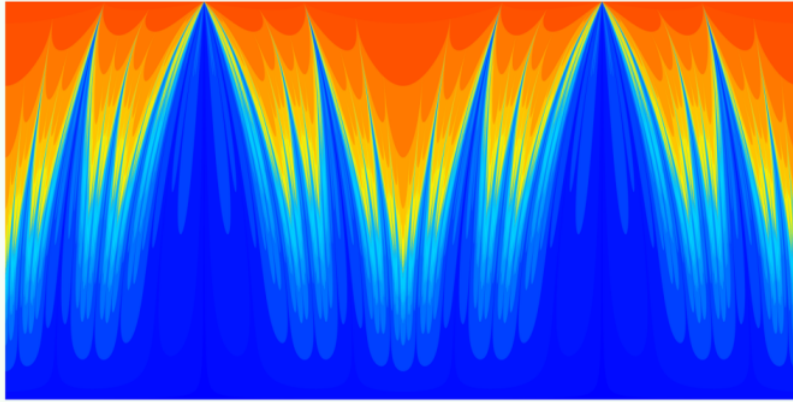


Math 351 – Differential Equations, Dynamics, and Chaos
Instructor: Roland Roeder
Stony Brook University, Spring 2009



Course Description:

Dynamical systems is a relatively recent subject of mathematics and it has close ties with physics, chemistry, and biology, as well as engineering. Math 351 is an introduction to dynamical systems, with the intention to make the subject accessible to people from outside of mathematics, while still indicating some of the deep mathematical theorems and even open problems in the field.

Instructor:

Roland Roeder, office: Math Tower 4-117, phone: (631) 632-8995, email: rroeder@math.sunysb.edu
Office hours: Mondays 2-3PM and Wednesdays 10-12AM and also by appointment.

Lectures

Monday, Wednesday 3:50-5:10PM, SB Union 237.

Blackboard:

Various announcements and handouts will be placed on the Blackboard website:

<http://blackboard.stonybrook.edu/>

In addition, you will be able to access your grades on this site.

Textbook:

“Nonlinear Dynamics and Chaos, with Applications to Physics, Biology, Chemistry, and Engineering” by Steven Strogatz.

Additional references:

The following may be helpful additional references:

- “Differential Equations and Dynamical Systems” by Lawrence Perko,

- “A First Course in Chaotic Dynamical Systems” by Robert L. Devaney, and
- “An Introduction to Chaotic Dynamical Systems” by Robert L. Devaney.

They are available in the library.

Quizzes: There will be six quizzes occurring during the first 30 minutes of class on the following Wednesdays:

- Quiz 1: February 11th
- Quiz 2: February 25th
- Quiz 3: March 11th
- Quiz 4: March 25th
- Quiz 5: April 15th
- Quiz 6: April 29th

A majority of the questions on the quizzes will come from the homework problems, listed below. They will also be very closely tied to material that is emphasized in lecture.

Project: This course is designed to be accessible and (hopefully) interesting to people from both mathematics and relevant areas outside of mathematics. The course project allows you to relate the course material to your area of expertise. You will study a topic of your choice and prepare a 30 minute oral presentation. A list of possible topics will be distributed later in the semester. You are also welcome to choose your own topic, as long as you clear it with me first.

Presentations will be given in my office during the last two weeks of classes. You will be graded on the mathematical/scientific content as well as the quality of presentation. However, do not worry, I will work with you during the weeks before the presentation in order to help make sure that it will be a success.

Final Exam: Monday May 18, 5-7:30PM in SB Union 237 (the usual room for lectures). A detailed description of what material will be covered on the final will be given 1-2 weeks before the exam.

Grading Scheme:

45% Quizzes (based on your top 5 quizzes)

25% Course project

30% Final exam

There will be no make-ups in the event that you miss a quiz or the final exam, with exceptions for serious illness or death in the family. In such an unfortunate circumstance written proof will be necessary.

