Course Information for Math 351

- **Pre-requisites:** C or better in Math 250 and Math 262.
- **Course Description:** Topics covered. The topics in brackets represent topics that are either not covered by all faculty or those that are covered only if time allows.

  Basic definitions. Ordinary vs. Partial differential equations. The order of an ODE. Linear vs. Nonlinear ODE's. Initial value problems.

  First order ODE's: Seperation of variables. Linear first order ODE's. Applications of first order ODE's- Newton's law of cooling, mixing problems, the logistic equation. (Exact and Homogeneous first order ODE's). (Numerical methods- Euler's method).

  Existence and uniqueness theory of first order ODE's. Picard iteration and long time vs. short time existence. Gronwall's Inequality and dependence on parameters.

  Higher order linear ODE's: Existence of a fundemental set of solutions. Linear independence, the wronskian, and uniqueness of solutions to initial value problems. Constant coefficient ODE's. Undetermined Coefficients. Variation of Parameters.

  Systems of ODE's: Introduction to systems. Solution of constant coefficient systems by substitution or elimination method. Examination of homogeneous constant coefficient systems by the eigenvalue/eigenvector method. Nonlinear systems. Almost linear systems and linearization around critical points. Sketching solutions.

  Power series methods. Finding the power series expansion to the solution of a linear ODE with analytic coefficients. (Special functions). (Solution about singular points).

  Goals:

  1. The content of this course is similar to Math 280, although there is a much heavier emphasis on theory and it is assumed that the students know the material for Math 262. There is also some interaction with this material and that of Math 350 although knowledge of Math 350 is not assumed.
  2. To understand both the qualitative and quantitative behaviour of solutions to ODE's.
  3. To understand existence/uniqueness of solutions to initial value problems for both first and higher order ODE's.

- **Books used:**

  Boyce and Diprima, Elementary Differential Equations (and Boundary Value Problems).

  Coddington, An Introduction to Ordinary Differential Equations.

  Braun, Differential Equations and their Applications.