COURSE OUTLINE

Course Number	Course Title	Credits
MAT 152	**Calculus II for the Mathematical and Physical Sciences**	**4**

Hours: Lecture/Lab/Other	Co- or Pre-requisite	Implementation Semester & Year
4 lecture	**MAT151: Calculus I for the Mathematical and Physical Sciences with a minimum of a C or better**	**Spring 2022**

Catalog description:
Continuation of MAT 151. Topics include techniques of integration, areas, volumes, arc length, surface area, improper integrals, Simpson's Rule, sequences and infinite series, Taylor and Maclaurin series, differentiation of polar and parametric equations, conic sections in rectangular and polar form, and rotation of axes.

General Education Category:
Goal 2: Mathematics

Course coordinator:
Kyle Anderson, 609-570-3359, andersok@mccc.edu

Required texts & Other materials:
Calculus: Volume 2, Edwin Herman and Gilbert Strang
https://openstax.org/details/books/calculus-volume-2

Course Student Learning Outcomes (SLO):

Upon successful completion of this course the student will be able to:

1. Calculate areas, volumes, and arc lengths using integration. [Supports ILG #2, 11, PLO #1 - 4]
2. Identify and use techniques necessary for integration. [Supports ILG #2, 11, PLO #1 - 4]
3. Understand the difference between a sequence and an infinite series and determine when each of them converges or diverges. [Supports ILG #2, 11, PLO #1 - 4]
4. Find power series representations of functions and use the appropriate convergence test to study the behavior of series. [Supports ILG #2, 11, PLO #1 - 4]
5. Apply techniques of differential and integral calculus to parametric and polar equations. [Supports ILG #2, 11, PLO #1 - 4]
6. Use calculus methods to model and solve applications problems, including selecting or developing appropriate procedures and verifying the validity and appropriateness of the solution. [Supports ILG #2, 11, PLO #1 - 4]

Course-specific Institutional Learning Goals (ILG):

Institutional Learning Goal 2. Mathematics. Students will use appropriate mathematical and statistical concepts and operations to interpret data and to solve problems.
Institutional Learning Goal 11. Critical Thinking: Students will use critical thinking skills understand, analyze, or apply information or solve problems.

Program Learning Outcomes for Mathematics AS (PLO)

1. Apply a range of mathematical skills spanning fundamental concepts to more advanced mathematical concepts.
2. Apply quantitative knowledge, including the required technological skills and theoretical knowledge.
3. Demonstrate critical thinking skills to solve real world problems using mathematical modeling.
4. Communicate methods of solutions and results to problems using mathematical language and notation.

Units of study in detail – Unit Student Learning Outcomes:

Unit I **Applications of the Definite Integral [Supports Course SLOs #1, 6]**

Learning Objectives

The student will be able to:

- Calculate the area bounded by several functions using x or y as the independent variable of integration.
- Calculate the volume generated by revolving an area bounded by several functions about the x-axis or y-axis by using the disk, washer, or cylindrical shell methods.
- Define and use integrals to find the length of a curve.
- Define and use integrals to find the area of a surface of revolution.

Unit II **Techniques of Integration [Supports Course SLOs #2, 6]**

Learning Objectives

The student will be able to:

- Apply the appropriate integration formulas from the previous course.
- Recognize when to use and perform integration by parts as many times as needed to evaluate an integral.
- Use trigonometric identities to integrate powers of trigonometric functions.
- Use trigonometric substitution where applicable to evaluate integrals.
- Use partial fraction decomposition when needed to integrate rational functions.
- Use the trapezoid rule or Simpson's rule to approximate definite integrals.
- Determine whether an integral is improper, and if so, determine if it converges or diverges and find what it converges to if it converges.

Unit III **Sequences and Infinite Series [Supports Course SLOs #3, 4, 6]**

Learning Objectives

The student will be able to:

- Define what a sequence is, write several of its terms, write its general term, and determine if it converges or diverges.
- Determine if a sequence is eventually monotonic or neither, if it is bounded, and, if it is bounded, its limit.
- Definite what a geometric series is, write several of its terms, write its general term, and determine if it converges or diverges.
- Determine which convergence test (divergence test, integral test, comparison test, limit comparison test, ratio test, root test, alternating series test) to use to and apply it to determine absolute convergence, conditional convergence or divergence.
- Calculate the radius of convergence and interval of convergence for a given power series.
- Determine an *n*th degree Maclaurin or Taylor polynomial for a given function and determine the related Maclaurin or Taylor series.

- State and apply the Remainder Estimation Theorem to estimate the error in using a polynomial of *n*th degree to approximate a function.
- Perform algebraic and calculus manipulations of power series.

Unit IV **Calculus and Analytic Geometry [Supports Course SLOs #5, 6]**

Learning Objectives

The student will be able to:

- Convert points in rectangular form to poplar form and vice-versa.
- Graph equations and points using the polar coordinate system and polar symmetry tests.
- Determine the polar equation for a given graph.
- Calculate slopes of tangent lines, equations of tangent lines, and length of parametric and polar curves.
- Calculate areas of regions that are bounded by polar curves.
- Find vertices, foci, centers, asymptotes, directrix, where applicable of conic sections given in rectangular form and use this information to solve application problems.
- For a given polar equation of a conic section find its eccentricity, foci, the distance from the pole to the directrix or vertices in order to graph the conic section.
- Derive the polar equation of a conic section for given conditions.

Evaluation of student learning:

Tests, quizzes, homework assignments and projects may be used in evaluating the students' progress throughout the course depending on the individual instructor. It is suggested that three tests and a final exam be used in evaluating the students' progress. A suggested day-by-day schedule and suggested homework problems should be available to the students. A cumulative final exam must be given in the course.

Tests	55%
Cumulative Final Exam	30%
Quizzes, Homework, Projects	15%