

Carthage Mathematics Department
Course Summary for Math 2020 Differential Equations

1. Credits: 4 cr.
2. Semesters Offered: Fall
3. Text(s): *Differential Equations* by Blanchard, Devaney and Hall or Lecture Notes by Snavely
4. Topics Covered:
 - a. First order equations and systems
 - i. Modeling
 - ii. Analytic
 1. Separation of variables
 - iii. Qualitative
 2. Slope fields, phase plane and bifurcations
 - iv. Numerical techniques
 3. Euler's Method
 - iii. Existence and Uniqueness
 - v. Linear equations
 - b. Linear Systems
 - i. Eigenvalues, Eigenvectors and Characteristic Equations
 - ii. Phase portraits
 - c. Forcing and Resonance
 - d. Nonlinear systems
 - i. Equilibrium point analysis
 - e. Laplace Transforms
 - i. Linear Equation
 - ii. Discontinuous Functions
 - iii. Second-Order Equations
 - iv. Convolutions
5. Skills Enhanced:
 - a. Deciding whether to use numerical or analytical methods
 - b. Technical writing
6. Sample Syllabus from Snavely:
 - a. Chapter 1
 - b. Chapter 2
 - c. Chapter 3
 - d. Chapter 4, sections 1-3
 - e. Chapter 5, section 1
 - f. Chapter 6.
7. Miscellanea
 - a. Students will do a research or modeling project as part of this course.
 - b. Mathematica is the current preferred software package for this course.
8. Course Goals: By the end of the course, students should be able to do the following.
 - a. Verify that a given function is a solution to a differential equation.
 - i. Assessment: Each exam contains multiple differential equations.
 - b. Solve linear differential equations.
 - i. Assessment: The first two exams contain multiple linear differential equations.
 - c. Recognize non-linear differential equations and apply an appropriate method of solution.
 - i. Assessment: Each exam contains non-linear equations.
 - d. Model an appropriate system using differential equations.
 - i. Assessment: Student research and modeling projects are evaluated on the validity of their approach to modeling their problem.

- e. Demonstrate sufficient knowledge of the course content.
 - i. Assessment: Sufficient knowledge is required to obtain a passing grade. The knowledge must be demonstrated on exams, homework, and the research project.