MOREHOUSE COLLEGE
DEPARTMENT OF MATHEMATICS

CALCULUS III
MATH 263

Prerequisite: Calculus II (Math 162, formerly Math 252) with a grade of "C" or better
Text: Calculus: One and Several Variables, 9th ed., by Salas, Hille, and Etgen (Wiley, 2003)
Recommended Supplement: Student Solution Manual
Coverage: Chapters 9, 12, 13, 14, 15, 16 and 17

COURSE OUTLINE

CHAPTER 9. The Conic Sections; Polar Coordinates; Parametric Equations
- 9.6. Curves Given Parametrically
- 9.7. Tangents to Curves Given Parametrically
- 9.8. Arc Length and Speed
- 9.9. Area of a Surface of Revolution; the Centroid of a Curve; Pappus's Theorem on Surface Area

CHAPTER 12. Vectors
- 12.1. Cartesian Space Coordinates
- 12.2. Displacements and Forces
- 12.3. Vectors
- 12.4. The Dot Product
- 12.5. The Cross Product
- 12.6. Lines
- 12.7. Planes

CHAPTER 13. Vector Calculus
- 13.1. Vector Functions
- 13.2. Differentiation Formulas
- 13.3. Curves
- 13.4. Arc Length
- 13.5. Curvilinear Motion; Curvature
- 13.6. Vector Calculus in Mechanics
- 13.7. Planetary Motion

CHAPTER 14. Functions of Several Variables
- 14.1. Elementary Examples
- 14.2. A Brief Catalog of Quadric Surfaces; Projections
- 14.3. Graphs; Level Curves and Level Surfaces
- 14.4. Partial Derivatives
- 14.5. Open and Closed Sets
- 14.6. Limits and Continuity; Equality of Mixed Partials

CHAPTER 15. Gradients; Extreme Values; Differentials
- 15.1. Differentiability and Gradient
- 15.2. Gradients and Directional Derivatives
- 15.3. The Mean-Value Theorem; Chain Rules
- 15.4. The Gradient as a Normal; Tangent Lines and Tangent Planes
- 15.5. Local Extreme Values
- 15.6. Absolute Extreme Values
- 15.7. Maxima and Minima with Side Conditions
- 15.8. Differentials
- 15.9. Reconstructing a Function from its Gradient

CHAPTER 16. Double and Triple Integrals

16.1. Multiple-Sigma Notation
16.2. The Double Integral
16.3. The Evaluation of a Double Integration by Repeated Integrals
16.4. Double Integrals in Polar Coordinates
16.5. Some Applications of Double Integration
16.6. Triple Integrals
16.7. Reduction to Repeated Integrals
16.8. Triple Integrals in Cylindrical Coordinates
16.9. The Triple Integral as a Limit of Riemann Sums; Spherical Coordinates
16.10. Jacobians; Changing Variables in Multiple Integration

CHAPTER 17. Line Integrals and Surface Integrals

17.1. Line Integrals
17.2. The Fundamental Theorem for Line Integrals
17.3. Work-Energy Formula; Conservation of Mechanical Energy
17.4. Line Integrals with Respect to Arc Length
17.5. Green's Theorem
17.6. Parameterized Surfaces; Surface Area
17.7 Surface Integrals
17.8. The Vector Differential Operator ∇
17.9. The Divergence Theorem
17.10. Stokes's Theorem

BEHAVIORAL OBJECTIVES

After successfully completing this course, the students should be able to perform the following tasks:

The Conic Sections; Polar Coordinates; Parametric Equations

- Obtain the graph of a parametric curve as well as tangents to the graph
- Compute arc lengths, surface areas, and centroids involving parametric curves

Vectors

- Perform Operations with plane/space vectors including addition, scalar multiplication, magnitude, and dot product
- Find cross products of space vectors
- Write equations of planes and lines in three-dimensional space

Vector Calculus

- Differentiate and integrate vector-valued functions and apply concepts to projectile motion

Functions of Several Variables

- Obtain the graphs of "selected" quadric surfaces and level curves
- Plot points in three dimensional space and sketch the graphs of cylinders
- Evaluate partial derivatives
- Find limits of functions of more than one variable

Gradients; Extreme Values; Differentials

- Investigate the notion of differentiability of functions of several variables
- Find directional derivatives, gradients, and extrema of functions of several variables
- Use chain rules to find derivatives and partial derivatives
- Apply the technique to Lagrange Multipliers to Optimization problems

Double and Triple Integrals

- Evaluate multiple integrals in rectangular, cylindrical and spherical coordinate systems
- Find areas, volumes, and surface areas using multiple integrals

Line Integrals and Surface Integrals

- Evaluate line and surface integrals
- Use Green's Theorem, the Divergence Theorem, and Stokes's Theorem in selected physical problems