University of Arkansas – Fort Smith
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General Syllabus

MATH 2904 Calculus III

Credit Hours: 4 Lecture Hours: 4 Laboratory Hours: 0

Prerequisite: MATH 2854 Calculus II

Effective Catalog: 2018~2019

I. Course Information

A. Catalog Description

Vectors and basic vector operations in two and three dimensions, lines and planes in space, cylindrical, and spherical coordinate systems, vector valued functions, functions of several variables, partial derivatives, multiple integration, and line and surface integrals. (ACTS: MATH 2603)

B. Additional Course Information

This is the third of three calculus courses taught at the University of Arkansas – Fort Smith. It is taken by students pursuing majors in mathematics, mathematics education, chemistry, physics, or engineering.

II. Student Learning Outcomes

A. Subject Matter

The student who completes this course will be able to:

1. Perform the vector operations of addition, subtraction, scalar multiplication, dot product and cross product, and interpret the results geometrically.
2. Convert three dimensional points and equations between rectangular, cylindrical, and spherical coordinates.
3. Differentiate vector-valued functions.
4. Find the vector velocity and acceleration of a particle moving along a space curve, and separate the acceleration into tangential and normal components.
5. Determine traces and sketch graphs of three-dimensional surfaces.
6. Find partial derivatives and differentials of functions of several variables
7. Evaluate double integrals of functions of two variables in rectangular and polar coordinates.

8. Evaluate triple integrals of functions of three variables in rectangular, cylindrical, and spherical coordinates.
9. Evaluate line integrals.
10. Evaluate surface integrals of scalar fields and flux integrals of vector fields.
11. Apply Green's Theorem and Stoke's Theorem to convert between surface integrals and line integrals.
12. Apply the Divergence Theorem to convert between flux integrals and volume integrals.

B. University Learning Outcomes

Analytical Skills
Quantitative Reasoning: Students will assign and use numbers, read and analyze data, create models, draw inferences, and support conclusions based on sound mathematical reasoning. Students will apply appropriate mathematical models to solve problems; represent mathematical information symbolically, visually, numerically, verbally, and interpret models and data to draw inferences; and recognize limits of quantitative analysis.

Communication Skills (written and oral)
Students will communicate proficiently by composing coherent documents which are appropriate for the intended audience and will effectively communicate orally in a public setting, such as presentation for peers or at conferences.

III. Major Course Topics

A. Vectors
   1. Vectors in the plane
   2. Coordinate systems and vector in 3-space
   3. The dot product and cross product

B. Vector-valued Functions and Curves in Space
   1. Vector-valued functions
   2. Space curves
   3. Arc length and curvature

C. Normal and Tangent Vectors
   1. Unit tangent vector
   2. Principal unit normal vector

D. Functions of Several Variables and Surfaces in Space
   1. Functions of several variables
   2. Limits and continuity
   3. Surface in space

E. Partial Derivatives, and Related Differential Operators
   1. Partial derivatives
   2. The chain rule
   3. Directional derivative and the gradient vector

F. Extrema of Functions of Several Variables

1. Maximum and minimum values
2. Lagrange multipliers

G. Double and Triple Integrals
   1. Double integrals
   2. Double integrals in polar coordinates
   3. Triple integrals
   4. Triple integrals in cylindrical coordinates
   5. Triple integrals in spherical coordinates

H. Vector Fields and Conservative
   1. Vector fields
   2. Divergence and curl
   3. Conservative

I. Line, Surface, and Flux Integrals
   1. Line integrals
   2. The fundamental theorem for line integrals
   3. Green’s Theorem
   4. Surface integrals
   5. Stokes’ Theorem