MATH 231 Calculus III
(3 Lecture– 3 Credits)

Prerequisite: MATH 112

Course Catalog Description:
This course covers differential and integral calculus for multivariable functions. First, students learn calculus tools such as partial derivatives, directional derivatives, gradients and how to apply them to analyze functions and solve constrained optimization problems. Subsequently, multiple integrals and their applications to calculate areas, volumes, mass and center of mass will be discussed. The course concludes with topics from vector calculus and key theorems such as Green's theorem, Stokes' theorem, and Gauss's theorem.

Textbook:
Calculus: Early Transcendental Functions by Robert T. Smith, Roland B. Minton and Ziad A. T. Rafhi, Publisher: McGraw-Hill, 5th Edition, 2018. ISBN: 9781526869968.

Reference Materials:
- *Calculus* by James Stewart, Publisher: CENGAGE Learning, 8th Edition (Metric Version), 2016. ISBN: 9781305266728.
- *Calculus: Concepts & Connections* by Robert Smith and Roland Minton, Publisher: McGraw-Hill, 1st Edition, 2007. ISBN: 9780073309293.

Course Topics :
1. Functions of Several Variables and Partial Differentiation:
   A. Functions of Several Variables (2 lectures)
   B. Partial Derivatives (4 lectures)
   C. The Gradient (4 lectures)

2. Multiple Integrals
   A. Double Integrals (6 lectures)
   B. Triple Integrals (4 lectures)
   C. Change of Variables in Multiple Integrals (1 lecture)

3. Vector Calculus
   A. Vector Fields (1 lecture)
   B. Line Integrals (5 lectures)
   C. Curl and Divergence- Exclude Vector Form of Green's Theorem (1 lecture)
   D. Parametric Surfaces and their Areas (2 lectures)
   E. Surface Integrals (1 lecture)
   F. Stokes' Theorem (1 lecture)
   G. The Divergence Theorem (1 lecture)

Structure and Learning Methodologies:
Lectures will be either 3 x 50 minutes per week or 2 x 75 minutes per week. Lectures will be presented using the whiteboard, and may be complemented with handouts and/or Powerpoint slides.

Assessment:
All course learning outcomes are assessed using the following assessment tools.

Coursework (Quizzes and assignments)	40%
Semester Examination	25%
Final Examination	35%

Contribution to Applied Mathematics, Statistics Students and Data Science Program Learning Outcomes (PLOs):

a	b	c	d	e	f	g	h
M	L	---	---	---	---	---	---

H – High M – Medium L – Low

Course Learning Outcomes & PLOs:

No.	Course Learning Outcomes	PLOs
1	Analyze functions of several variables using calculus tools including limits, partial derivatives, directional derivatives, and multiple integrals.	a
2	Describe relative and absolute extrema of functions of several variables.	a
3	Solve optimization problems and apply the method of Lagrange Multipliers for constrained optimization problems.	a, b
4	Solve problems involving area, volume, mass and center of mass using multiple integration techniques.	a, b
5	Interpret the divergence and curl of a vector field.	a
6	Solve line integrals, surface integrals and flux integrals.	a, b
7	Solve integration problems using Green's Theorem, Gauss' Theorem and Stokes' Theorem.	a