COURSE SYLLABUS

Course: Differential Equations
Number: Math 317
Credit-Hours: 3 credits [semester credit hours]

Course Description: Studies methods of solution of ordinary differential equations with applications in science and engineering. Extensive use is made of the method of Laplace transforms.

Prerequisites: Successful completion (C- or higher) of MATH 214 (Calculus II) or equivalent.

Course Workload: 3 semester credit hours • 3 student work hours per credit hour • 14 week Carnegie semester = 126 hours student course workload average

Examination Requirements: Proctored written final examination must be passed at 60% or higher to earn passing grade in course. "B" and "A" grade paths have additional examinations. See http://www.distancecalculus.com/grades/ for more information.

Course Professor: Robert R. Curtis, Ph.D. <robert@distancecalculus.com>

University Information: Roger Williams University, University College, 1 Empire Plaza, Providence, RI, USA 02903. Accredited by New England Commission of Higher Education (NECHE). See https://www.rwu.edu/academics/accreditations for more information.

E-Textbook: "Differential Equations & Mathematica" by Davis/Porta/Uhl et al
Mathematics Software: Mathematica™ Computer Algebra & Graphing System

Detailed Syllabus

1. Getting Started
    - 1.1. Email and Chat
    - 1.2. Learning About the Course
    - 1.3. Required Hardware
    - 1.4. Software Fundamentals

2. Basic Differential Equations
    - 2.1. Unforced
    - 2.2. Forced
    - 2.3. Steady State
    - 2.4. Personal Finance
    - 2.5. Step Function and Dirac Delta Function
    - 2.6. Tangent Vectors
    - 2.7. Initial Conditions
    - 2.8. Integration Factors

3. Second-Order Differential Equations
    - 3.1. Overdamped and Underdamped Oscillators
    - 3.2. Linear Forced and Unforced Oscillators
    - 3.3. Homogeneous Equations
    - 3.4. Inhomogeneous Equations
    - 3.5. Characteristic Equations
    - 3.6. Euler's Formula
    - 3.7. Impulse Forcing
    - 3.8. Convolution Integrals Methods
    - 3.9. Springs and Electrical Charges
    - 3.10. Resonance
    - 3.11. Higher Order Equations

4. Laplace Transforms
    - 4.1. Laplace Transform Method
    - 4.2. Introductory Fourier Analysis and Fourier Fitting

5. Graphical Analysis of Differential Equations
    - 5.1. Euler's Method
    - 5.2. Flow Plots and Trajectories
    - 5.3. Phase Lines
    - 5.4. Predator-Prey Model
    - 5.5. Logistic Harvesting
    - 5.6. Bifurcation Points
    - 5.7. Sensitivity to Initial Conditions

6. Non-Linear First-Order Differential Equations
    - 6.1. Autonomous Equations
    - 6.2. Non-Autonomous and Other Equation Types
    - 6.3. Separation of Variables Solving Method

7. Linear Systems of Differential Equations
    - 7.1. Flows, Trajectories, and Vector Fields
    - 7.2. Conversion Between Higher Order ODEs and Linear Systems
    - 7.3. Eigenvalues, Eigenvectors, and Classification of Solutions