Marshall University

College of Science

Mathematics Department

MTH 231: Calculus with Analytic Geometry III

Course catalog description

Vectors, curves, and surfaces in space. Derivatives and integrals of functions of more than one variable. A study of the calculus of vector-valued functions.

Credit hours

4 hours

Prerequisites

A grade of C or higher in MTH 230

List of topics

- **Vectors**
  - Rectangular coordinate system in three-dimensions
  - Surfaces
  - Vectors
  - Dot product
  - Cross product
- **Vector-valued Functions of One Variable**
  - Curves in three-dimensions
  - Differentiation and Integration of vector-valued functions
  - Tangent vectors
  - Normal vectors
  - Arc length and Curvature
  - Velocity and acceleration

- **Differential Calculus of Multivariable Functions**
    - Limits
    - Continuity
    - Partial Derivatives
    - Gradient of a function
    - Implicit Differentiation
    - Directional Derivatives
    - Tangent planes
    - Differentials
    - Relative maxima and minima
    - Lagrange multipliers
- **Multiple Integrals**
    - Double integrals
    - Double iterated integrals
    - Areas and volumes of solids of revolution
    - Surface area
    - Double iterated integrals in polar form
    - Triple integrals and triple iterated integrals
    - Volumes
    - Cylindrical coordinates
    - Spherical coordinates
- **Vector Calculus**
    - Vector Fields
    - Line Integrals
    - Independence of path
    - Greenâ€™s Theorem
    - Surface Integrals
    - Stokes theorem
    - Divergence Theorem
    - Applications

Learner outcomes

1. Students will evaluate multivariate limits, partial and directional derivatives, and multiple integrals symbolically.
2. Students will calculate basic operations of two- and three-dimensional vectors along with velocity, acceleration and curvature of trajectories.
3. Students will interpret data in terms of functions of several variables.
4. Students will model problems from physics, engineering, and geometry in terms of vectors, partial derivatives, and multiple integrals.
5. Students will interpret symbolic and numerical results in real-world terms, and analyze their results in a real-world setting.
6. Students will apply definitions from three-dimensional space to solve problems involving lines, planes and conic sections and their equations.
7. Students will compute the differential of a multivariate function, calculate an approximation to a functionâ€™s value using the differential and justify the differentiability of a function by means of its definition.
8. Students will state the definitions of limits, derivatives, and integrals of functions of several variables, apply these definitions to test properties of these concepts, and produce verbal arguments and examples showing that basic properties hold or do not hold.

Technology

Students must have graphing calculators. Computer labs may be assigned at the discretion of the instructor.

Suggested textbooks

- Rogawski, *Calculus (Early Transcendentals)*, second edition.
- Stewart, *Calculus (Early Transcendentals)*, eighth edition.

Last updated

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