MATH 467-3 **Fall 2003**

DYNAMICAL SYSTEMS

Instructor: Ralf Wittenberg K-10536, 291-4792
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Office Hours: Tue. 3:00–4:30pm, Wed. 10:00–11:30am,
or by appointment (preferably by e-mail).

Course Web Page: `http://www.math.sfu.ca/~ralfw/math467`

Lecture: Monday 2:30–3:20pm, Wednesday 2:30–4:20pm, AQ 4130.

Text: Steven H. Strogatz, *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry and Engineering* Westview Press.

Prerequisites:
Please see me if you have a question about your preparation. This course will depend most strongly on a previous course in ordinary differential equations (Math 310) and linear algebra (Math 232), in addition to the standard calculus sequence.

Homework:
Homework assignments will be assigned weekly; they will be posted on the web by Wednesday, and due the following Wednesday.

Exams and Grading:
There will be two midterm exams in class, provisionally on October 20 and November 19, and a project at the end of the semester. The (tentative) overall grading policy is as follows:

Homework	= 25%
Midterm exam 1	= 20%
Midterm exam 2	= 30%
Project	= 25%

Nonlinear Dynamics and Bifurcation

This course is an introduction to the study of dynamical systems. Nonlinear differential equations and iterative maps arise in the mathematical description of numerous systems throughout science and engineering, for instance in physics, chemistry, biology, economics, and elsewhere. Such systems may display complicated and rich dynamical behaviour, and we will develop some linear and nonlinear mathematical tools for their analysis, and consider models in such fields as population biology, ecology, and mechanical and electrical oscillations. Our emphasis throughout will be on the qualitative behaviour of the models, in particular, on the prediction of qualitative change in the nature of the dynamics as a system parameter varies (bifurcation).

In this course we will proceed from simpler to more complicated (and more interesting!) systems. We begin with one-dimensional flows, their steady states, stability and bifurcations, and then observe the far more complicated dynamics, including chaos, that may occur in one-dimensional maps. Phase-plane analysis in two dimensions reveals the possibility of oscillations and limit cycles, and we study their bifurcations. As time permits, we will also investigate higher-dimensional dynamical systems, deterministic chaos and strange attractors.