

## 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*

Advanced Engineering Mathematics, 2<sup>nd</sup> Edition by Michael D. Greenberg

#### *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