



Daffodil International University
Department of Electrical and Electronic Engineering
Faculty of Engineering

Final Examination, Spring – 2026

Course Code: 0541-121

Course Title: Linear Algebra and Complex Variable

Section: A, B, C, D, E, F, G

Level-Term: L1-T2

Teacher's Initial: HRP, SS

Full Marks: 40

Date: April 27, 2026

Time: 2 Hours

[Answer all the following questions]

[The second right-most column indicates the COs with the respective Bloom's level]

[The right-most column indicates the assigned marks]

- Q1.** **Explain** the following with example
(i) Cayley-Hamilton Theorem (ii) Analytic Function CO-1 [2]
(C2)
- Q2.** $A = \begin{pmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{pmatrix}$ is a matrix CO-1 [8]
(C2)
- a) **Identify** the eigenvalues of A^T , A^2 , A^{-1} , A^{-2}
- b) **Identify** the eigenvectors of the matrix A .
- Q3.** a) **Calculate** whether or not the following vectors are linearly dependent CO-2 [5]
 $t^2 + t + 2, 2t^2 + t, 3t^2 + 2t + 2$ in $\mathbb{R}^3$. (C3)
- b) **Identify** the following mapping is linear or not and **discover** T^{-1} if it exists, CO-2 [5]
where $T: \mathbb{R}^3 \rightarrow \mathbb{R}^3$ is given by (C3)
 $T(x, y, z) = (3x + y, -2x - 4y + 3z, 5x + 4y - 2z)$
- c) **Interpret** whether or not the vector $(12, 5, 11, 8)$ as a linear combination of CO-2 [5]
the vectors $(2, 1, 0, 1)$, $(1, 0, 1, 1)$, $(1, 1, 1, 0)$ and $(3, -1, 1, 2)$ in $\mathbb{R}^4$. (C3)
- Q4.** a) In Electrical and Electronic Engineering, complex analysis plays a crucial role in CO-3 [5]
analyzing signals and systems, especially in frequency-domain techniques. One (C4)
important result is the Cauchy's Integral Formula. **Analyze** the following
integrals by identifying the singularities inside the given contours and determine
their values
- i. $\oint \frac{9z^2 - iz + 4}{z(z^2 + 1)} dz$, Where the circle is $|z| = 2$
- ii. $\oint \frac{z-3}{z^2 + 2z + 5} dz$, Where the circle is $|z + 1 - i| = 2$
- b) **List** out all the possible roots of CO-3 [7]
(C4)
- i) $z^5 + 32 = 0$, ii) $z^4 + 8 - 8\sqrt{3}i = 0$
- c) Consider the complex expression $\left(\frac{1-i}{1+i}\right)^{100}$. First, **evaluate** the expression and CO-3 [3]
represent your answer in the form $P+iQ$, where P and Q are real numbers. Then, (C4)
classify the resulting complex number based on its position on the complex plane
by identifying the quadrant or axis it lies on.