# Daffodil International University

**Faculty of Science & Information Technology**
**Department of Computer Science & Engineering**
**Final Examination, Fall 2025**
**Course Code: MAT101, Course Title: Mathematics I**
**Level: 1 Term: 1 Batch: 70**

**Time: 2:00 Hrs** **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.]***

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| **1.** | ***a)*** | Construct the following rational fraction into the partial fraction $$\frac{x^2+5x+1}{x\left(x^2+3\right)\left(x^2+6\right)}$$ | [6] | CO2 |
| | ***b)*** | Construct the following rational fraction into the partial fraction $$\frac{x^2+4x}{x^2+3x-40}$$ | [4] | |
| **2.** | | A temperature distribution along a thin metal rod is modeled by a continuous function $T(x)$, where $x$ (in meters) represents the position along the rod. $$T(x)=x^5-4x^4+6x^3-4x^2+x$$ 1. List all critical points of the temperature function $T(x)$. 2. Examine using derivative tests to classify each critical point as a local maximum, local minimum, or point of inflection. 3. Interpret the results physically: i. At what positions is the rod hottest? ii. At what positions is the rod coldest? | [5] | CO3 |
| **3.** | ***a)*** | Simplify the following integrals **(i)** $$\int\frac{1}{\sqrt{\left(x^2-1\right)}\left\{9x+x(\sec^{-1}x)^2\right\}}dx$$ **(ii)** $$\int\frac{1}{1+\sin^2 x}dx$$ | [5] [5] | CO4 |
| | ***b)*** | Consider the circle given by the equation $x^2+y^2=144$ and the vertical line $x=c$ where $c$ is a real number and they intersect each other. If $c=6$ then examine the smallest area of the region bounded by the circle and the line. | [5] | |

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| | c) | Let the function $$\int a^{2x} \sin 4x dx$$ represent a rate of thermal exchange along a thin rod. Examine the total accumulated exchange from $x=0$ to $x=\pi$ | [5] | |
| 4. | | Assume the vector $\varphi = (2xy+z)i + (x^2+2yz)j + (y^2+3xz)k$ , then examine that the vector is rotational (i.e. Curl $\vec{\varphi} \neq 0$). Also simplify the Divergence of $\varphi$ . | [5] | |