Daffodil International University

Faculty of Science & Information Technology
Department of Software Engineering
Final Examination, Summer-2026

Course Code: MAT 102; Course Title: Mathematics II
Sections & Teachers: (A-O) DK, ZT, MSIM, DMMK, SST

Time: 2:00 Hours **Marks: 40**

Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	**Explain** the geometric representation of the argument of a complex number, and **describe** how to determine its value across all four quadrants.	4 × 2	CLO-1 *Level-2*
	b)	**Explain** the mathematical conditions required for a complex function $f(z)$ to be analytic at a specific point.		
	c)	**Explain** why an even periodic function's Fourier series has only cosine terms plus a constant.		
	d)	**Describe** the difference between the Fourier sine and cosine transforms of a function.		
2.	a)	**Solve** the equation $z^5 + 2^5 = 0$ for all five roots, and express each in the form $a + ib$. **Analyze** the geometric pattern they form on the complex plane.	4+1	CLO-2 *Level-4*
	b)	**Compute** the principal and general arguments of z^9 where $z = -3 + 3i$. Briefly **analyze** why the general argument, not just the principal one, is needed to track a phase that has completed several full rotations.	4+1	
3.	a)	**Determine** whether $u(x, y)$ is harmonic; if it is, **construct** the conjugate harmonic function $v(x, y)$, where $u(x, y)$ is given below: $$u(x, y) = 2x^2 + 3x^3 - 9xy^2 - 2y^2$$	1+4	CLO-3 *Level-3*
	b)	**Apply** the Cauchy–Riemann equations to check whether the function $f(z) = e^{z^2}$ is analytic; if analytic, **find** $f'(z)$.	4+1	
4.	a)	**Calculate** the infinite Fourier sine transform $f_s(n)$ of the following function: $$F(x) = \begin{cases} x, & 0 \le x < \pi \\ 0, & \pi \le x \end{cases}$$ Obtain $f_s(n)$ at $n = 1$ and $n = 2$, and briefly **analyze** whether the magnitude increases or decreases as n increases.	5+1	CLO-4 *Level-4*
	b)	**Find the Fourier series** of the function $F(x) = x^2$ on the interval $[-\pi, \pi]$. Briefly **analyze what the constant term** $\left(\frac{a_0}{2}\right)$ represents in the series.	5+1	