MAC2313 Course Outline

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

Description: This is the third semester in a three semester calculus sequence. This course includes the study of multivariable calculus; including partial derivatives, multiple integrals, and their applications; parametric curves and surfaces in 3-space; solid analytic geometry; and the calculus of vector-valued functions, including line integrals and flux integrals.

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: MAC2312 with a grade of "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 III* continues the development of both differential and integral calculus. The course applies toward the General Education mathematics requirement area B for an Associate of Arts degree. MAC2313 is a prerequisite for 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/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 MAC2313, 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. *Functions and the Geometry of Space*

A. Identify, describe, and visualize equations in 3-space.

B. Use contour maps for functions of two or three variables to analyze the functions.

C. Use the algebra of vectors to study geometry in 3-space.

II. *Calculus of Vector-Valued Functions*

A. Use the calculus of vector-valued functions to analyze motions in 3-space.

B. Find and interpret the unit tangent and unit normal vectors and curvature.

III. *Calculus of Functions of Several Variables - Differentiation*

A. Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies.

B. Find and interpret the gradient and directional derivatives for a function at a given point.

C. Find the total differential of a function of several variables and use it to approximate incremental change in the function.

D. Analyze and solve constrained and unconstrained optimization problems.

IV. *Calculus of Functions of Several Variables - Integration*

A. Explain the relationship between multiple and iterated integrals.

B. Evaluate multiple integrals either by using iterated integrals or approximation methods.

C. Relate rectangular coordinates in 3-space to spherical and cylindrical coordinates, and use spherical and cylindrical coordinates as an aid in evaluating multiple integrals.

D. Model applied problems using multiple integrals.

V. *Vector Analysis*

A. Define a line integral, and use it to find the total change in a function given its gradient field.

B. Calculate and interpret the flow and divergence for a vector field.

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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.