HIGHLAND COMMUNITY COLLEGE

Syllabus

MAT 110 Calculus II
5 Credit Hours (Lecture)
Prerequisite: MAT 106 with a C or higher
Revision Date: 12/06/2019

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. The course also covers calculus involving three-dimensional space, vector operations including the dot product, projections, the cross product, parametric equations of lines, and three-dimensional plane operations with quadric surfaces, as well as selected topics in analytic geometry as time permits.

Course Competencies:

Upon completion of the course, the student should be able to:

1. Take derivatives and integrals of inverse trigonometric and hyperbolic functions.
2. Use substitution and other elementary techniques to complete indefinite and definite integrals and solve problems that find the area of a region between two curves.
3. Take derivatives and integrals of logarithm and exponential functions.
4. Use basic integration techniques to find the volume of a region (generally by revolution) by the disk method, the washer method, or the cylindrical shell method.
5. Apply integration techniques to find arc length, surface of revolution, work problems, moments, centers of mass, centroids, fluid pressure, and fluid force.
6. Integrate functions using tables or integration by parts.
7. Integrate powers of the trigonometric functions by using reduction formulas and simplification techniques.
8. Use trigonometric substitutions, partial fractions, and other substitutions to integrate non-routine functions as needed.
9. Perform numerical integration, with special emphasis on Trapezoidal and Simpson’s Rule, to approximate otherwise too-difficult integration problems.
10. Evaluate improper integrals and use L'Hopital's Rule for limit problems of all types.
11. Write out terms in a sequence and identify monotonicity for a given sequence.
12. Determine convergence for infinite series.
13. Use various convergence and comparison tests for infinite series, including the divergence test, integral test, p-series test, comparison test, limit comparison test, ratio test, and root test.
14. Use convergence tests to classify alternating series as absolutely convergent, conditionally convergent, or divergent, and satisfy hypotheses about alternating series.
15. Use Maclaurin and Taylor polynomials to improve the accuracy of local linear approximations.
16. Use Maclaurin and Taylor series and functions defined by power series to find the radius of convergence and the interval of convergence and differentiate and integrate power series.

17. Establish the convergence of Taylor series.
18. Express given equations in polar coordinates, find equations for polar graphs, and sketch curves in polar coordinates using appropriate technology.
19. Derive the formulas required to find slopes, tangent lines, and arc lengths of both parametric and polar curves.
20. Find areas of regions that are bounded by polar curves.
21. Sketch parabolas, ellipses, and hyperbolas, and identify foci, vertices, axes, and asymptotes, and use these conic sections in polar coordinates.
22. Explain polar coordinates, analyze polar graphs, and find area enclosed by regions described by polar coordinates.
23. Find dot products of two vectors, including finding projections, find the cross product of two vectors in space, including calculation of the scalar triple product, and use a parametric equation to find tangent lines and arc length.
24. Use vectors to derive equations of planes in 3-space, including the use of these equations to solve geometric problems, time permitting.
25. Find limits, derivatives, and integrals for vector-valued functions, time permitting.

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
        c. Applications
    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]
    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. The Binomial Series
11. Applications of Taylor Series

E. Parametric Equations and Polar Coordinates (time permitting)
1. Introduction to Polar Coordinates
2. Parametrizations of Plane Curves
3. Calculus with Parametric Curves

Learning Assessments:

Course competencies will be assessed by written examinations covering all course material, including regular hour-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.

Guidelines for Requesting Accommodations Based on Documented Disability or Medical Condition

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.