



Daffodil International University
Department of Electrical and Electronic Engineering
Faculty of Engineering
Final Examination, Summer-2026

Course Code: 0541-111

Course Title: **Differential and Integral Calculus**

Section: A, B, C, D, E, F, Retake

Level-Term: L1-T1

Teacher's Initial: SDN, TRS

Full Marks: 40

Exam Date: August 19, 2026

Time: 2 Hours

[Answer all the following questions sequentially]

[The second right-most column indicates the Cos with the respective Bloom's level]

[The right-most column indicates the assigned marks]

- Q1.** (a) Express the Gamma function as the generalization of the factorial function. CO-1 [3]
(b) Express the solution of the definite integral $\int_0^{\pi/2} \sin^p \theta \cos^q \theta d\theta$ in terms of the Gamma function. (C2) [3]
(c) Describe Walli's formula and identify the value of $\int_0^{\pi} \sin^7 x \cos^2 x dx$ using this formula. [3]
- Q2.** (a) Prepare the reduction formula for $\int x^n (\ln x)^m dx$. Hence, solve the integral $\int x^5 (\ln x)^4 dx$ CO-2 [4]
(b) Solve the indefinite integral $\int \frac{x+1}{(x^2+5)(x^2-3)} dx$ (C3) [4]
- Q3.** (a) Calculate the value of the following definite integrals using the appropriate techniques of definite integration. [10]
(i) $\int_0^{\pi/2} \frac{dx}{3+5\cos x}$ CO-2 [3]
(ii) $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x} dx$ (C3) [3]
(b) Solve the definite integrals (i) $\int_0^{\infty} x^{-7/2} e^{-x} dx$ (ii) $\int_0^1 x^3 (1-x)^5 dx$
- Q4.** (a) Calculate the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $a > b$ using the integration technique. [5]
Hence, compute the area of the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$.
- (b) A Capacitor has capacitance $c(t) = c_0(1 + \beta t)$ and is driven by the voltage $v(t) = v_0 \sin(\omega t)$. The instantaneous current is $i(t) = c(t) \frac{dv(t)}{dt} + v(t) \frac{dc(t)}{dt}$. CO-3 [5]
(C3)
Compute the energy delivered to the capacitor, $W = \int_0^{\pi} v(t)i(t)dt$, when $C_0 = 10^{-6}F$, $\beta = 0.1s^{-1}$, $v_0 = 10V$ and $\omega = 100 rad/s$.