MAT 151 CALCULUS II

Department of Mathematics

Southern Connecticut State University

I. Catalog Description

Continuation of MAT 150. Calculus of inverse trigonometric functions, techniques, and applications of integration, numerical integration, improper integrals, integration with polar coordinates, parametric curves, infinite sequences and series, power series, Taylor's formula, vectors in two and three-dimensions. A graphing calculator approved by the instructor is required.

II. Credit

(A) MAT 151 carries four (4) semester hours of college credit.

(B) MAT 151 is required of all mathematics majors.

(C) MAT 151 does not satisfy the All-University requirement in mathematics.

III. Prerequisite

The student must have passed MAT 150 with a grade of C- or better.
Specifically, the following material is prerequisite:

(A) Limits, including L'Hôpital's rule.

(B) Derivatives of polynomial, rational, exponential, logarithmic and trigonometric functions.

(C) Applications of the derivative as a rate of change and to graphs of functions.

(D) Indefinite integrals, including the method of substitution.

(E) Definite integrals, including application to finding area below a curve.

IV. Format

(A) MAT 151 is primarily a lecture-based course.

(B) A graphing calculator approved by the instructor is required.

(C) Use of a computer algebra system is required.

V. Outline

Instructors and students are expected to use technology including the graphing calculator and a computer algebra system to investigate and illustrate concepts from symbolic, graphical, and numerical points of view.

(A) Integration with applications

1. Areas of planar regions
2. Numerical integration
3. Volumes of solids of revolution
4. Arc length
5. At least one non-geometric application of the integral such as work, center of mass, or fluid force
6. The definition of the natural logarithm as an integral
7. Inverse trigonometric functions
8. Integral tables and simple substitutions
9. Integration by parts
10. The method of partial fractions
11. Improper integrals

(B) Polar coordinates and parametric curves

1. Definition of polar coordinates
2. Area computations with polar coordinates
3. Parametric curves
4. Integration with parametric curves

(C) Infinite Series

1. Infinite sequences
2. Infinite series
3. Tests for convergence
4. Alternating series, Absolute and Conditional Convergence
5. Power series
6. Taylor series and Taylor polynomials

(D) Vectors

1. Vectors in two and three-dimensions
2. Dot product and cross product
3. Lines and planes in space

VI. Current Text

G. Thomas, M. Weir, J. Hass, F. Giordano, *Thomas' Calculus, Early Transcendentals*, 11th edition, Addison Wesley, 2007.

Sections covered :

- Chapter 5 : Section 5.6.
- Chapter 6 : Sections 6.1, second half of 3.5, 6.3, one of 6.4, 6.6, 6.7.
- Chapter 7 : Sections 7.1, 7.2, 7.3 (optional).
- Chapter 8 : Sections 8.1 – 8.3, 8.6 – 8.8.
- Chapter 10 : Sections 10.5 – 10.7.
- Chapter 11 : Sections 11.1, 11.2,
  11.3 (the p–series is required and the integral test is optional),
  11.4, 11.5 (ratio test), 11.6 – 11.9.
- Chapter 12 : Sections 12.1 – 12.5.

VII. Outcomes

Students passing MAT 151 should minimally be able to do each of the following tasks.

By hand (without the use of technology):

(A) Evaluate integrals using elementary anti-differentiation rules, integration by parts, the method of partial fractions, and integral tables.

(B) Set up definite integrals that represent area (in rectangular and polar coordinates), volume, and arc length.

(C) Determine whether a sequence converges or diverges.

(D) State the definition of the sum of a series.

(E) Find the sum of basic telescopic series and geometric series.

(F) Compute several terms of the Taylor polynomial for a function.

(G) Manipulate power series in some basic ways.

(H) Do basic vector arithmetic, including the dot product and cross product in 2–dimensional and 3–dimensional spaces.

(I) Find the equations of lines and planes in $\mathbb{R}^3$.

Using technology (Graphing calculator and/or computer algebra system):

(A) Implement a numerical integration method.

(B) Evaluate complicated definite integrals that represent area, volume, arc length, and other applications.

(C) Find derivatives and anti-derivatives using the symbolic capabilities of a computer algebra system.

(D) Obtain 2–dimensional graphs of functions in rectangular or polar coordinates and graphs of parametric functions.

(E) Investigate the convergence of a sequence.

(F) Investigate the convergence (and sum if pertinent) of an infinite series.

(G) Approximate definite integrals using series.

(H) Compare a function $f(x)$ with its Taylor polynomials.