Daffodil International University

Department of Electrical and Electronic Engineering
Faculty of Engineering
Mid-Term Examination, Fall – 2025

Course Code: 0541-111 | Course Title: Differential and Integral Calculus
Section: A, B, C, D, E, F, G, H | Level-Term: L1-T1 | Teacher's Initial: SDN, HRP, TRS
Full Marks: 25 | Exam Date: October 08, 2025 | Time: 1.5 Hours

[Answer all the following questions sequentially]

Q1. (a) **Explain** Limit of a function. CO-1 (C2) [2]

(b) **Identify** the value of k for which the function CO-1 (C2) [4]

$$f(x) = \begin{cases} 7x - 2, & x \leq 1 \\ kx^2 & x > 1 \end{cases}$$

is continuous at $x = 1$. Also, **express** the function $f(x)$ approximately in a graph.

Q2. (a) **Calculate** $\frac{dy}{dx}$ for the following functions: CO-2 (C3) [4]

(i) $y = \sqrt{1 + x^4}\ln(\cos^2 x) + x^{\tan^{-1}x}$ (ii) $y = \frac{x^3+2x^2-1}{x+5}$

(b) The parametric equations of a prolate cycloid are CO-2 (C3) [2]

$$x = 2 - \pi cost, y = 2t - \pi sint, \qquad -\pi \leq t \leq \pi$$

Calculate the value of $\frac{dy}{dx}$ at $t = \frac{\pi}{2}$.

(c) For $y = e^{m\cos^{-1}x}$, **show** that $(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0$ using the Leibnitz theorem. CO-2 (C3) [5]

Q3. (a) The output voltage of a temperature sensor is given by $V(T) = 0.001T^2 + 0.5T + 1$. Using the mean value theorem, **compute** the temperature T at which the average rate of change of the sensor voltage occurs over the interval $[20, 80]°C$. CO-3 (C3) [4]

(b) An electrical voltage E is given by $E = (5\ sin\ 2\pi t + 15\ cos\ 2\pi t)$ volts, where t is the time in seconds. **Compute** the time at which the maximum voltage occurs and the value of the maximum voltage. CO-3 (C3) [4]