Course Outline
Department of Mathematics
and Statistics
Minnesota State University, Mankato

Math 321 Ordinary Differential Equations (4 semester hours)

Course Description:

This course presents the theory, computations and applications of first and second order
ordinary differential equations and two-dimensional systems.

Prerequisites: MATH 122 with “C” (2.0) or better or consent

Learning Outcomes:

Students will be able to:
1. Apply analytic, qualitative, and quantitative methods to a variety of ordinary
differential equations.
2. Identify the appropriate method to use on linear and nonlinear 1st and 2nd order
ordinary differential equations and systems of differential equations.
3. Interpret the results of the analysis of differential equations analytically,
   geometrically, and physically.
4. Construct models of the physical world using ordinary differential equations
   and use those models to predict, synthesize, and explain the related physical
   phenomena.

Content Outline:

1. First order ordinary differential equations - separable equations, integrating
   factors, phase lines, bifurcation diagrams, existence and uniqueness theorems,
   and applications.
2. Second order ordinary differential equations - linear homogeneous and
   nonhomogeneous with constant coefficients, characteristic values, undetermined
   coefficients, variation of parameters, linear independence and the Wronskian,
   and applications to harmonic oscillators with dampening and driving force.
3. Laplace transforms - solutions of initial value problems, step functions, Dirac
   delta function, discontinuous forcing, and convolution.
4. Two-dimensional first order linear systems - eigenvalues, eigenvectors, linear
   independence, fundamental matrix, classification of equilibrium and phase plane
   diagram, homogeneous and nonhomogeneous linear systems with constant
   coefficients.
5. Two-dimensional first order nonlinear autonomous systems - phase plane
   analysis, stability, Poincare-Bendixson theory, and applications to dynamical
   systems.

Textbook/Related Readings/Materials:
Blanchard, Devaney, and Hall, Differential Equations
Boyce and DiPrima, Elementary Differential Equations and Boundary Value Problems
Martensen, A Beginner’s Guide to Differential Equations
Zill, Differential Equations with Boundary Value Problems