

**Department:**

Mathematics

**Course Description:**

This course is the second in a three-semester sequence of calculus courses. This course consists of working with logarithms and other exponential functions, hyperbolic functions, inverse and hyperbolic trigonometric functions, numerous integration techniques including using tables, integration by parts, substitutions, partial fractions, improper integrals, continued work with L'Hopital's rule, sequences and series, convergence and comparison tests, using formulas to estimate integrals, and differential equations.

**Course Competencies:**

The learning outcomes and competencies detailed in this syllabus meet or exceed the learning outcomes and competencies specified by the Kansas Core Outcomes Groups for this course as approved by the Kansas Board of Regents. (Kansas Regents Shared Number Course and Title: **KRSN: MAT 2020 Calculus II**.)

Upon completion of this course, students will be able to:

1. Apply techniques of differential and integral calculus.
  - a. Find derivatives and integrals of hyperbolic functions, inverse hyperbolic function, and inverse trigonometric functions.
  - b. Find antiderivatives using partial fractions.
  - c. Find antiderivatives using trigonometric substitution.
  - d. Find antiderivatives of powers of trigonometric functions.
  - e. Find antiderivatives using integration by parts.
  - f. Evaluate improper integrals and determine their convergence.
2. Solve applied integration problems.
  - a. Solve scientific applications.
  - b. Solve geometric applications including volumes of revolution, arc length, and surface area of revolution.
3. Utilize concepts of infinite sequences and series.
  - a. Determine convergence of an infinite sequence by an appropriate theorem.
  - b. Determine convergence of an infinite series by an appropriate test including comparison tests, ratio test, root test, integral test, divergence (nth term) test, alternating series test, and absolute convergence theorem.
  - c. Determine the sum of geometric and telescoping series.
4. Utilize concepts of power series.
  - a. Determine the radius and interval of convergence.
  - b. Differentiate and integrate term-by-term.

- c. Construct a Taylor series or polynomial approximation for a given function.
- d. Approximate a definite integral using Taylor polynomial.
- 5. Utilize concepts of parametric and polar equations.
  - a. Describe algebraic and geometric relationships in both parametric and polar form for objects such as conic sections.
  - b. Apply techniques of differential and integral calculus to parametric and polar equations.

## Course Content:

- A. Applications of the Definite Integrals (some review)
  - 1. Volumes using Cross-Sections/Cylindrical Shells
  - 2. Arc length by the differential formula
  - 3. Areas of Surfaces of Revolution
    - a. Revolved about the x-axis
    - b. Revolved about the y-axis
  - 4. Physical Applications
    - a. Work by a constant force
    - b. Work by a variable force
    - c. Hooke's Law for Springs
    - d. Fluid force problems
- B. Integrals and Transcendental Functions
  - 1. The Logarithm Defined as an Integral
    - a.  $e$  and natural logarithm rules, definitions, and domain/range
    - b. Integrals leading to logarithms, trigonometric functions
  - 2. Exponential Change
  - 3. Separable Differential Equations
    - a. Techniques for expressing differential equation
    - b. Initial value problems
    - c. Applications of differential equations
  - 4. Hyperbolic Functions
    - a. Derivatives
    - b. Integrals
  - 5. Relative Rates of Growth
- C. Techniques of Integration
  - 1. Integration by Parts
  - 2. Trigonometric Integrals
  - 3. Trigonometric Substitutions
  - 4. Integration of Rational Functions by Partial Fractions
  - 5. Integration using Integral Tables
  - 6. Integration using Computer Algebra Systems
  - 7. Integration using Numerical Integration
    - a. Trapezoidal Rule

- b. Simpson's (Parabolic) Rule
  - 8. Improper Integrals
    - a. At infinity (or negative infinity)
    - b. For all real values
    - c. Integrands for vertical asymptotes
    - d. Tests for Convergence and Divergence
- D. Infinite Sequences and Series
  - 1. Sequences
    - a. Finding a sequence's formula
    - b. Convergence or Divergence of sequences
    - c. Recursively defined sequences
  - 2. Infinite Series
    - a. Partial Sums
    - b. Geometric Terms
    - c. N-th Term test [or Limit Test or Divergence Test]
    - d. Telescoping Series
  - 3. The Integral Test for Series
  - 4. The Comparison Test and Limit Comparison Test for Series
  - 5. The Ratio and Root Test for Series
  - 6. Alternating Series
    - a. Absolute Convergence
    - b. Conditional Convergence
    - c. The Absolute Convergence Test
  - 7. Power Series
  - 8. Taylor and Maclaurin Series
  - 9. Convergence of Taylor Series
  - 10. Applications of Taylor Series
- E. Parametric Equations and Polar Coordinates
  - 1. Introduction to Polar Coordinates
  - 2. Parametrizations of Plane Curves
  - 3. Calculus with Parametric Curves
  - 4. Calculus with Polar Equations

## Learning Assessments:

Course competencies will be assessed by written examinations covering all course material, including regular period-long exams and a required, comprehensive final exam. Additionally, assessment may also occur through any of the following at the discretion of the instructor: regular collection of homework, in-class work, quizzes, and various projects.

## Instructional Materials:

Textbook: Briggs, W., Cochran, L., Gillett, B., & Schultz, E. (2015). *Calculus: Early Transcendentals* (2nd ed.). Boston, MA: Pearson Education. ISBN-13: 978-0321947345.

A graphing calculator is also required. The TI-84 plus model is recommended. Students should use the instructional book that accompanies the graphing calculator of their choice, as the instructor will not have time to teach students how to use the various graphing calculators.

It is the intention of Highland Community College to work toward full compliance with the Americans with Disabilities Act, to make instructional programs accessible to all people, and to provide reasonable accommodations according to the law.

Students should understand that it is their responsibility to self-identify their need(s) for accommodation and that they must provide current, comprehensive diagnosis of a specific disability or medical condition from a qualified professional in order to receive services. Documentation must include specific recommendations for accommodation(s). Documentation should be provided in a timely manner prior to or early in the semester so that the requested accommodation can be considered and, if warranted, arranged.

In order to begin the process all students **must** complete the “Disabilities Self-Identification Form” on our [Disability Services website](#).

This form can also be accessed at the Highland Community College homepage under Students Services/Student Resources/Disability Service or by contacting the Disabilities Coordinator.

#### **A Note on Harassment, Discrimination and Sexual Misconduct**

Highland Community College seeks to assure all community members learn and work in a welcoming and inclusive environment. Title VII, Title IX, and College policy prohibit harassment, discrimination and sexual misconduct. Highland Community College encourages anyone experiencing harassment, discrimination or sexual misconduct to talk to report to the Vice President for Student Services, the Human Resources Director or complete an [online report](#) about what happened so that they can get the support they need and Highland Community College can respond appropriately.

There are both confidential and non-confidential resources and reporting options available to you. Highland Community College is legally obligated to respond to reports of sexual misconduct, and therefore we cannot guarantee the confidentiality of a report, unless made to a confidential resource. Responses may vary from support services to formal investigations. As a faculty member, I am required to report incidents of sexual misconduct and thus cannot guarantee confidentiality. I must provide our Title IX coordinator with relevant details such as the names of those involved in the incident. For more information about policies and resources or reporting options, please review our [Equity Grievance Policy](#).