OFFICIAL SYLLABUS

501- DIFFERENTIAL EQUATIONS AND THE FOURIER ANALYSIS

ADOPTED – SPRING 2006 (Committee: Pelekanos (chair), Lu, Leem)

Catalog Description

Brief review of ODE. Legendre and Bessel Functions. Fourier series, integrals and transforms. Wave equation, heat equation, Laplace equation. Prerequisite: MATH 250, MATH 305, or consent of instructor. Not for Math Majors.

Textbook


Course Outline and Topics

Instructors should dedicate a maximum of two lectures for ODE review.

i) Chapter 17: Fourier Series, Fourier Integral, Fourier Transform
17.1 Introduction
17.2 Even, Odd, and Periodic Functions
17.3 Fourier Series of a Periodic Functions
  17.3.1 Fourier series
  17.3.2 Euler’s formulas
  17.3.3 Applications
  17.3.4 Complex exponential form for Fourier series
17.4 Half- and Quarter-Range Expansions
17.5 Manipulation of Fourier Series
17.9 Fourier Integral
17.10 Fourier Transform
  17.10.1 Transition from Fourier integral to Fourier transform
  17.10.2 Properties and applications

ii) Chapter 18: Diffusion Equation
18.1 Introduction
18.2 Preliminary Concepts
  18.2.1 Definitions
  18.2.2 Second-order linear equations and their classification
  18.2.3 Diffusion equation and modeling
18.3 Separation of Variables
  18.3.1 The method of separation of variables
  18.3.2 Verification of solution
18.4 Fourier and Laplace Transforms

iii) Chapter 19: Wave Equation
19.1 Introduction
19.2 Separation of Variables; Vibrating String
  19.2.1 Solution by separation of variables
  19.2.2 Traveling wave interpretation
19.3 Separation of Variables; Vibrating Membrane
19.4 Vibrating String; d’Alembert’s Solution
  19.4.1 d’Alembert’s solution
  19.4.3 Solution by integral transforms

iv) Chapter 20: Laplace Equation
20.1 Introduction
20.2 Separation of Variables; Cartesian Coordinates
20.3 Separation of Variables; Non-Cartesian Coordinates
  20.3.1 Plane polar coordinates
  20.3.2 Cylindrical coordinates
  20.3.3 Spherical coordinates