MAT 272
CALCULUS II

COURSE DESCRIPTION:

Prerequisites: MAT 271
Corequisites: None

This course provides a rigorous treatment of integration and is the second calculus course in a three-course sequence. Topics include applications of definite integrals, techniques of integration, indeterminate forms, improper integrals, infinite series, conic sections, parametric equations, polar coordinates, and differential equations. Upon completion, students should be able to use integration and approximation techniques to solve application problems. *This course has been approved to satisfy the Comprehensive Articulation Agreement for the general education core requirement in natural sciences/ mathematics.* Course Hours Per Week: Class, 3. Lab, 2. Semester Hours Credit, 4.

LEARNING OUTCOMES:

1. Students will be able to use a variety of techniques, both analytical and technological, to evaluate integrals involving elementary functions and use integration to compute quantities whose values vary over an interval. Students will display proficiency by demonstrating the following competencies:

a. Compute the area of a region bounded by two curves.
b. Compute the volume of a solid of revolution by the use of disks, washers, or cylindrical shells.
c. Compute the length of an arc.
d. Compute the surface area of a surface of revolution.
e. Compute moments and centers of mass.
f. Compute total work in selected practical applications.
g. Compute fluid pressures on a surface.
h. Evaluate integrals using integration by parts.
i. Evaluate integrals involving trigonometric functions.
j. Evaluate integrals using trigonometric substitution.
k. Evaluate integrals using partial fraction decomposition.
l. Evaluate the limits of indeterminate forms.
m. Integrate improper integrals.

2. Students will be able to solve selected types of differential equations and use these equations to model real-world problems. Students will display proficiency by demonstrating the following competencies:

a. Solve selected first order differential equations that are separable or linear.
b. Solve selected second order differential equations.
c. Approximate the solutions of differential equations using Euler's Method.
d. Use first and second order differential equations to solve selected practical problems.
e. Differentiate and integrate selected hyperbolic expressions.

3. Students will be able to test the convergence of infinite series and use these series to both approximate and find exact representations of elementary functions. Students will display proficiency by demonstrating the following competencies:

a. Define a sequence of numbers and apply limit theorems to determine whether the sequence converges or diverges.
b. Identify indeterminate forms; use L'Hôpital's Rule to apply a limit to an indeterminate form.
c. Define a series and apply the appropriate tests to determine whether the sequence of partial sums converges or diverges.
d. Identify a geometric series and determine whether or not it converges; if it does, find its value.
e. Identify a p-series and determine whether or not it converges.
f. Define a power series and determine its interval of convergence.
g. Define and determine absolute convergence.
h. Define an alternating series and determine conditional convergence.
i. Determine a Taylor Polynomial, a Maclaurin Series, or a Taylor Series for selected functions.
j. Use Taylor's Theorem to place a bound on the error for selected Taylor and Maclaurin Series.

4. Students will be able to convert between rectangular, polar, and parametric functions and be able to differentiate and integrate these expressions. Students will display proficiency by demonstrating the following competencies:

a. Eliminate the parameter in a set of parametric equations.
b. Given a set of parametric equations, find the slope of a tangent line to the curve and the arc length of the curve.
c. Sketch the graphs of polar equations, find the length of curves described by polar equations, and find the area of regions bounded by curves described by polar equations.
d. Write the equation, graph, state the properties, and analyze parabolas, ellipses, and hyperbolas.
e. Use a computer-algebra system for calculus applications.

OUTLINE OF INSTRUCTION:

I. Applications of integration
   A. Area between two curves
   B. Volume: The disk method
   C. Volume: The shell method
   D. Length of a plane curve
   E. Area of a surface of revolution
   F. Work
   G. Moments, centers of mass, and centroids
   H. Fluid pressure and fluid force

II. Integration techniques
   A. Overview of integration methods
   B. Integration by parts
   C. Trigonometric integrals
   D. Trigonometric substitution
   E. Partial fractions
   F. Integration by tables and computer algebra systems
   G. Indeterminate forms and L'Hôpital's Rule
   H. Improper integrals

III. Differential equations
   A. First-order differential equations and applications
   B. Euler's Method
   C. Modeling with first-order differential equations
   D. Second-order homogeneous differential equations

IV. Infinite Series
   A. Sequences
   B. Monotone sequences
   C. Infinite series
   D. Convergence tests
   E. The comparison, ratio, and root tests
   F. Alternating series; conditional convergence
   G. Maclaurin and Taylor Polynomials
   H. Maclaurin and Taylor Series; power series
   I. Convergence of Taylor Series
   J. Differentiating and integrating power series

V. Conics, parametric equations, and polar coordinates
   A. Parametric equations
   B. Polar coordinates
   C. Tangent lines and arc length for parametric and polar curves
   D. Area in polar coordinates
   E. Conic sections in calculus

VI. Computer-algebra system

REQUIRED TEXTBOOK AND MATERIALS:

Anton, Howard, Irl Bivens, and Stephen Davis. Calculus: Early Transcendentals Single Variable. 8th Ed. Wiley, 2005.

TI-83/84 Graphing Calculator.

STATEMENT OF DISABILITIES ACCOMMODATION:

Students who require academic accommodations due to any physical, psychological, or learning disability are encouraged to request assistance from a disability services counselor within the first two weeks of class. Likewise, students who potentially require emergency medical attention due to any chronic health condition are encouraged to disclose this information to a disability services counselor within the first two weeks of class. Counselors can be contacted by calling 686-3652 or by visiting the Student Development Office in the Phail Wynn Jr. Student Services Center, room 1309.