

**MATH 3321**  
**Engineering Mathematics**

**1. Introduction to Differential Equations**

- 1.1 Preliminaries
- 1.2 Differential Equations; Basic Terminology
- 1.3  $n$ -Parameter Family of Solutions; General Solution
- 1.4 Initial-Value Conditions; Initial-Value Problems

**2. First Order Differential Equations and Applications**

- 2.1 Preliminaries
- 2.2 Linear Differential Equations
- 2.3 Separable Differential Equations
- 2.4 Change of Variable: Extensions to Other First Order Equations
- 2.5 Some Applications of First Order Differential Equations
- 2.6\* Direction Fields; Existence and Uniqueness
- 2.7\* Some Numerical Methods

**3. Second Order Linear Differential Equations**

- 3.1 Introduction; Basic Terminology and Results
- 3.2 Second order Linear Homogeneous Equations
- 3.3 Homogeneous Equations with Constant Coefficients

**Exam 1**

- 3.4 Second Order Linear Nonhomogeneous Equations
- 3.5 Nonhomogeneous Equations with Constant Coefficients; Undetermined Coefficients
- 3.6 Vibrating Mechanical Systems
- 3.7 Higher-Order Linear Differential Equations

**3. The Laplace Transform**

- 4.1 Preliminaries
- 4.2 Laplace Transform Introduction
- 4.3 Basic Properties of the Laplace Transform
- 4.4 Inverse Laplace Transforms and Initial-Value Problems
- 4.5 Piecewise Continuous Functions, Part I: Laplace Transforms
- 4.6 Piecewise Continuous Functions, Part II: Inverse Laplace Transforms
- 4.7 Initial-Value Problems with Piecewise Continuous Nonhomogeneous Terms

**Exam 2**

**5. Linear Algebra**

- 5.1 Introduction
- 5.2 Systems of Linear Equations; Some Geometry
- 5.3 Solving Systems of Linear Equations, Part I

- 5.4 Solving Systems of Linear Equations, Part II
- 5.5 Matrices and Vectors
- 5.6 Square Matrices; Inverse of a Matrix, Determinants
- 5.7 Vector Spaces and Subspaces
- 5.8 Linear Dependence and Linear Independence of Vectors
- 5.9 Eigenvalues and Eigenvectors
- 5.10\* Diagonalization

**6. Systems of Linear Differential Equations**

- 6.1 Systems of Linear Differential Equations
- 6.2 Homogeneous Systems
- 6.3 Homogeneous Systems with Constant Coefficients, Part I
- 6.4 Homogeneous Systems with Constant Coefficients, Part II

**Exam 3**

- 6.5\* Nonhomogeneous Systems
- 6.6\* Direction Fields and Phase Planes

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\* Optional Section