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Daffodil International University
Department of Electrical and Electronic Engineering
Faculty of Engineering
Final Examination, Fall – 2024

Course Code: 0541-121 Course Title: **Linear Algebra and Complex Variable**
Section: **A, B, C** Level-Term: L1-T2 Teacher's Initial: HRP
Full Marks: 40 Date: December 21, 2024 Time: 2 Hours

[*Answer all the following questions*]

Q1. **Illustrate** the following with example — CO-1 (C2) [1*5]
(a) Spectrum (b) Singularity
(c) Characteristic Polynomial (d) Algebraic Multiplicity
(e) Analytic Function

Q2. $A = \begin{pmatrix} 0 & 4 & 2 \\ -3 & 8 & 3 \\ 4 & -8 & -2 \end{pmatrix}$ is a matrix — CO-1 (C2) [10]

i) **Identify** the spectrum of A
ii) **Identify** the eigenvalues of A^T,A^3, A^{-1},A^{-3}.
iii) **Identify** the eigenvectors of the matrix A.

Q3. a) **Examine** whether the vector (16,1,-11.-23) is a linear combination of the vectors (2,0,-1,1), (-1,1,2,0), (1,1,0,-5) and (1,0,0,-1) in $\mathbb{R}^4$. — CO-2 (C4) [6]

b) **Examine** the linear dependency of S, where — CO-2 (C4) [4]
$S=\{(1,-2,1), (2,1,-1), (7,-4,1)\} \subset \mathbb{R}^3$

c) **Examine** whether the following mapping is linear or not and discover T^{-1} if it exists,where $T: \mathbb{R}^3 \to \mathbb{R}^3$ is given by $T(x,y,z) = (2x + 8y, 5y, -2z)$ — CO-2 (C4) [5]

Q4. a) **List** out all the possible roots of — CO-3 (C4) [6]
i) $z^5 = -32$ ii) $z^3 = 8i$

b) Using Cauchy's integral formula, **analyze** — CO-3 (C4) [4]
$$\oint \frac{ze^z}{z-2i} dz$$
Where the Circle is i) $|z| = \frac{1}{2}$ ii) $|z| = 3$