THE OHIO STATE UNIVERSITY

Mathematics 4512
Partial Differential Equations
for Science and Engineering
Autumn, Spring, Summer
3 credits

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, 11th OSU Custom Edition, by Boyce, published by Wiley, ISBN: 9781119805113
This text is only available as an eBook

Link for students to buy the eText:

https://www.vitalsource.com/products/partial-differential-equations-amp-boundary-value-william-e-boyce-v9781119805113?term=9781119805113

Topics List:

Part I: ODE's via The Laplace Transform (Chapter 6); Euler's and Bessel's Equation (½ 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)