

MATH 3195: Linear Algebra and ODE (Topical List)

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Course Description: Presents the essential ideas and methods of linear algebra and differential equations, emphasizing the connections between and the applications of both subjects. The course is designed for students in the sciences and engineering.

Prereq: MATH 2411.

Core Topics (Mandatory)

(this is from Edwards and Penney, Differential Equations and Linear Algebra, 3rd edition, Prentice Hall – though the textbook may change, the following topics do not)

Chapter 1: First-Order Differential Equations

- 1.1 Differential Equations and Mathematical Models
- 1.2 Integrals as General and Particular Solutions
- 1.4 Separable Equations and Applications
- 1.5 Linear First-Order Equations

Chapter 2: mathematical Models and Numerical Methods

- 2.1 Population Models
- 2.3 Acceleration-Velocity Models

Chapter 3: Linear Systems and Matrices

- 3.1 Introduction to Linear Systems
- 3.2 Matrices and Gaussian Elimination
- 3.3 Reduced Row-Echelon Matrices
- 3.4 Matrix Operations
- 3.5 Inverses of Matrices

Chapter 4: Vector Spaces

- 4.1 The Vector Spaces of \mathbb{R}^3
- 4.2 The Vector Space of \mathbb{R}^n and Subspaces
- 4.3 Linear Combinations and Independence of Vectors
- 4.4 Bases and Dimension for Vector Spaces
- 4.5 Row and Column Spaces
- 4.6 Orthogonal Vectors in \mathbb{R}^n
- 4.7 General Vector Spaces

Chapter 5: Higher-Order Linear Differential Equations

- 5.1 Introduction: Second-Order Linear Equations
- 5.2 General Solutions of Linear Equations
- 5.3 Homogeneous Equations with Constant Coefficients

5.4 Mechanical Vibrations

5.5 Nonhomogeneous Equations and Undetermined Coefficients

Chapter 6: Eigenvalues and Eigenvectors

6.2 Introduction to Eigenvalues

6.2 Diagonalization of Matrices

Chapter 7: Linear Systems of Differential Equations

7.1 First-Order Systems and Applications

7.2 Matrices and Linear Systems

7.3 The Eigenvalue Method for Linear Systems

7.4 Second-Order Systems and Mechanical Applications

7.5 Multiple Eigenvalue Solutions

Optional Topics

Linear Equations and Curve Fitting

Laplace Transform Method, (covered most semesters)

Slope Fields and Solution Curves,

Numerical Methods for First-Order Differential Equations,

Power Series Method

Projects – numerical, analytical, and/or application oriented.

Technology Exposure

No technology is strictly required, though to do some of the homework problems students must minimally use TI-89 or MATLAB or online software.

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