



## COURSE SYLLABUS

Course: Multivariable Calculus

Number: MAT 3380

Credit-Hours: 4 Credits

Course Description: Applications of differential and integral calculus to vector-valued functions, partial derivative, multiple integrals, vector field analysis, line and surface integrals, Jacobian transformations, Green, Stokes, and Gauss Theorems.

Prerequisite: MAT 2620 (Calculus II or equivalent)

Detailed Syllabus:

### 0. Getting Started

1. Email and Chat
2. Learning About the Course
3. Software Fundamentals

### 1. Vectors

1. Geometry of Vectors
2. Tangent Vectors; Velocity Vectors, Acceleration Vectors
3. Vector Length
4. Dot Products
5. Vector Projection
6. Perpendicularity
7. Lines
8. Normal Vectors
9. Cross Product
10. Planes in 3D
11. Normal Vectors on 3D Planes and Surfaces

### 2. The Derivative

1. Partial Derivatives
2. Gradient
3. Level Curves and Surfaces
4. Linearization
5. Total Differential
6. Data Fitting
7. Lagrange Multipliers

## 3. Vector Fields

1. Plotting and Trajectories
2. Flows Along and Flows Across Curves
3. Differential Equations and Vector Fields
4. Path Integrals
5. Gradient Fields
6. Line Integrals
7. Sources, Sinks
8. Divergence Theorem
9. Singularities
10. Rotation and Curl

## 4. Multiple Integrals

1. Basic Computation
2. u-v Substitution
3. Measurement of Volume, Mass, Density
4. 3D Integrals
5. Average Value
6. Fubini's Theorem

## 5. Other Coordinate Systems

1. Cylindrical Coordinates
2. Spherical Coordinates
3. Integration in Other Coordinate Systems

## 6. Gauss, Green, Stokes Theorems

1. Green's Theorem
2. Stoke's Theorem
3. Green's Theorem
4. Generalized Fundamental Theorem of Calculus