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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. [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. CO-1 (C2) [3]

(c) **Describe** Walli's formula and **identify** the value of $\int_0^{\frac{\pi}{2}} \sin^7 x \cos^2 x\, dx$ using this formula. [3]

Q2. (a) **Prepare** the reduction formula for $\int x^n (lnx)^m dx$. Hence, **solve** the integral $\int x^5 (lnx)^4\, dx$ [4]

(b) **Solve** the indefinite integral $\int \frac{x+1}{(x^2+5)(x^2-3)}\, dx$ CO-2 (C3) [4]

Q3. (a) **Calculate** the value of the following definite integrals using the appropriate techniques of definite integration. [10]

(i) $\int_0^{\pi/2} \frac{dx}{3+5\cos x}$ (ii) $\int_0^{\pi} \frac{x \sin x}{1+\cos^2 x}\, dx$

(b) **Solve** the definite integrals (i) $\int_0^{\infty} x^{\frac{-7}{2}} e^{-x} dx$ (ii) $\int_0^1 x^3(1-x)^{\frac{5}{2}} dx$ CO-2 (C3) [3]

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 (C3) [5]

Compute the energy delivered to the capacitor, $W = \int_0^{\frac{\pi}{\omega}} v(t)i(t)dt$, when $C_0 = 10^{-6}F$, $\beta = 0.1s^{-1}$, $v_0 = 10V$ and $\omega = 100\, rad/s$.