Department of Mathematics **COURSE OUTLINE**
Bangladesh University of Engineering and Technology

PART A: General Information

1.	**Course Number**	MATH 141
	Course Title	Calculus I
	Credit (Contact) Hours	3.0 (3.0)
2.	**Level and Term (Section)**	Level-1, Term-1
	Academic Session	January 2024
3.	**Type of Course**	Core Course
	Offered to	Department of Computer Science and Engineering
4.	**Pre-requisite Course(s)**	None
5.	**Course Website**	https://---.math.buet.ac.bd
6.	**Lecture Schedule**	Saturday (10:00-10:50 am) Sec A (R-904) Tuesday (11:00-11:50 am) Sec B (R-504) (12:00-12:50 pm) Sec C (R-503)
7.	**Important Dates**	For important dates and examination schedules and latest updates, please follow the course website.

8. Course Teacher(s)

Name (Initials):	Office:	Email:	Consultation Hour(s)
Dr. K M Ariful Kabir	Dept. of Math	Km_ariful@math.buet.ac.bd	TBA
Teacher 2	Dept. of Math	y@ math.buet.ac.bd	Y day (00:00-00:00 am)
Teacher 2	Dept. of Math	z@ math.buet.ac.bd	Z day (00:00-00:00 am)

PART B: Course Details

9. Course Content (As approved by the Academic Council)

Differential Calculus: Continuity and differentiability; Successive differentiation: Leibnitz's forms; Maxima and minima of functions of single variable: Rolle's theorem, Mean value theorem; Evaluation of indeterminate forms by L' Hospital's rule; Expansion of functions: Taylor's and Maclaurin's theorems, Lagrange's and Cauchy's forms of remainders; Partial differentiation, Euler's theorem; Tangent, normal.

Integral Calculus: Definite integrals and its properties; Walli's formula; Improper integrals; Beta function and Gamma function; Parametric equations and polar coordinates; Applications of integration: area under a plane curve, area of a region enclosed by two curves and arc lengths in Cartesian and polar coordinates, volume and surface area of solids of revolution; Multiple integrals.

Ordinary Differential Equations (ODE): Definition. Formation of differential equations. Solution of first order differential equations by various methods with applications. Solution of general linear equations of second and higher order with constant coefficients. Solution of Euler's homogeneous linear equations.

10. Course Objectives

- To understand the fundamentals concepts of calculus and learn the standard methods for evaluating indefinite, definite and improper integrals.
- To understand the standard methods of indefinite and definite integrals with their applications.
- To explain the basic concept of differential equations together with their solution techniques.

11. Knowledge required

Familiarity with basic properties of set theory and function; fundamental concepts of precalculus and preliminary knowledge to solve algebraic and transcendental equations.

12. Course Outcomes

CO No.	CO Statement After undergoing this course, students should be able to	Corresponding PO(s)*	Domains and Taxonomy level(s)	Delivery Method(s) and Activity(-ies)	Assessment Tool(s)
CO1	**Define** the basic concepts of differential and integral calculus and ordinary differential equations.	-	C1	Lectures, Homework	Written exams (Quiz / Class Test / Final Exam)
CO2	**Explain** the methods of differential and integral calculus and ordinary differential equations.	-	C2	Lectures, Homework	Written exams (Quiz / Class Test / Final Exam)
CO3	**Apply** the knowledge of calculus and ordinary differential equations to solve problems that arise in science and engineering.	-	C3	Lectures, Homework	Written exams (Quiz / Class Test / Final Exam)

***Program Outcomes (POs)**
PO1: Engineering knowledge; PO2: Problem analysis; PO3: Design/development of solutions; PO4: Investigation; PO5: Modern tool usage; PO6: The engineer and society; PO7: Environment and sustainability; PO8: Ethics; PO9: Individual work and teamwork; PO10: Communication; PO11: Project management and finance; PO12: Life-long learning.

****Domains**
C-Cognitive: C1: Knowledge; C2: Comprehension; C3: Application; C4: Analysis; C5: Synthesis; C6: Evaluation
A-Affective: A1: Receiving; A2: Responding; A3: Valuing; A4: Organizing; A5: Characterizing
P-Psychomotor: P1: Perception; P2: Set; P3: Guided Response; P4: Mechanism; P5: Complex Overt Response; P6: Adaptation; P7: Organization

13. Mapping of Knowledge Profile, Complex Engineering Problem Solving and Complex Engineering Activities

COs	K 1	K 2	K 3	K 4	K 5	K 6	K 7	K 8	P 1	P 2	P 3	P 4	P 5	P 6	P 7	A 1	A 2	A 3	A 4	A 5
CO 1		√	√						√	√						√				
CO 2		√	√		√				√	√									√	√
CO 3		√	√						√	√									√	√
CO 4		√	√						√	√									√	√

K-Knowledge Profile:

K1: A systematic, theory-based understanding of the natural sciences applicable to the discipline; **K2:** Conceptually based mathematics, numerical analysis, statistics and the formal aspects of computer and information science to support analysis and modeling applicable to the discipline; **K3:** A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline; **K4:** Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline; **K5:** Knowledge that supports engineering design in a practice area; **K6:** Knowledge of engineering practice (technology) in the practice areas in the engineering discipline; **K7:**Comprehension of the role of engineering in society and identified issues in engineering practice in the discipline: ethics and the engineer's professional responsibility to public safety; the impacts of engineering activity; economic, social, cultural, environmental and sustainability; **K8:** Engagement with selected knowledge in the research literature of the discipline.

