# MA 366 Topics

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

If time permits, then also

### 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*