

# MA 366 Topics - Fall 2025

## **Chapter 1 - Introduction**

- 1.1 - Basic Mathematical Models; Direction fields
- 1.2 - Solutions of Some Differential Equations
- 1.3 - Classification of Differential Equations

## **Chapter 2 - First Order Differential Equations**

- 2.1 - First Order Linear Equations
- 2.2 - Separable Equations
- 2.3 - Modeling With First Order Equations
- 2.4 - Differences Between Linear and Nonlinear Equations
- 2.5 - Autonomous Equations
- 2.6 - Exact Equations & Integrating Factors
- 2.7 - Numerical Approximations; Euler (Tangent Line) Method

## **Chapter 3 - Second Order Linear Differential Equations**

- 3.1 - Homogeneous Equations with Constant Coefficients
- 3.2 - Solutions of Linear Homogeneous Equations; Wronskians
- 3.3 - Complex Roots of the Characteristic Equation (and review of  $\mathbb{C}$ )
- 3.4 - Repeated Roots of the Characteristic Equation; Reduction of Order
- 3.5 - Nonhomogeneous Equations; Undetermined Coefficients
- 3.6 - Variation of Parameters
- 3.7 - Mechanical & Electrical Vibrations
- 3.8 - Forced Periodic Vibrations

## **Chapter 4 - Higher Order Linear Differential Equations**

- 4.1 -  $n^{\text{th}}$  Order Linear Equations
- 4.2 - Homogeneous Equations with Constant Coefficients
- 4.3 - Undetermined Coefficients
- 4.4 - Variation of Parameters

## **Chapter 6 - The Laplace Transform**

- 6.1 - Definition of the Laplace Transform
- 6.2 - Solution of Initial Value Problems
- 6.3 - Step Functions and Heaviside Function
- 6.4 - Differential equations with Discontinuous Forcing Functions
- 6.5 - Impulse Functions
- 6.6 - Convolutions

## **Chapter 7 - Systems of First Order Linear Equations**

- 7.1 - Introduction
- 7.2 - Matrices
- 7.3 - Systems of Linear Algebraic Equations; Linear Independence, Eigenvalues, Eigenvectors
- 7.4 - Basic Theory of Systems of First-Order Linear Equations
- 7.5 - Homogeneous Linear Systems with Constant Coefficients
- 7.6 - Complex Eigenvalues (and review of  $\mathbb{C}$ )
- 7.7 - Fundamental Matrices
- 7.8 - Repeated Eigenvalues
- 7.9 - Nonhomogeneous Linear Systems

## **Chapter 9 - Nonlinear Differential Equations and Stability**

- 9.1 - The Phase Plane
- 9.2 - Autonomous Systems and Stability
- 9.3 - Locally Linear Systems

If time permits, then also

- 9.4 - Competing Species
- 9.5 - Predator-Prey Equations