P-Range of Complex Engineering Problem Solving:

P1: Cannot be resolved without in-depth engineering knowledge at the level of one or more of K3, K4, K5, K6, or K8, which allows a fundamentals-based, first principles analytical approach; **P2:** Involve wide-ranging or conflicting technical, engineering, and other issues; **P3:** Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models; **P4:** Involve infrequently encountered issues; **P5:** Are outside problems encompassed by standards and codes of practice for professional engineering; **P6:** Involve diverse groups of stakeholders with widely varying needs; **P7:** Are high-level problems including many component parts or sub-problems.

A-Range of Complex Engineering Activities:

A1: Involve the use of diverse resources (and for this purpose, resources include people, money, equipment, materials, information and technologies); **A2:** Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues; **A3:** Involve creative use of engineering principles and research-based knowledge in novel ways; **A4:** Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation; **A5:** Can extend beyond previous experiences by applying principles-based approaches.

14. Assessment Strategy

- **Class Participation:** Class participation and attendance will be recorded in every class.
- **Continuous Assessment:** Continuous assessment for any of the activities such as quizzes, assignment, presentation etc. The scheme of the continuous assessment for the course will be declared on the first day of classes.
- **Final Examination:** A comprehensive term final examination will be held at the end of the term following the guideline of academic council.

15. Distribution of Marks

Class Participation	10%
Continuous Assessment	20%
Final Examination	70%
Total	100%

16. Textbooks

- Calculus by James Stewart
- Calculus: Early Transcendentals by Howard Anton, Irl Bivens and Stephen Davis.
- Differential and Integral Calculus by B. C. Das and B. N. Mukherjee.
- Integral Calculus with applications by A. K. Hazra.
- Elementary Differential Equations by Earl D. Rainville and Phillip E. Bedient.
- A First Course in Differential Equations with Modelling Applications by Dennis G. Zill.

17. Reference Books

- Differential Calculus by P. N. Chatterjee.
- Advanced Engineering Mathematics by Erwin Kreyszig, Herbert Kreyszig and Edward J. Norminton.
- Ordinary and Partial Differential Equations by M. D. Raisinghania.
- Differential Equations with Applications by M. M. K. Chowdhury.

18. Lecture plan

Weekly schedule For Differential Calculus

Week	Topics	COs
Week-1	Continuity and differentiability	
Week-2,3	Successive differentiation: Leibnitz's forms	
Week-4,5	Maxima and minima of functions of single variable: Rolle's theorem, Mean value theorem	
Week-6	Evaluation of indeterminate forms by L' Hospital's rule	
Week-7	**Class Test**	
Week-8,9	Expansion of functions: Taylor's and Maclaurin's theorems, Lagrange's and Cauchy's forms of remainders	
Week-10,11	Partial differentiation	
Week-12	Euler's theorem	
Week-13	Tangent, normal	
Week-14	**Class Test**	

Weekly schedule for Integral Calculus

Week	Topics	COs
Week-1,2	Definite integrals and its properties, Walli's formula	
Week-3	Improper integrals	
Week-4,5	Beta function and Gamma function	
Week-6,7	**Class Test** Parametric equations and polar coordinates	
Week-8,9	Applications of integration: area under a plane curve, area of a region enclosed by two curves and arc lengths in Cartesian and polar coordinates	
Week-10,11,12	Volume and surface area of solids of revolution	
Week-13	Multiple integrals	
Week-14	**Class Test**	

Weekly Schedule for Ordinary Differential Equations

Week	Topics	COs
Week-1,2	Definition, Formation of differential equations	
Week-3,4,5	Solution of first order differential equations by various methods with applications	
Week-6	**Class Test**	
Week-7,8,9	Solution of general linear equations of second and higher order with constant coefficients	
Week-10,11,12	Solution of Euler's homogeneous linear equations	
Week-13	**Class Test**	
Week-14	Review Class	

19. Important University Policies

- Rules and regulations for the undergraduate programmes: https://www.buet.ac.bd/info/Academicinformation/RulesUndergradprogram

Course Outline Prepared by	SAC	05/11/2022
Course Outline Reviewed by		22/11/2022