



বাংলাদেশ আর্মি ইন্টারন্যাশনাল ইউনিভার্সিটি অব সায়েন্স অ্যান্ড টেকনোলজি (বিএআইইউএসটি) কুমিল্লা
Bangladesh Army International University of Science and Technology (BAIUST) Comilla

Term Final Examination, Spring 2022

Department of Electrical and Electronic Engineering

Level-1, Term-I

Course Code: MATH111

Course Title: Calculus-I

Credit Hour: 3.00

Notes:

Time : 3 hrs.

Marks : 150

- Each question carries 25 marks.
- Answer any five (05) questions. **Either three from Part-A and two from Part-B, or two from Part-A and three from Part-B.**

PART-A

- Determine the area of the region enclosed by the curves $y^2 = 4x$ and $y = x$ and also sketch the graph. 10
 - Construct a fraction whose numerator is x and denominator is $(1+x)(1+x^2)$, then integrate the fraction with respect to x . 15
- Calculate: (i) $\int_0^{\pi/2} \sin^5 x \cos^2 x dx$ (ii) Show that, $\beta(p+1, q) + \beta(p, q+1) = \beta(p, q)$. 12
 - Compute the radius of curvature at any point of the curve $x = a \cos^3 \theta$, $y = a \sin^3 \theta$. 13
- Show that of the tangents at the points where the curve $y = (x-1)(x-2)(x-3)$ is met by the axis, two are parallel and the third makes an angle 135° of with the x -axis. 15
 - Investigate for what values of x , the given function $f(x) = 5x^6 - 18x^5 + 15x^4 - 10$ possess a maximum and minimum value. 10
- Determine the equation of normal at t on the curve $x = a(2 \cos t + \cos 2t)$,
 $y = a(2 \sin t - \sin 2t)$. 12
 - Identify all the asymptotes of the curve $x^3 - x^2 y - xy^2 + y^3 + 2x^2 - 4y^2 + 2xy + x + y + 1 = 0$. 13

PART-B

1. a. Identify the definition of curvature and radius of curvature. 04
- b. By using techniques involving the Gamma function, determine the value of $\int_0^{\infty} x^3 e^{-\frac{1}{2}x^2} dx$. 13
- c. Estimate the radius of curvature at the point (p, r) of the curve $r^{m+2} = k^m p$. 08
2. a. Show that the radius of curvature at the point (r, θ) of the curve $r^2 \sec 2\theta = a^2$ is $\frac{r^3}{a^2}$. 13
- b. Calculate: (i) $\int \frac{5(x-3)^2}{x\sqrt{x}} dx$ (ii) $\int (e^{a \log x} + e^{x \log a}) dx$. 12
3. a. By using techniques involving the Beta function, show that the value of $\int_0^{\frac{\pi}{2}} \cos^4 x dx = \frac{3\pi}{16}$. 10
- b. Determine all the asymptotes of the curve $y^3 + x^2 y + 2xy^2 - y + 1 = 0$. 15
4. a. Identify any three (03) formula of tangent or normal. 06
- b. Show that the tangent at (a, b) to the curve $\left(\frac{x}{a}\right)^3 + \left(\frac{y}{b}\right)^3 = 2$ is $\frac{x}{a} + \frac{y}{b} = 2$. 08
- c. Write a fraction whose numerator is $(x+4)$ and denominator is $(x-2)(x-3)$. Then integrate the fraction with respect to x . 11