Syllabus
MATH 670 / AMSC 670, Fall 2007
Ordinary Differential Equations

1. Introduction. Fundamental Notions, Results in Analysis:
   - Compact Sets, continuity, norms, convergence, uniform convergence
   - Arzela-Ascoli Theorem

2. Fundamental Theorems in ODE:
   - Existence, Uniqueness
   - Approximation, Extension, Continuity with respect to the initial conditions

3. Classical Themes:
   - Exact Solutions (Integrals)
   - Qualitative Description (Dynamical Systems): Phase Space
   - Differential Inequalities

4. Linear Differential Equations:
   - General Properties, Fundamental Matrix Solution
   - Higher Order LDE, Complex LDEs
   - Constant Coefficients: Matrix Exponential, Canonical Forms, Range of the Exponential Map

5. Qualitative Behavior of Solutions:
   - General Stability Theory: Definitions, Lyapunov’s Method, Invariance Principle
   - Stability for LDE with constant coefficients
   - Stability of General LDE (i.e. Time-Varying)
   - Linear Systems with Periodic Coefficients (Floquet Theory)
   - Theory of Cycles:
     - Poincare Return Map
     - Planar Dynamical Systems, Poincare-Bendixon Theorem
     - Recurrence

6. (if time) Local Phenomena:
   - Linearization
   - Invariant Manifolds (Local Theory)