MAC2312 Course Outline

Calculus II with Analytical Geometry.....(4) (P)

Description: This is the second semester in a three semester calculus sequence. This course includes the study of applications of definite integral, numerical integration, techniques of antidifferentiation, improper integral and indeterminate forms, parametric and polar representation of plane curves, and sequences and series.

General Education Learning Outcome: The primary General Education Learning Outcome (GELO) for this course is Quantitative Reasoning, which is to understand and apply mathematical concepts and reasoning, and analyze and interpret various types of data. The GELO will be assessed through targeted questions on either the comprehensive final or an outside assignment.

Prerequisite: MAC2311 with a "C" or better, OR the equivalent.

Rationale: In an increasingly complex world, mathematical thinking, understanding, and skill are more important than ever. Calculus will provide the students with the necessary tools to understand and formulate advanced mathematical concepts and an awareness of their relationship to complex problems. Students wishing to major in the sciences, engineering, or medicine are required to have a working knowledge of the calculus and its applications.

Impact Assessment: *Calculus II* continues the development of both differential and integral calculus. The course applies toward the General Education mathematics requirement area A for an Associate of Arts degree. MAC2312 is a prerequisite for MAC2313, MAP2302 and many upper division courses and programs in mathematics and the sciences.

Broad Course Objectives: This course supports the following goals of the Math Department.

- Engage students in sound mathematical thinking and reasoning. This should include students finding patterns, generalizing, and asking and answering relevant questions.
- Provide a setting that prepares students to read and learn mathematics on their own.
- Explore multiple representations of topics including graphical, symbolic, numerical, oral, and written. Encourage students to make connections between the various representations to gain a richer, more flexible understanding of each concept.
- Analyze the structure of real-world problems and plan solution strategies. Solve the problems using appropriate tools.
- Develop a mathematical vocabulary by expressing mathematical ideas orally and in writing.
- Enhance and reinforce the student's understanding of concepts through the use of technology when appropriate.

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As a result of successfully completing MAC2312, students should be able to demonstrate the following:

- Analyze and interpret quantitative data verbally, graphically, symbolically and numerically.
- Communicate quantitative data verbally, graphically, symbolically and numerically.
- Appropriately integrate technology into mathematical processes.
- Use mathematical concepts in problem-solving through integration of new material and modeling.

Topical Outline with Specific Course Objectives:

I. *Integration*

A. Apply a variety of numerical methods for approximating definite integrals.

B. Estimate and compare the errors associated with each approximation method for definite integrals.

C. Apply antidifferentiation techniques, such as integration by parts, partial fractions, trigonometric substitution and the use of a table of integrals.

D. Develop an organized approach for classifying a given integrand and determining the appropriate technique of antidifferentiation.

E. Model applied problems of area, volume, arc length, and work using integrals.

F. Recognize an improper integral and determine whether it is convergent or divergent.

G. Find the value of a convergent improper integral symbolically when possible, otherwise estimate the value numerically.

II. *Infinite Sequences and Series*

A. Verify the convergence or divergence of a sequence by employing appropriate tools, and find or estimate the limit of a convergent sequence.

B. Define the sequence of partial sums for an infinite series and relate the convergence of this sequence to the convergence of the series. Then find or estimate the sum.

C. Exhibit knowledge of convergence tests, their usefulness, conditions, and limitations, and apply the tests to determine the convergence or divergence of a series.

D. Develop an organized approach for determining the convergence or divergence of a series.

E. Find the interval and radius of convergence for a given power series.

F. Find the Taylor and Maclaurin series representations of a function and determine the interval of convergence.

G. Relate differentiation/integration of a given function to differentiation/integration of the corresponding power series representation.

H. Use the sequence of partial sums of a power series, in its interval of convergence, as a useful approximation for a function.

III. Parametric Equations

A. Represent a plane curve parametrically and determine its orientation.

B. Use parametric equations to model and analyze physical processes such as curvilinear motion.

IV. Polar Coordinates

A. Apply calculus to examine the properties of curves represented in polar coordinates, e.g. area, tangent lines, and arc length.

Evaluation: Each instructor will determine the specific criteria for determining the final course grade. These criteria will be delineated in the first day handout provided to each student. Each instructor will give a comprehensive final exam during the assigned final exam period.

Commonality: All instructors will use the same textbook and cover all topics in the topical outline. A computer lab with mathematical software is provided to facilitate collaboration and the use of technology. A graphing calculator will be required for this course. Either the TI-83 or the TI-84 line of calculators is recommended; any other graphing calculator will need to be approved by the instructor.