

International Islamic University Chittagong
Department of Electrical and Electronic Engineering
B. Sc. Engineering in EEE
Semester End Exam, Spring 2023

Course Code: **MATH 1107**

Time: 2 hours 30 minutes

Course Title: **Mathematics I**

Full Marks: 50

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

Course Outcomes (COs), Program Outcomes (POs) and Bloom's Levels (BL) of the Questions			
CO	CO Statements	PO	BL
CO1	For 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 series.	POa	C2
CO2	By applying the method of partial differential (PD) to recognize the optimal value of the model equations.	POa	C3
CO3	Implementing the mathematical problems by applying the definite and indefinite along with the surface and volume integration expresses engineering problems.	POa	C3,C5

Bloom's Levels (BL) of the Questions						
Letter Symbols	C1	C2	C3	C4	C5	C6
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Part A

[Answer the questions from the followings]

1. a) State and Prove Euler's theorem. If $u = \log(x^3 + y^3 + z^3 - 3xyz)$ then CO2 C3 3+3
show that $(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z})^2 u = -\frac{9}{(x+y+z)^2}$
1. b) Evaluate the maximum and minimum values of $f(x) = (x-1)^4 \cdot (x-2)^3$ by CO2 C3 4
using first time derivative.
2. a) Evaluate $\int e^{ax} \sin bx \, dx$. CO3 C5 3
2. b) Evaluate (i). $\int \frac{x^2}{(x+1)(x+2)} dx$, (ii). $\int e^{ax} \cos bx \, dx$ CO3 C5 2×
3.5

Or,

2. a) Evaluate the following integrals: (i) $\int \frac{3x+5}{(x+1)^2(3x-2)} dx$ (ii) $\int \sqrt{a^2 - x^2} dx$ CO3 C5 4+3
2. b) Evaluate $\int \sin^4 x dx$. CO3 C5 3

Part B

[Answer the questions from the followings]

3. a) Show that $\int_0^{\pi/2} \sin^p \theta \cos^q \theta d\theta = \frac{\Gamma(\frac{p+1}{2})\Gamma(\frac{q+1}{2})}{2\Gamma(\frac{p+q+2}{2})}$ and $\int_a^b f(x)dx = -\int_b^a f(x)dx$ CO3 C3 5
3. b) Establish a reduction formulae for $\int \tan^n x dx$ and compute $\int_a^b x dx$ as the limit of a sum. CO3 C3 5
4. a) Evaluate (i). $\int_0^1 \int_0^1 \frac{dx dy}{\sqrt{1-x^2}\sqrt{1-y^2}}$ (ii). $\int_0^1 \int_0^1 \int_0^1 (x^2 + y^2 + z^2) dz dy dx$. CO3 C2 3+3
4. b) Find the area of the surface $z^2 = 2xy$ included between the planes $x = 0, x = a, y = 0, \text{ and } y = b$. CO3 C3 4
5. a) Obtain the area of the region bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$ CO3 C3 5
5. b) Determine the perimeter of the circle $x^2 + y^2 = 8$ CO3 C3 5
- Or,**
5. a) Find the volume and area of the curved surface of the paraboloid of revolution formed by revolving the parabola $y^2 = 4ax$ about the x -axis, and bound the section $x = x_1$. CO3 C3 6
5. b) Find the volume of the part of the parabola $y^2 = 4x$ bounded by the latus rectum revolves about the tangent at the vertex. CO3 C3 4