

Math 251

Ordinary and Partial Differential Equations (4) First- and second-order equations; series solutions; Laplace transform solutions; higher order equations; Fourier series; second-order partial differential equations.

Prerequisite: Math 141, or equivalent courses.

Topics

INTRODUCTION

Direction Fields

Solution of Some Differential Equations

Classification of Differential Equations

FIRST ORDER DIFFERENTIAL EQUATIONS

Linear Equations with Variable Coefficients

Separable Equations

Modeling with First Order Equations (cover mixing problems, plus either motion with air resistance, compound interest, or Newton's law of cooling)

Differences Between Linear and Nonlinear Equations

Autonomous Equations and Population Dynamics (cover stability of equilibrium solutions)

Exact Equations (omit Integrating Factors)

SECOND ORDER LINEAR DIFFERENTIAL EQUATIONS

Homogeneous Equations with Constant Coefficients

Fundamental Solutions of Linear Homogeneous Equations

Linear Independence and the Wronskian

Complex Roots of the Characteristic Equations

Repeated Roots; Reduction of Order

Nonhomogeneous Equations; Method of Undetermined Coefficients

Mechanical and Electrical Vibrations

Forced Vibrations (w/o damping)

HIGHER ORDER LINEAR EQUATIONS

General Theory of n-th Order Linear Equations

Homogeneous Equations with Constant Coefficients

THE LAPLACE TRANSFORM

Definition of the Laplace transform

Solution of Initial Value Problems

Step Functions

Differential Equations with Discontinuous Forcing Functions

Impulse Functions

7. SYSTEMS OF TWO LINEAR DIFFERENTIAL EQUATIONS

Introduction to Systems of Differential Equations

Introduction to 2×2 Matrices

2×2 Linear Systems of Differential Equations

NONLINEAR DIFFERENTIAL EQUATIONS AND STABILITY

Phase Portraits of 2×2 Linear Systems

Autonomous Systems and Stability

Almost Linear Systems

Predator-Prey Equations

PARTIAL DIFFERENTIAL EQUATIONS AND FOURIER SERIES

Two-Point Boundary Value Problems

Fourier Series

The Fourier Convergence Theorem

Even and Odd Functions

Separation of Variables; Solutions of Heat Conduction Problems

Other Heat Conduction Problems

The Wave Equation: Vibrations of an Elastic String

Laplace's Equation