

COURSE OUTLINE

MATH-240

Calculus III

4 Semester Hours

HOWARD COMMUNITY COLLEGE

Description

In this course, students will develop the skills necessary to conclude the calculus sequence. It contains vector calculus in both two and three dimensional space along with the classical theorems of Green, Stokes and Gauss. It will also include a discussion of partial derivatives and multiple integrals along with a number of appropriate applications. A graphing calculator is recommended. The use of a computer algebra system will be an integral part of the course. Prerequisite: MATH-182 or equivalent. (4 hours weekly)

Statement on General Education and Liberal Learning

A liberal education prepares students to lead ethical, productive, and creative lives and to understand how the pursuit of lifelong learning and critical thinking fosters good citizenship. General education courses form the core of a liberal education within the higher education curriculum and provide a coherent intellectual experience for all students by introducing the fundamental concepts and methods of inquiry in the areas of mathematics, the physical and natural sciences, the social sciences, the arts and the humanities, and composition. This course is part of the general education core experience at Howard Community College.

Overall Course Objectives

Upon completion of this course, the student will be able to:

1. Evaluate elementary vector arithmetic expressions.
2. Evaluate and manipulate the dot and cross products of vectors
3. Formulate parametric equation of lines.
4. Formulate the point normal equation of a plane
5. Completely describe the features of any quadric surface.
6. Solve classical engineering and physics problems using vector calculus, *e.g.* velocity and acceleration.
7. Understand and use the chain rule, for functions of two/three variables, to solve problems
8. Apply the concepts of multiple integration to solve complex volume, area, density, centroid, and moment of inertia problems.
9. Understand and apply curls and gradients to solve problems in conservative force fields.
10. Solve simple problems using the concepts of Green/Stokes Theorem and the Divergence Theorem.
11. Use the computer algebra system, MATLAB, as a means of discovery to reinforce concepts, AND as an efficient problem solving tool.

Major Topics

- I. Vectors and the Geometry of Space
 - A. Vectors in the Plane
 - B. Space Coordinates and Vectors in Space
 - C. The Dot Product of Two Vectors
 - D. The Cross Product of Two Vectors in Space
 - E. Lines and Planes in Space

- F. Surfaces in Space
 - G. Cylindrical and Spherical Coordinates
- II. Vector-Valued Functions
- A. Vector-Valued Functions
 - B. Differentiation and Integration of Vector-Valued Functions
 - C. Velocity and Acceleration
 - D. Tangent Vectors and Normal Vectors
 - E. Arc Length and Curvature
- III. Functions of Several Variables
- A. Introduction to Functions of Several Variables
 - B. Limits and Continuity
 - C. Partial Derivatives
 - D. Differentials
 - E. Chain Rules for Functions of Several Variables
 - F. Directional Derivatives and Gradients
 - G. Tangent Planes and Normal Lines
 - H. Extrema of Functions of Two Variables
 - I. Applications of Extrema of Functions of Two Variables
 - J. Lagrange Multipliers.
 - K. Change of Variables; Jacobians
- IV. Multiple Integration
- A. Iterated Integrals and Area of the Plane
 - B. Double Integrals and Volume
 - C. Change of Variables: Polar Coordinated
 - D. Center of Mass and Moments of Inertia
 - E. Surface Area
 - F. Triple Integrals and Applications
 - G. Triple Integrals in Cylindrical and Spherical Coordinates
- V. Vector Analysis
- A. Vector Fields
 - B. Line Integrals
 - C. Conservative Vector Fields and Independence of Path
 - D. Green's Theorem
 - E. Surface Integrals
 - F. Divergence Theorem
 - G. Stokes's Theorem

Course Requirements

Grading/Exams: Grading procedures will be determined by the individual faculty member within the guidelines of the Mathematics Division and will include several unit exams, projects involving MATLAB and a comprehensive departmental final exam.

Technology requirements: Graphing calculator (TI-84 recommended) and required course software.

Other Course Information

This course may be used as a Mathematics core course or as an Arts and Science elective. Check with your transfer institution concerning transferability for your program.