North South University

Department of Mathematics & Physics (DMP)

MAT250: Calculus and Analytical Geometry (Calculus III)

Instructor	Dr. Md. Kamrujjaman Associate Professor, Department of Mathematics, University of Dhaka
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Course coordinator	: Prof. Dr. Md. Mamun Molla
Office hour:	Thursdays and Saturdays → 3:00pm – 4:00pm, and by appointment
Credit Hour	3

Course Objectives

1. To demonstrate the function of several variables and plotting 3D figures.
2. To teach the concept of partial derivatives and their applications.
3. To develop the ability of multiple integration in different coordinate systems.
4. To analyze the vector calculus and their physical significance.

Course Learning Outcomes:

Upon successful completion of this course, students will be able to:

(CO-1) Classify the difference between single and several variables functions and limits as well as plotting 3D figures.

(CO-2) Evaluate the partial derivatives for several variables functions and distinguish ordinary and partial derivatives.

(CO-3) Apply multiple integration techniques to find area and volume of the different model geometries.

(CO-4) Demonstrate their understanding of vector calculus and vector algebra.

(CO-5) Apply line and surface integrals to evaluate the work done and the corresponding flux.

Mapping of Course Outcomes

#	Course Outcomes (CO)	Bloom's taxonomy domain/level (**C**: *Cognitive* **P**: *Psychomotor* **A**: *Affective*)	Delivery methods and activities	Assessment tools
CO-1	Classify the difference between single and several variables functions and limits as well as plotting 3D figures.	**C1, C2, C3**	Lecture Discussion	Quiz, Assignment
CO-2	Evaluate the partial derivatives for several variables functions and distinguish ordinary and partial derivatives.	**C3, C4, P2**	Lecture, in-class group discussion,	Concept clarification, Midterm exam, Assignment
CO-3	Apply multiple integration techniques to find area and volume of the different model geometries.	**C2, C3, P2**	Lecture, Discussion	Class work, Quiz, Assignment, Final Exam
CO-4	Demonstrate their understanding of vector calculus and vector algebra.	**C2, P2**	Lecture, Discussion	Concept, Demonstration, Quiz, Assignment, Final Exam
CO-5	Apply line and surface integrals to evaluate the work done and the corresponding flux.	**C2, C3, C4, P2**	Lecture Demonstration	Assignment, Final Exam

Text book **: 1.** ***Calculus: Early Transcendental***; **Anton, Bivens and Davis, 10th Edition.**

Marks Distribution: **(Subject to change according to the directives from UGC/NSU)**

Assessment Strategy and Grading Scheme	
Grading tool	**Marks**
Attendance	10%
Assignments (At least 4 assignments)	10%
Quizzes (Best 3 quizzes out of at least 5 quizzes)	20%
Midterm	20%
Final Exam	40%

Course Content:

Partial Derivatives: (Exercise 13)

1. Functions of several variables, Limit and Continuity
2. Partial Derivatives, Differentiability and Chain Rule
3. Directional Derivatives, Tangent planes and normal vector, maxima and minima

Some Chapters from MAT240 (Need revision)

1. Cylindrical surface:3D graph plotting (11.1)
2. Parametric equation of lines (11.5)
3. Cylindrical and Spherical Coordinates (11.8)

Multiple Integrals: (Exercise 14)

1. Double Integrals over rectangular and non-rectangular regions
2. Double Integrals in Polar Coordinates
3. Triple Integrals: Cartesian, Cylindrical and spherical coordinates
4. Change of variables in Multiple Integrals; Jacobean

Vector Calculus: (Exercise 15)

Dot and cross product (exercise 11.3 and 11.4, need revision), Vector fields, Line integrals, Green's Theorem, Surface Integrals, The Divergence, Theorem, Stokes Theorem.

Course Schedule:

Lesson	Topics	Learning Activities	Assessment tools	Learning Outcome
1	Functions of two variables: drawing of natural domain	Lecture1	Discussions Mid term	CO-1
2	Function of two variables: 3D graph plotting	Lecture1		
3	Limits and Continuity	Lecture Assignment		CO-1
4	Partial Derivatives: first order derivatives and their physical significance	Lecture Group Discussion	Discussions Mid term	CO-2
5	Partial Derivatives: 2^{nd} and mixed order derivatives and their applications	Lecture Discussion	Mid term	CO-2
6	Differentiability and Chain Rule	Lecture	Mid term	CO-2
7	Directional Derivatives	Lecture Assignment	Mid term	CO-2
8	Tangent planes and normal line	Lecture	Mid term	CO-2
9	maxima and minima	Discussion Lecture Assignment	Mid term	CO-2
10	Double Integrals over rectangular regions	Lecture Assignment	Mid term	CO-3

11	Double Integrals over non-rectangular regions	Lecture	Mid term	CO-1
12	Double Integrals over non-rectangular regions: volume calculation			
13	Revision of the previous lectures	Lecture assignment	Mid term	
14	Midterm (Maximum 13 lectures)			
15	Double Integrals in Polar Coordinates	Lecture assignment	Mid term	CO-3
16	Double Integrals in Polar Coordinates			
17	Triple Integrals: in Cartesian coordinates	Lecture assignment	Mid term	CO-3
	Triple Integrals: in Cartesian coordinates	Lecture assignment	Mid term	CO-3
18	Change of variables in Multiple Integrals; Jacobean (chapter 14.7)	Lecture	Final	CO-3
19	Change of variables in Multiple Integrals; Jacobean (chapter 14.7)			
20	Cylindrical and Spherical Coordinates: chapter 11.8. We need this chapter for understanding Cylindrical and Spherical Coordinates	Lecture	Final	CO-3
21	Triple Integrals: Cylindrical and spherical coordinates (chapter 14.6) In this chapter we need the Jacobean concept from the chapter 14.7	Lecture	Final Exam	CO-3
22	Triple Integrals: Cylindrical and spherical coordinates (chapter 14.6)	Lecture	Final Exam	CO-3

23	Vector fields	Lecture	Final Exam	CO-4
24	Line integrals: for scalar function	Lecture	Final Exam	CO-4
25	Line integrals: for vector field	Lecture	Final Exam	CO-4
26	Line integrals: work done calculation	Lecture	Final Exam	CO-4
27	Green's Theorem	Lecture	Final Exam	CO-4
28	Surface Integrals: for scalar function	Lecture	Final exam	CO-5
29	Surface Integrals: for scalar function	Lecture	Final exam	CO-5
30	Divergence theorem	Lecture	Final exam	CO-5
31	Divergence theorem	Lecture	Final exam	CO-5
33	Stokes theorem: verification	Lecture,	Final exam	CO-5
34	Stokes theorem: evaluation of line integral	Lecture,	Final exam	CO-4
35	Stokes theorem: relation with Green's theorem	Lecture,	Final exam **Formative assessment**	CO-4
36	Revision on the previous lecture for final exam	Lecture,	Final exam	
	Final Exam			

Rules and regulations:

(a) There is **no scope to retake a quiz**. In case of Mid-term- or Final exam, exceptional cases*(unfortunate physical inability, accidents, serious illness) may be considered conditionally (with a **penalty of 20% reduced marks**) with proper justification.
(b) Three consecutive absents need an official clarification.
(c) Student having attendance **less than 60% of total classes will be not allowed to sit for Final Exam**.

**** Minimum five quizzes will be taken.**
***** Minimum four assignments will be taken.**

Note: Full attendance will carry the bonus marks.

********** **No Make Up Exam** **********