

**Ordinary Differential Equations**  
**MATH 565a**

**Text:** Differential Equations and Dynamical Systems (3<sup>rd</sup> ed.) by  
Lawrence Perko

**Course outline** on following page.

**Professor:** Robert Sacker

**Office:** KAP 438-A, (213)740-3793

**Office hours:** See “Course Web page” below.

**E-mail:** rsacker@usc.edu

**Personal web page:** <http://www-bcf.usc.edu/~rsacker>

**Course web page:** <http://www-bcf.usc.edu/~rsacker/M565a.html>

**Course credit:** 3 units

See course web page for more detailed information.

# Course Description

## Math 565a

### Ordinary Differential Equations

First order system with a parameter,  
Uniform contraction principle,  
 $C^k$  Implicit Function Theorem,  
Existence, Uniqueness,  $C^k$  Dependence,  
Continuation of solutions,  
Autonomous versus non-autonomous,  
Linearizations, Stability,  
Real Jordan decomposition,  
Abel-Liouville's Theorem,  
Periodic systems, Floquet's Theorem,  
Lyapunov-Perron Formula,  
Stable Manifold Theorem, Center Manifold Theorem  
Hartman-Grobman Theorem

### Flows

Continuous and Discrete Flow,  
Positive and Negative orbits, Omega-limit sets,  
Invariant Sets, Positively compact orbits,  
Poincare-Bendixson Theorem, Limit Cycles,  
Index of a Vector Field,

### Bifurcations

Examples: Fold or Cusp Bifurcation, Discontinuous or Hysteresis-like  
Bifurcation, Pitchfork Bifurcation, Subcritical and Supercritical cases,  
Hopf Bifurcation, Poincare Map,  
Bifurcation in Discrete Case-Maps, Neimark-Sacker Bifurcation.

### Skew Product Dynamical Systems

Examples: Retarded Functional Differential Equations, Evolution Equations.  
Shift flow, Skew Product Dynamical System, Sacker-Sell Spectral Theorem,  
the Splitting Index, Morse-like decomposition of an Invariant Set

### Miscellaneous Topics

Stability by Lyapunov Functions, Invariance Principle of LaSalle,  
Nearly Linear Systems, Regular Perturbations,  
KAM Theory