Course content

This course is a core foundational subject for mathematics majors, focusing on rigorous reasoning and proofs in mathematical problems, as opposed to the more application-oriented approach of calculus for non-math majors. It aims to provide students with special training in logical and abstract mathematical thinking, fostering analytical problem-solving skills.

The course covers systematic knowledge of series and multivariable calculus, including:

1. Convergence and properties of numerical series.
2. Function sequences and power series.
3. Fourier series and their applications.
4. Multivariable functions: limits, continuity, and differentiability.
5. Implicit function theorems and constrained optimization.
6. Parameter-dependent integrals and their properties.
7. Line, surface, and volume integrals, with fundamental theorems of calculus.
8. Introduction to ordinary differential equations.

Course objectives

Knowledge

1. Understand the theory of series, including numerical series, power series, Fourier series, and their convergence properties.
2. Acquire systematic knowledge of multivariable calculus, including limits, continuity, differentiation, and integration.
3. Learn the fundamental principles and techniques for solving ordinary differential equations.

Skills

1. Develop rigorous proof-writing skills and abstract mathematical reasoning.
2. Analyze and solve complex mathematical problems using logical reasoning and calculus techniques.
3. Perform calculations for series, integrals, and differential equations with precision and confidence.

Competencies

1. Apply mathematical theories to analyze and solve problems in engineering and computer science contexts.
2. Utilize mathematical modeling techniques to represent and solve complex problems in various fields.
3. Develop critical thinking and independent problem-solving capabilities for advanced studies and research.