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

PART A: General Information

1.	**Course Number**	MATH 241
	Course Title	Advanced Calculus
	Credit (Contact) Hours	3.0 (3.0)
2.	**Level and Term (Section)**	Level-2, Term-1
	Academic Session	July 2025
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**	Xday (00:00-00:00 am) Yday (00:00-00:00 am) Zday (00:00-00:00 am)
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. Md. Abdul Alim	Dept. of Math	x@math.buet.ac.bd	Xday (00:00-00:00 am)
Teacher 2	Dept. of Math	y@math.buet.ac.bd	Yday (00:00-00:00 am)

PART B: Course Details

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

Vector Calculus: Vector and scalar fields; Differentiation and integration of vectors; Gradient of a scalar field: directional derivative; Divergence and curl of a vector field; Vector calculus identities: Jacobian, Hessian, Laplacian; Line integrals.

Complex Calculus: Functions of a complex variable; Limits and continuity of functions of complex variables; Complex differentiation: analytic functions, Cauchy-Riemann equations; Elementary complex functions: exponential, trigonometric, hyperbolic; Line integral of a complex function.

Partial Differential Equations (PDE): Introduction and formation of PDE; Solution of linear and non-linear PDE of order one; Second order linear PDE: classifications to standard forms; Parabolic, elliptic, hyperbolic; Solution of second order linear PDE by separation of variables.

10. Course Objectives

- To establish sufficient knowledge to deal with different complex and vector functions for applying them in engineering problems.
- To provide fundamental concepts of complex and vector analyses.
- To provide the basic concepts of differential equations, their solution methods along with their physical significance.

11. Knowledge required

Fundamental concepts of differential calculus, integral calculus and geometry.

12. Course Outcomes

CO No.	CO Statement	Corresponding PO(s)*	Domains and Taxonomy level(s)	Delivery Method(s) and Activity(-ies)	Assessment Tool(s)
1	**Define** basic concepts of complex number system, functions of a complex variable, vector calculus and partial differential equations	PO(a)	C1	Lectures, Homework	Written exams; assignment
2	**Explain** different methods of complex variables and differentiation and integration of various complex and vector functions and linear and non-linear partial differential equations	PO(b)	C2	Lectures, Homework	Written exams; assignment
3	**Apply** vector calculus, complex calculus and differential equations for solving real-life problems	PO(b)	C3	Lectures, Homework	Written exams; assignment

*PO (a): Engineering knowledge; PO(b): Problem analysis; PO (c): Design/development of solutions; PO(d): Investigation; PO(e) Modern tool use; PO(f): The engineer and society; PO(g): Environment and sustainability; PO(h): Ethics; PO(i): Individual work and teamwork; PO(j): Communication; PO(k): Project management and finance; PO(l): life-long learning.

**The cognitive domain (C) and its Taxonomy Levels (1 to 6) aim to develop the mental skills and the acquisition of knowledge of the individual. The cognitive domain encompasses of six categories which include:

C1-knowledge/remember; **C2-**understand/explain/estimate; **C3-**apply; **C4-**analysis; **C5-** evaluate/judge/verify; **C6-** synthesis/design/create/construct

13. Assessment Strategy

- **Class Participation:** Class participation and attendance will be recorded in every class.
- **Continuous Assessment:** Continuous assessment 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.

14. Distribution of Marks

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

15. Textbooks

- Calculus by Howard Anton, Irl Bivens and Stephen Davis.
- Schaum's Outline of Theory and Problems of Vector Analysis by Murray R. Spiegel.
- Complex Variables and Application by Ruel V. Churchill/James Ward Brown.
- Schaum's Outline of Theory and Problems of Complex Variables by Murray R. Spiegel.
- Elements of Partial Differential Equations by Ian Naismith Sneddon.

16. Reference Books

- Vector Analysis with Applications by Md. Ali Ashraf and Md. Abdul Khaleq Hazra.
- Vector Analysis by M.D. Raisinghania.
- Complex Variables: Harmonic and Analytic Functions by Francis J. Flangian.
- Functions of Complex Variable by M.L. Khanna.
- Advanced Engineering Mathematics by Erwin Kreyszig, Herbert Kreyszig and Edward J. Norminton.
- Ordinary and Partial Differential Equations by M. D. Raisinghania.

17. Lecture Plan

Weekly schedule for Vector Calculus

Week	Topics	COs
Week-1,2	Vector and scalar fields	
Week-3,4	Differentiation and integration of vectors	
Week-5,6	Gradient of a scalar field: directional derivative	
Week-7	**Class Test**	
Week-8,9	Divergence and curl of a vector field	
Week-10,11	Vector calculus identities: Jacobian, Hessian, Laplacian	
Week-12,13	Line integrals	
Week-14	**Class Test**	

Weekly schedule for Complex Calculus

Week	Topics	COs
Week-1, 2	Functions of a complex variable	
Week-3, 4	Limits and continuity of functions of complex variables	
Week-5, 6	Complex differentiation: analytic functions, Cauchy-Riemann equations	
Week-7	**Class Test**	
Week-8, 9, 10	Elementary complex functions: exponential, trigonometric, hyperbolic	
Week-11,12	Line integral of a complex function	
Week-13	**Class Test**	
Week-14	**Review Class**	

Weekly schedule for Partial Differential Equations

Week	Topics	COs
Week-1, 2	Introduction and formation of PDE	
Week-3, 4, 5	Solution of linear and non-linear PDE of order one	
Week-6, 7, 8	Second order linear PDE: classifications to standard forms	
Week-9	**Class Test**	
Week-10, 11	Parabolic, elliptic, hyperbolic	
Week-12, 13	Solution of second order linear PDE by separation of variables	
Week-14	**Class Test**	

18. 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		05/11/2022