International Islamic University Chittagong

Department of Electrical and Electronic Engineering

B. Sc. Engineering in EEE

Final Exam, Autumn 2022

Course Code: MATH 1107 Course Title: Mathematics I

Time: 2 hours 30 minutes 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) of the Questions	
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.
CO2	By applying the method of partial differential(PD) to recognize the optimal value of the model equations.
CO3	Implementing the mathematical problems by applying the definite and indefinite along with the surface and volume integration expresses engineering problems

Bloom's Levels of the Questions						
Letter Symbols	R	U	App	An	E	C
Meaning	Remember	Understand	Apply	Analyze	Evaluate	Create

Q. No.		Part A [Answer the questions from the followings]	CO	BL	M
1.	a)	(i) Define the term "homogeneous function." If $u = \log(x^3 + y^3 + z^3 - 3xyz)$ then show that $(\frac{\partial}{\partial x} + \frac{\partial}{\partial y} + \frac{\partial}{\partial z})^2 u = -\frac{9}{(x+y+z)^2}$	CO2	R, Ap,	1+3+3
		(ii) Investigate the maximum and minimum value of $f(x) = (x-2)^3(x-1)^4$ by using first time derivative.		Ap	
1.	b)	State and prove Euler's theorem.	CO2	R,E	1+2
2.	a)	Evaluate (i)$\int \frac{x^3}{4+x^8}\,dx$, (ii) $\int \frac{x+3}{x^2+3x+7}\,dx$, and (iii) $\int \frac{1-\sin x}{x+\cos x}\,dx$	CO3	Ap	1× 3
2.	b)	Evaluate (i) $\int \left(\frac{x\tan^{-1}x}{(1+x^2)^{\frac{3}{2}}}\right)dx$, and (ii) $\int \frac{x^2}{(x+1)(x+4)(x+3)}\,dx$	CO3	Ap	2 ×3.5

Or,

2.	a)	Evaluate, $\int e^{2x} \cos 2x \ dx$.	CO3	E	4
2.	b)	Evaluate (i) $\int \frac{x^2}{(x^2+1)(3x^2+1)} dx$, and (ii) $\int \tan^{-1} \sqrt{\frac{1-x}{1+x}} \ dx$	CO3	E	2× 3

Part B

[Answer the questions from the followings]

3.	a)	(i). Evaluate the integral $\int_0^5 2x \, dx$ by the definition of the limit of sum. (ii). Express $\int_0^1 x^m(1-x^n)^p \, dx$ in terms of beta function then Evaluate, $\int_0^1 x^6(1-x^4)^9 dx$.	CO3	An	2.5+2.5
3.	b)	(i). Evaluate $\int \sin^5 x$ by applying the reduction formula. (ii). Evaluate $\int_0^{2a} x^{\frac{9}{2}} (2a-x)^{-\frac{1}{2}} \, dx$ by applying Willi's formula.	CO3	E	2.5+2.5
4.	a)	Evaluate the followings integrals :$(i) \int_0^1 \int_{5-y}^{\sqrt{25-y^2}} ydydx$ $(ii) \int_0^{ln3} \int_0^{ln2} e^{x+y} dydx$	CO3	E,E	2+2
4.	b)	i) Evaluate $\iiint_R (2x-y+z)dxdydz$, where $R: 0 \leq x \leq 1, 0 \leq y \leq 1, 0 \leq z \leq 1$ (ii) Determine the area of the region bounded by the parabolas $y^2 = 4ax$ and $x^2 = 4ay$	CO3	E,E	3+3
5.	a)	Determine the volume of the spindle shaped solid generated by revolving the asteroid $x^{\frac{2}{3}} + y^{\frac{2}{3}} = 5^{\frac{2}{3}}$.	CO3	Ap	5
5.	b)	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	E	5

Or,

5.	a)	Find the volume and area of the curved surface of the paraboloid of revolution formed by revolving the parabola $x^2 = 4ay$ about the y −axis, and bound the section $y = y_1$.	CO3	Ap	5
5.	b)	Find the volume of the part of the parabola $y^2 = 4ax$ bounded by the latus rectum revolves about the tangent at the vertex.	CO3	E	5