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Daffodil International University

Faculty of Science & Information Technology
Department of Computer Science and Engineering
Midterm Examination, Spring-2024
Course Code: MAT 102, Course Title: Mathematics II
Level: 01 Term: 02 Batch: 65

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)	Illustrate β-Γ function to calculate the exact value of $\int_0^1 x^2\left(1-x^{\frac{2}{3}}\right)^{\frac{5}{2}}dx$.	[3]	CO1
	b)	Demonstrate the value of $\int_0^{\pi/2} \sin^{\frac{11}{2}}\theta \cos^5\theta \, d\theta$.	[3]	
	c)	Show that $\int_0^\infty 2\, e^{-3x^2}\, dx = \sqrt{\frac{\pi}{3}}$.	[2]	
2.	a)	Identify the value of f_{xx} and f_y where $f(x,y) = e^{xy}y^2 - \frac{x}{y}$.	[2]	CO2
	b)	Apply Euler's theorem for the function $u = \tan^{-1}\left(\frac{x^3+y^3}{\sqrt{x}-\sqrt{y}}\right)$ to show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{5}{4}\sin 2u$.	[4]	
3.		Evaluate the total energy $E = \iint_R T(x,y)\,dxdy$ stored within the rectangular metal plate R which is bounded by $0 \le x \le 2$ and $1 \le y \le 3$. The temperature distribution within this plate is represented by $T(x,y) = x^2 + 2xy + 3y^2$ with x and y are coordinates within the plate.	[5]	CO4
4.		Construct the matrix form of $z_1 + z_2 z_3$, where $z_1 = (-1-2i)^4$, $z_2 = (7.2, 87^\circ)$ and $z_3 = (13.5, 162^\circ)$.	[6]	CO2