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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science and Engineering
Midterm Examination, Spring-2025
Course Code: MAT 102, Course Title: Mathematics II
Level: 01 Term: 02 Batch: 67

Time: 1.5 Hours **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.	a)	Demonstrate the exact value of the integral $\int_0^\infty 5x^4 e^{-2x^2} dx$ by using techniques involving the Gamma function.	[3]	CO1
	b)	Illustrate β-Γ function to calculate the exact value of $\int_0^1 \frac{x}{\sqrt[3]{(1-x^2)}} dx$.	[3]	
	c)	Demonstrate the value of $\int_0^{\pi/2} 6\sin^8\theta \, d\theta$.	[2]	
		Note: In all cases of Question 1, express your answers as fractions, not decimals.		
2.	a)	In a computational model, the cost function is given by $C(x,y,t) = \ln\left(\sqrt{x+y-t^2}\right) + e^{-yt} - \cos^2(3x+2y)$, where x is CPU usage, y is memory allocation, and t is execution time. Identify C_{xy} and C_{yt} to analyze their impact on system optimization.	[3]	CO2
	b)	Apply Euler's theorem for the function $u = \cos^{-1}\left(\frac{x+y-\sqrt{xy}}{x^3+y^3+z^3}\right)$ to show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = \frac{2}{\tan u}$.	[4]	
3.		Evaluate $\iiint_V xy^2z^3 dxdzdy$, where V is the region of space defined by $V = \{(x,y,z): z^2 \le x \le y, 0 \le y \le 2, \sqrt{y} \le z \le 1\}$.	[5]	CO4
4.		Construct the matrix form of the complex number $z = (-2+5i)^8 - 7.5(4.9, 230^\circ)$	[5]	CO2