023-2024
SCHOOL OF ADVANCED SCIENCES
CONTINUOUS ASSESSMENT TEST – II

Programme Name & Branch: B. Tech.

Course Code: MAT2004

Course Name: Linear Algebra

Class Number(s): 3814 / 3811

Exam Duration: 90 minutes

Maximum Marks: 50

General instruction(s):1: Answer all the questions

1. Express the matrix $A = \begin{bmatrix} 2 & 5 & 9 \\ 1 & 3 & 3 \\ -1 & 3 & 2 \end{bmatrix}$ as product of lower (L) and upper (U) triangular matrices. Hence, use these L and U to solve the linear system $AX = [1 \ 3 \ -2]^T$ [10]
2. (i) Let $U = \{(x + 2y, 2x - 5y) | x, y \in \mathbb{R}\}$. Is U a subspace to $\mathbb{R}^2$? Justify why or why not? [5+5]
(ii) Let $P_2 = \text{span} \{2 - x + 4x^2, 3 + 6x + x^2, 2 + x - 4x^2, 1 + x^2\}$. Find the basis and dimension of P_2 .
3. A jet fighter's position on an aircraft carrier's runway was timed during landing:

Time t, sec	0	4	6	8
Position x, m	1	2	4	5

where x is the distance from the end of the carrier. Fit an appropriate interpolating polynomial of the form $x = a_0 + a_1t + a_2t^2$. Hence estimate the velocity of jet fighter at the instant $t = 3$. [10]
4. (i) Let $V = \mathbb{R}^3$ be an inner product space defined by $\langle u, v \rangle = 2u_1v_1 + u_2v_2 + u_3v_3$. If $u = (-1, 2, 3)$ and $v = (1, 0, 2)$ be two vectors, then verify the inequality $\|u + v\| \leq \|u\| + \|v\|$. [5+5]
(ii) Let $\mathbb{R}^3$ have the standard inner product. Use Gram-Schmidt process to transform the basis set $\{u_1 = (1, 2, 0), u_2 = (1, -1, 0), u_3 = (0, 2, 1)\}$ into an orthogonal basis set.
5. Find the QR factorization of the matrix $A = \begin{pmatrix} 2 & -1 & -1 \\ 2 & 0 & 2 \\ 2 & -1 & 3 \end{pmatrix}$. [10]