



**Catalog Description:**

Second-order PDEs; boundary value problems; Fourier series; wave, heat and Laplace equations; applications.

**Prerequisite:**

C- or better in 2173, 2153, 2162.xx, 2182H, or 4182H; or credit for 254.xx, 263.xx, 263.01H, or 264H. Intended for undergraduate and master degree students in Engineering and Science.

**Exclusions:**

Not open to students with credit for 4557, 512, or 557.

Not open to students with a math major, math minor or actuarial science major.

**Purpose of Course:**

This course develops problem solving skills with little emphasis on theory. Students should be able to solve the PDE's and ODE's and interpret the solution.

**Text:**

*Partial Differential Equations & Boundary Value Problems*, 9th OSU custom edition, by Boyce, published by Wiley, ISBN: 9781119935148

**Topics List:**

- Part I: ODE's via The Laplace Transform (Chapter 6);  
Euler's and Bessel's Equation (1/2 of Chapter 5)*
- 6.1 Definition of the Laplace Transform
  - 6.2 Solution of Initial Value Problems
  - 6.3 Step Functions
  - 6.4 Differential Equations with Discontinuous Forcing Functions
  - 6.5 Impulse Functions
  - 6.6 Convolution Integral
  - 5.4 Euler's Equation; Regular Singular Points
  - 5.5 Series Solution near a Singular Point: Part I
  - 5.6 Series Solution near a Singular Point: Part II
  - 5.7 Bessel's Equation

*Midterm I*



*Part II: Partial Differential Equations and Fourier Series (Chapter 10)*

- 10.1 The Two-Point Boundary Value Problem
- 10.2 Fourier Series
- 10.3 Fourier Convergence Theorem
- 10.4 Even and Odd Functions
- Appendix A Heat Conduction Equation: Motivation via Derivation
- 10.5 Separation of Variables; Heat Conduction in a Rod
- 10.6 Other Heat Conduction Problems: Nonhomogeneous, Mixed Boundary Conditions
- Appendix B Wave Equation: Motivation via Derivation;
- 10.7 Vibrations of an Elastic String
- 10.8 Laplace's Equation: Separation in Cartesian Coordinates Dirichelet vs. Neumann Boundary Conditions
- 10.8 Separation and Solution in Polar and Cylindrical Coordinates

*Midterm II*

*Part III: Boundary Value Problems (Chapter 11)*

- 11.1 Two-point Boundary Value Problems
- 11.2 Sturm-Liouville Boundary Value Problems I
- 11.2 Sturm-Liouville Boundary Value Problems II
- 11.3 Nonhomogeneous Boundary Value Problems
- 11.4 Singular Sturm-Liouville Problems
- 11.5 Bessel Series Expansion: Vibrating Drum
- 11.6 (If time permits: Series of Orthogonal Functions: Mean Convergence)