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Daffodil International University

Department of Software Engineering
Faculty of Science & Information Technology
Midterm Examination, Fall 2025

Course Code: MAT101, Course Title: Mathematics I

Sections & Teachers: 45 (all) & AKA, DMMK, DK, HSA, NRA, AAR

Time: 1 Hour 30 Mins **Marks: 25**

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.		Discuss the following terms with suitable example: (i) One-One Function. (ii) Surjective Function.	[Marks-02]	CLO1 *Level-2*
2.		Compute the domain and range of the following function: $f(x) = 2 - \ln(x)$.	[Marks-03]	
3.		Given the piece-wise function $g(x)$: $g(x) = \begin{cases} 2+x & when\ x < 0 \\ x^2+2 & when\ 0 \le x \le 1 \\ 2x+1 & when\ x > 1 \end{cases}$ Estimate the continuity and differentiability of $g(x)$ at $x = 0$ and $x = 1$.	[Marks-05]	
4.	*a)*	Derive the value of $\frac{dy}{dx}$ for $y = \tan\left[\ln\{\sin(e^{x^2})\}\right]$.	[Marks-04]	CLO2 *Level-3*
	b)	An experimental drone taxi is designed to fly a specific curved path from DIU academic building-4 to a landing pad in academic building-1. The drone's progress is tracked by a central navigation beacon, which records its position using a sweep angle θ (in radians). The distance, S, in kilometers, that the drone has traveled along its path is given by the function $S = e^{\ln\left(\cos^{-1}\left(\cos(10^{\theta})\right)\right)}$. The time, t, in minutes, taken to reach that point in its journey is given by the function $t = \sin\theta + 2$. Determine the instantaneous velocity of the drone taxi, in kilometers per minute.	[Marks-04]	
5.	*a)*	Calculate the n^{th} derivative of $y = \ln(ax+b)^k$.	[Marks-04]	
	b)	If $u(x,y) = \ln(x^2+y^2)$, then, derive the value of $\frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial x^2}$.	[Marks-03]	

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