Course Title: Calculus II

Number of Credits: 4

Catalog Description: Differential and integral calculus of functions of a single variable. Two semesters in sequence. Meets GOAL 4. Prerequisite: Qualifying score on the mathematics placement exam or MATH 212 - Calculus I.

Text: Calculus: Early Transcendentals, by James Stewart (6th edition)

Topics Covered:

A. Techniques of Integration:
   1. Integration by Parts
   2. Trigonometric Integrals
   3. Trigonometric Substitution
   4. Integration of Rational Functions by Partial Fractions
   5. Strategy for Integration (optional)
   7. Approximate Integration
   8. Improper Integrals

B. Applications of Integration:
   1. Areas between Curves
   2. Volumes by Washers
   3. Volumes by Cylindrical Shells
   4. Work (optional)
   5. Average Value of a Function (optional)

C. Further Applications of Integration:
   1. Arc Length
   2. Area of a Surface of Revolution
   3. Applications to Physics and Engineering (optional)

D. Differential Equations (optional):
   1. Modeling with Differential Equations (optional)
   2. Direction Fields and Euler’s Method (optional)
   3. Separable Equations (optional)
   4. Models for Population Growth (optional)

E. Parametric Equations and Polar Coordinates:
   1. Curves Defined by Parametric Equations
   2. Calculus with Parametric Curves
   3. Polar Coordinates
4. Areas and Lengths in Polar Coordinates
5. Conic Sections (optional)
6. Conic Sections in Polar Coordinates (optional)

F. Infinite Sequences and Series:
   1. Sequences
   2. Series
   3. The Integral Test and Estimates of Sums
   4. The Comparison Tests
   5. Alternating Series
   6. Absolute Convergence and the Ratio and Root Tests
   7. Strategy for Testing Series
   8. Power Series
   9. Representations of Functions as Power Series
   10. Taylor and Maclaurin Series
   11. Applications of Taylor Polynomials (optional)

**Listing of Sections to be Covered (Calculus: ET, 7th edition, by James Stewart):**

- **Chapter 7:** 1-4, 7, 8 with 5 & 6 optional.
- **Chapter 6:** 1-3, with 4 & 5 optional.
- **Chapter 8:** 1, 2, with 3 optional.
- **Chapter 9:** optional.
- **Chapter 10:** 1-4, with 5 & 6 optional.
- **Chapter 11:** 1-10, with 11 optional.

**Remarks:**

- Review or at least assign material from 4.9 and 5.5, which is pre-requisite material from Calculus I.
- Cover integration by parts thoroughly, even though this should have been previously covered in Calculus I.
- At least two major applications to the real world should be covered in the class, whether chosen from sections 6.4, 8.3, 8.4, 8.5, or 11.1, or presented from some other source (such as projects). We are not mandating coverage of the aforementioned sections, but rather applications of Calculus in general.

**Approximate pace of coverage:**

25 required sections plus 2 or more application sections in 14 weeks → approximately 2 sections per week.

**Method of Instruction:** Lecture-presentation, discussion, question-answer sessions, use of calculators/computers, group work.

**Evaluation Procedure:** Homework, quizzes, projects, midterm exams, and a final exam.

**Minnesota Transfer Curriculum:** The following language should appear on each instructor’s syllabus for the course:
Goal 4 under GEP: Mathematics/Logical Reasoning – This is a General Education Program course that satisfies the Mathematics/Logical Reasoning requirement of the Minnesota Transfer Curriculum. The goal of this requirement is to increase students' knowledge about mathematical and logical modes of thinking. This will enable students to appreciate the breadth of applications of mathematics, evaluate arguments, and detect fallacious reasoning. Students will learn to apply mathematics, logic, and/or statistics to help them make decisions in their lives and careers. Minnesota's public higher education systems have agreed that developmental mathematics includes the first three years of a high school mathematics sequence through intermediate algebra.

Students will be able to:

1. Illustrate historical and contemporary applications of mathematics/logical systems.

   Each course in the Calculus sequence contains numerous applications to the physical sciences and to the field of finance. It is, in fact, the “language” in which many of the core ideas of those disciplines are expressed. Some examples of the types of applications covered are: predicting the spread of an epidemic; calculating the tax on a plot of land; designing a high-speed parachute relating study time to final grade; measuring the density of an object.

2. Clearly express mathematical/logical ideas in writing.

   Solving word problems forces students to extract from given information (or data) the important elements that can then be used to set up equations or other representations that allow them to solve the problem. Students will be required not only to use the data to solve the problems, but will be required to explain and interpret their solution and how they used that data and why their solution is appropriate.

3. Explain what constitutes a valid mathematical/logical argument (proof).

   The development of the main concepts of limit, differentiation, and integral involve processes which unfold subject to the rules of mathematical logic.

   In addition, solving the real-world problems requires students to develop methods of mathematical argument. This involves logically leading from a problem’s statement to its solution through a sequence of mathematically valid steps.
4. Apply higher-order problem-solving and/or modeling strategies.

In working with the different forms of information and developing solutions to problems students will see connections between various approaches. The ability to approach a fresh problem and develop new approaches is stressed.

**MnSCU Learning Outcomes:**
- Students will demonstrate the ability to use various techniques of integration.
- Students will demonstrate the ability to use integrals to find areas between curves, the arc lengths of curves, and for other applications.
- Students will demonstrate the ability to use integrals to find volumes and areas of surfaces of revolution.
- Students will demonstrate the ability to use parametric equations and polar coordinates.
- Students will demonstrate the ability to determine the convergence of sequences and series.
- Students will demonstrate the ability to find power series of functions and their radii and intervals of convergence.

**Last Revised:** Spring 2013 by the Mathematics Subgroup