Computer usage:

Usage of a computer package can be very helpful on the homework assignments and perhaps also for your course project. *It can also be fun!!* During some of the lectures I will

demonstrate examples using Maple©. Other computer programs may be helpful, we will see later in the course.

You can download your own version of Maple (under the Stony Brook Site License) from:

<http://clientsupport.stonybrook.edu/public/software/Softweb.shtml>

you will be asked to provide your SB ID number and a password. Click on “University Applications”, and choose Maple v. 11.

Alternatively, Maple is available on computers in most of the campus computer labs.

Homework:

Homework will not be collected, but it is the best way to prepare for the quizzes, because the majority of quiz problems will come directly from this list of problems. (It will be updated periodically on this syllabus.) You are encouraged to work together in groups if you like.

- **Week 1** (Jan 26th-30th)
Read Strogatz Chapter 1. Please try to master technique on p. 5-8 for converting various equations to the form of equation (2) on page 6.
Chapter 2, problems 2.1.2, 2.1.3, 2.2.4, 2.2.5, 2.2.8, and 2.2.12.
- **Week 2** (Feb 2nd-6th)
TBA
- **Week 3** (Feb 9th-13th)
2.3.3, 2.4.1, 2.4.5, 2.4.7, 2.4.9, 2.5.1, 2.5.2, 2.5.6, 2.6.1, 2.7.1, 2.7.4, 2.7.7, 3.1.1, 3.1.3, 3.1.5
- **Week 4** (Feb 16th-20th)
2.2.13, 2.3.2, 3.1.2, 3.1.5, 3.2.2, 3.2.5, 3.2.6, 3.4.1, 3.4.8, 3.4.15, 3.5.4, 3.5.6
- **Week 5** (Feb 23rd-27th)
3.4.14, 3.5.1, 3.5.2, 3.5.3, 3.5.7 (Also, (1) start thinking about the topic for your project and (2) read Ch. 5 and review linear algebra.)
- **Week 6** (Mar 2nd-6th)
3.6.1, 3.6.2, 3.6.4, 3.6.5, 3.6.7, 3.7.1, 3.7.3, 3.7.4, 3.7.6
- **Week 7** (Mar 9th-13th)
5.1.1, 5.1.2, 5.1.10, 5.2.1, 5.2.2, 5.2.8, 5.2.10, 5.2.13
- **Week 8** (Mar 16th-20th)
6.1.1, 6.1.5, 6.1.10 (try to use Maple), 6.1.11 (try to use Maple), 6.2.1, 6.2.2., 6.3.1, 6.3.4, 6.3.10, 6.3.12, 6.3.13, 6.4.4, 6.4.6
- **Week 9** (Mar 23rd-27th)
6.5.1, 6.5.8, 6.5.11, 6.7.1, 6.7.2, 6.7.3, 6.8.1, 6.8.8, 6.8.9
- **Week 10** (Mar 30th-April 3rd)
TBA

- **Week 11** (April 6th-10th)
Spring break
- **Week 12** (April 13th-17th)
7.1.1,7.1.3,7.1.5,7.1.8
- **Week 13** (April 20th-24th)
7.3.1, 7.3.3, 7.3.4, 7.3.5, 7.3.6, 7.3.7, 7.4.2
- **Week 14** (April 27th-May 1st)
7.2.1,7.2.2, 7.2.5, 7.2.6, 7.2.10,7.2.13,7.2.15
- **Week 15** (May 4th-8th)
10.1.9, 10.1.10, 10.1.11, 10.1.12, 10.2.2, 10.3.1, 10.3.2, 10.3.4, 10.3.5, 10.3.7, 10.3.8, 10.3.9, 10.3.10

Disability statement:

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact Disability Support Services at (631) 632-6748 or

<http://studentaffairs.stonybrook.edu/dss/>.

They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website:

<http://www.sunysb.edu/ehs/fire/disabilities.shtml>