Comilla University
Department of Chemistry
1st Year 2nd Semester
Session: 2025-26

COURSE OUTLINE

Course Instructor: **Dr. Md. Maruf Hasan**
Professor, Department of Mathematics
Comilla University, Cumilla

Course Code: 0541-14-125	Course Title: Mathematics-II: Calculus and Mathematical Methods	Credit Hours: 3

Rationale:

Chemists use mathematical and physical tools to predict the properties of chemicals, the path of reactions and to design materials with a particular set of properties. Pharmaceutical companies hire chemists to use computational tools that rely heavily on physics and math to predict the interactions between potential drugs and their targets, so they can concentrate on synthesizing only the ones that show some promise. Mathematics plays a central role in almost any field of modern chemistry. This course is designed to equip students to apply calculus and mathematical methods to apply in physical chemistry in order to calculate thermodynamic, kinetics and quantum mechanical parameters.

Course Objectives:

➢ To describe and analyze the behavior of functions.
➢ To gain proficiency in calculus computations.
➢ Recognize the appropriate methods/tools of calculus to solve applied problems in chemistry.

Course Learning Outcomes (CLOs):

After completion of the Course, the Student will be able to –

CLO-1:	Identify and classify the functions, and use formulas to take derivatives of polynomial, radical,exponential, and logarithmic functions.
CLO-2:	Solve differentiation, integration and partial differentiation for a particle.

CLO-3:	Derive Maclaurin and Taylor expansions of different functions.
CLO-4:	Use properties to definite integrals to solve graphical net area problems
CLO-5:	Compute the Fourier series of periodic functions
CLO 6:	Use numerical methods in mathematical equation and describe the probability function for a particle using statistics

Teaching Methodology:

- Lecture will be the main method of teaching. Use of visual aids, like Multimedia will aid the lecture presentations.
- The techniques of experiential learning like classroom exercises, role play and group discussions will be used to increase participation.
- Assignments will help the students to solve real-life problems and develop insights into applied corporate approaches.

Course Contents:

Week	Topics	Corresponding CLOs
01	Functions: Concepts and Graphical representation of functions; Inverse function; Polynomials;	CLO-1
02	Rational functions; Trigonometric functions; Exponential function and logarithmic function; Hyperbolic function	CLO-1
03	Differentiation: Concepts and Process of Differentiation; Continuity;	CLO-1, CLO-2
04	Limit; Differentiation from first principles; Differentiation by rule; Implicit functions; Logarithmic differentiation;	CLO-1, CLO-2
05	Successive differentiation; Maximum and minimum values; Taylor's series; Maclaurin's series; Exponential and trigonometric series.	CLO-1, CLO-2, CLO-3
06	Integration: Concepts; Indefinite integral; Definite integral;	CLO-3, CLO-4
07	Integral calculus; Methods of integration; Applications.	CLO-3, CLO-4
08	Differential equations: First-order ordinary differential equation: Concept and application;	CLO-2
09	Second-order differential equation: Concept and application Partial differentiation: Concepts;	CLO-2
10	General solutions; Separation of variables; Applications.	CLO-2
11	Fourier analysis: Fourier series; Fourier coefficients; Dirichlet's condition; Different forms of	CLO-5
12	Fourier integral theorem; Fourier transform; Inverse Laplace transform and convolution; Evaluation of integrals.	CLO-5
13	Numerical Methods: Concepts; Solution of ordinary equation;	CLO-6

14	Interpolation; Numerical Integration; Methods in linear algebra.	CLO-6

Mapping of Course Learning Outcomes (CLOs) to Program Learning Outcomes (PLOs):

CLOs	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	2	-	-	2	-	-	-	-	-	-
CLO2	1	-	1	-	-	-	-	-	-	-
CLO3	1	-	-	-	2	-	-	-	-	-
CLO4	1	-	-	2	-	-	-	-	-	-
CLO5	1	-	-	-	-	-	-	-	-	-
CLO6	1	-	2	2	-	-	-	-	-	-

(Tick mark or level of correlation: 3-High, 2-Medium, 1-Low)

Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

CLOs	**Teaching-Learning Strategy**	**Assessment Strategy**
CLO1	Lecturing and Discussion	Summative (Midterm-1/ Semester Final) Assignment
CLO2	Lecturing and Discussion	Summative (Midterm-1/ Semester Final) Assignment
CLO3	Lecturing and Discussion	Summative (Midterm-1/ Semester Final) Assignment
CLO4	Lecturing and Group Discussion	Summative (Midterm-2/ Semester Final) Assignment
CLO5	Group Discussion and Student Activity	Summative (Midterm-2/ Semester Final) Assignment
CLO6	Lecturing and Discussion	Summative (Midterm-2/ Semester Final) Assignment

Learning Materials:

(i) Recommended Readings

• Anton, H., Bivens, I.C. and Davis, S., Calculus. Tenth Edition, John Wiley & Sons, 2021.
• Burden R. L. and Faires J. D., Numerical Analysis, Brooks/Cole, 2011.
• Zill D. G., A first Course in Differential Equations with Modeling Applications, Cengage Learning, 2012.
• Zachmann D. W., and DuChateau P., Partial Differential Equations, McGraw Hill, Third edition,
2011

(ii) Supplementary Readings

• Matin and Chakraborty, Differential Calculus, 6th edition, 2024

• Matin and Chakraborty, Integral Calculus, 6th edition, 2024
• Sastry S. S., Introductory Methods of Numerical Analysis, Prentice-Hall of India, 2008.
• Raisinghania M. D., Ordinary and Partial Differential Equations, S. Chand, 2004.

Evaluation System:

Continuous Assessment / Before-Final Assessment	= 40%
Semester-Final Examination	= 60%
Total = 100%	

Grading System:

Numerical Grade	**Letter Grade**		**Grade point**	**Interpretation**
80% and above	A+	(A Plus)	4.00	Outstanding
75% to less than 80%	A	(A regular)	3.75	Excellent
70% to less than 75%	A-	(A minus)	3.50	Very Good
65% to less than 70%	B+	(B Plus)	3.25	Good
60% to less than 65%	B	(B regular)	3.00	Satisfactory
55% to less than 60%	B-	(B minus)	2.75	Below Satisfactory
50% to less than 55%	C+	(C Plus)	2.50	Average
45% to less than 50%	C	(C regular)	2.25	Pass
40% to less than 45%	D	.....	2.00	Poor
Less than 40%	F	.....	0.00	Fail