



COURSE SYLLABUS

Course: Differential Equations
Number: MAT 4130
Credit-Hours: 4 Credits

Course Description: An introductory course in ordinary differential equations with applications. Topics covered include first and second order differential equations, power series solutions, Laplace transforms, linear systems, numerical methods, and linearization methods.

Prerequisite: MAT 2620 (Calculus II or equivalent)

Detailed Syllabus:

0. Getting Started

1. Email and Chat
2. Learning About the Course
3. Software Fundamentals

1. Exponential Differential Equations

1. Unforced
2. Forced
3. Steady State
4. Personal Finance
5. Step Function and Dirac Delta Function
6. Tangent Vectors
7. Initial Conditions

2. Second-Order Differential Equations

1. Overdamped and Underdamped Oscillators
2. Linear Forced and Unforced Oscillators
3. Homogeneous Equations
4. Inhomogeneous Equations
5. Characteristic Equations
6. Euler's Formula
7. Impulse Forcing
8. Dirac Delta Convolutions
9. Springs and Electrical Charges
10. Higher Order Equations

3. Laplace Transforms
 1. Laplace Transforms of First and Second Order Equations
 2. Fourier Analysis and Fits

4. Graphical Analysis of Differential Equations
 1. Euler's Method
 2. Flow Plots and Trajectories
 3. Predator-Prey Model
 4. Logistic Harvesting

5. First-Order Differential Equations
 1. Autonomous Equations
 2. Non-Autonomous Equations
 3. Separation of Variables Solving Method
 4. Bifurcation Points

6. Systems of Differential Equations
 1. Flows and Trajectories
 2. Conversion Between Higher Order ODEs and Systems
 3. Damped and Undamped Oscillators

7. Power Series Solutions of Differential Equations
 1. Recursion Relations
 2. Comparing Series Solution to Numerical Solution
 3. Barriers