

International Islamic University Chittagong (IIUC)
Department of Electronic and Telecommunication Engineering (ETE)
Final Examination

Program: **B.Sc in ETE**
Course Code: **MATH-1101**
Total Marks: **50**

Semester: **Spring 2023**
Course Title: **Differential & Integral Calculus**
Time: **2 Hours 30 Minutes**

- (i) Answer all the questions. The figures in the right-hand margin indicate full marks.
(ii) Course Learning Outcomes (CLOs) and Bloom's Levels are mentioned in additional Columns.

Course Learning Outcomes (CLOs) of the Questions

- CLO1** For complex Engineering problems, it is essential to get Knowledge of the limit, continuity, and differentiability, power series, Rolle's Theorem, Mean value theorem, Taylor, and McLaurin's series. Also the need concept of the partial derivatives, and Integration.
- CLO2** By using the above mentioned foundational mathematical information; One can implement it to solve the mathematical problems, which is expressing engineering principles.

Bloom's Levels of the Questions

Letter Symbols
Meaning

R **U** **Ap** **An** **E** **C**
Remember Understand Apply Analyze Evaluate Create

Part A

Answer the following Questions

Q1.	a)	Define critical point and saddle point of a function with example. Does the function $f(x) = 3x^2 - 36x + 10$ have maximum or minimum value?	CLO1, CLO2	R, U	5
	b)	Analyse the function $f(x,y) = 3x^2 + 2y^2 + 24x - 32y + 70$ and find the critical points and classify them as minima, maxima or saddle points.	CLO2	An	5
Q2.	a)	If $u = 4x^3 + 2x^2y^2 - 5xz^2 + 10$, then evaluate the followings: $\frac{\partial^2 u}{\partial x^2}, \frac{\partial^2 u}{\partial y^2}, \frac{\partial^2 u}{\partial z^2}$	CLO2	R, U	5
	b)	Define homogeneous function with example. Apply Euler's theorem and show that, $u(x,y) = 5x^3 + 10xy^2 + 8y^3$ is an equation of the 3 rd degree.	CLO1, CLO2	R, Ap	5
OR					
Q2.	a)	State and prove Euler's theorem on homogeneous function.	CLO1	R	5
	b)	If $Z = x^2 \tan^{-1}(\frac{y}{x}) - y^2 \tan^{-1}(\frac{x}{y})$, then show that $\frac{\partial^2 Z}{\partial y \partial x} = \frac{x^2 - y^2}{x^2 + y^2}$	CLO2	An	5
Part B					
Answer the following Questions					
Q3.	a)	Define integration with example. Solve the following: i) $\int x \ln(x) dx$ ii) $\int \tan^{-1} x dx$	CLO1, CLO2	R, An	5
	b)	What is the difference between definite and indefinite integral? Solve the following definite Integral: $\int_1^2 e^{2x^2+5x-2} (4x+5) dx$	CLO1, CLO2	R, An	5
Q4.	a)	Define multiple integral with example. Evaluate the following double integral: $\int_3^5 \int_2^3 (5xy) dy dx$	CLO1, CLO2	R, E	5
	b)	Evaluate the triple integral, $I = \int_0^2 \int_1^4 \int_2^3 (xyz + 10) dx dy dz$	CLO2	An	5
Q5.	a)	Analyse the volume generated by the areas bounded by the curve $x = y^4$ from $x = 0$ to $x = 4$ about the x-axis.	CLO2	An	5
	b)	Apply the integral formula to calculate the circumference of the circle, $x^2 + y^2 = 6^2$ about the y-axis.	CLO2	Ap	5
OR					
Q5.	a)	Define Gamma function. Apply the gamma function on the following: $\int_0^\infty x^3 e^{-\sqrt{x}} dx$	CLO1, CLO2	Ap	5
	b)	Evaluate the value of the following: $\int_0^{\pi/2} \sin^4 \theta \cos^5 \theta d\theta$	CLO2	E	5