

OFFICIAL SYLLABUS
Math 552 - Theory of Ordinary Differential Equations

Catalog Description. Existence and uniqueness theorem; dynamical systems; stability, bifurcation theory, boundary value problems. Prerequisites: MATH 350, 421.

Textbook: Differential Equations and Dynamical Systems, 3rd. by Lawrence Perko, Springer, 2001.

Sections to be covered in the textbook:

1. Linear Systems: 1.1-1.9.
2. Nonlinear Systems: Local Theory: 2.1-2.11, 2.13, 2.14.
3. Nonlinear Systems: Global Theory: 3.1-3.7.
4. Nonlinear Systems: Bifurcation Theory: 4.1, 4.2.

Contents:

1. Linear Systems.
 - (1) Uncoupled linear systems.
 - (2) Diagonalization.
 - (3) Exponentials of Operators.
 - (4) The fundamental theorem for linear systems.
 - (5) Linear planner systems.
 - (6) Application of Jordan forms.
 - (7) Stability theory.
2. Nonlinear Systems: Local Theory.
 - (1) The fundamental existence-uniqueness theorem.
 - (2) Dependence on initial conditions and parameters.
 - (3) The maximal interval of existence.
 - (4) The flow defined by a differential equation.
 - (5) Linearization
 - (6) The stable manifold theorem.
 - (7) Stability and Liapunov functions.
 - (8) Saddle, nodes, foci and centers.
 - (9) Normal form theory.
 - (10) Gradient and Hamiltonian systems.
3. Nonlinear Systems: Global Theory.
 - (1) Dynamical systems and global existence theorems.
 - (2) Limit sets and attractors.
 - (3) Periodic orbits.
 - (4) The stable manifold theorem for periodic orbits.
 - (5) The Poincare-Bendixson theorem.
4. Nonlinear Systems: Bifurcation Theory.
 - (1) Structural stability.
 - (2) Bifurcations at nonhyperbolic equilibrium points.