Chemistry 5010/7010
Nonlinear Dynamics for (Bio)Chemists
Fall 2019

Instructor:	Marc R. Roussel
Office:	SA9414
Phone:	403-329-2326
Email:	`roussel@uleth.ca`
Course web site:	`http://people.uleth.ca/~roussel/C4010nonlin`
Moodle:	`https://moodle.uleth.ca`

Textbook

Nonlinear Dynamics: A Hands-on Introductory Survey, by Roussel. An electronic copy of the book is available in the class Moodle site. The textbook is for your personal use and is not to be shared by any means, physical or electronic.

Email

Important information will frequently be communicated to the class via email. It is *your responsibility* to keep an eye on your email during the term.

Office hours

I strongly encourage office visits to clarify any material with which you are having difficulty. I operate on an open-door basis: If I'm in, you are welcome to stop in to ask questions. However, because other commitments frequently have me away from my office, to avoid frustration, *I recommend that you email ahead or talk to me before or after class so we can agree on a time for us to meet.*

Grading scheme

Evaluation type	Weight	Date
Assignments	32%	
Bibliography	2%	Sept. 27
Lecture notes	10%	Nov. 8
Lecture	8%	TBA
Test 1	12%	Oct. 8
Test 2	12%	Nov. 5
Final exam	24%	TBA

Changes to the in-class test dates will only be made if absolutely necessary, and will be announced by email and posted on the course web site at least two weeks in advance of the test.

If you miss one of the in-class tests, you will receive a grade of zero unless you have a medical or other equally serious, documentable reason. **It is your responsibility to notify me.** You should be prepared to present appropriate documents on request to support any claims you make with respect to a missed test. If you do miss an in-class test with a valid reason, the weight of the final exam will be increased by the weight of the missed test.

The University is responsible for the scheduling of the final exam, which will be announced in due course. Arrangements for rescheduling the final exam, if missed for a reason beyond your control, are handled by the Faculty of Arts and Science.

Conduct of exams

All exams will be conducted in a computer lab and will include a mixture of questions that require computer calculations and of pen-and-paper questions.

You can bring *handwritten* notes to the exams. There is no page limit. Index cards, looseleaf paper and notebooks are all permitted.

In-class tests will have a duration of two hours, with the remainder of the lab period devoted to instruction. The final exam will have a duration of three hours.

Labs and assignments

Labs will combine instruction with time to work on the assignments, which will be handed out in the lab each week. Thus, you should expect weekly assignments, with some variance to this schedule around exam dates. My intention is that, most weeks, you would have time to get a good start on the assignment in the lab, perhaps even completing much of the technical (computer or mathematical) work before you leave.

Lecture

During the last few lecture periods of the term, you will deliver a lecture on a topic of your choice in nonlinear dynamics. This should be a topic not covered in the textbook.

You must submit a short bibliography on your chosen topic by **Sept. 27** at the latest. You must discuss your ideas with me long before this deadline as **I must approve your topic before you proceed**. On this date, you will submit to me a bibliography listing **at least four** resources you plan to use in order to learn the material and prepare your lecture notes **in addition to any resources I provided as a starting point**. Acceptable resources include books and papers published in reputable journals. Web resources are generally not acceptable without my explicit agreement. Bibliographies should have full bibliographic details, and list relevant sources for the topic chosen. Bibliographies will be marked against these criteria. Late submissions will result in a loss of credit, except in case of illness or other exceptional circumstances.

Topics: Your lecture will present a type of dynamical system, or a dynamical behavior, or a detailed exploration of an application using the methods of nonlinear dynamics. Your lecture must, in some way or another, go beyond the material in the textbook. A straightforward application of methods studied in class is not sufficient. For example, we will do a lot of work with systems of two differential equations. Unless you present new dynamics, just analyzing a system of two differential equations using methods studied in class would not be appropriate. On the other hand, since you will be delivering just one lecture, the topic can't be too complex. Some examples of potential topics:

- Excitability
- Phase-resetting curves
- Multi-dimensional maps
- Canards
- Boolean networks
- Dynamics of the cell cycle
- Gas-evolution oscillators

By **Nov. 8**, you must submit a set of lecture notes presented at a roughly similar level of technical detail as a chapter of my textbook. Like my textbook chapters, your lecture notes should include text explaining the concept you have chosen, and could include analytical work, computational methods, or both. These notes should include enough material for a single lecture. It is not necessary to include exercises.

Because this is probably your first experience writing lecture notes, I will be happy to read and comment on drafts submitted to me at any time **before Nov. 1**. I will try to turn around drafts within two business days. I am quite happy to provide technical comments, as well as comments on your writing style in order to help you improve your notes. Furthermore, I am happy to look at incomplete drafts, or at drafts of a particular section of your notes, and to do so for as many drafts as you care to show me before Nov. 1. Only the final version submitted on Nov. 8 will be evaluated.

Your lecture notes must be submitted electronically.

Late submission will incur a penalty of 5% per day, with exceptions made only for illness or other exceptional circumstances.

Evaluation criteria for lecture notes:

Topic coverage: About the right amount of material covered (possibly slightly more than you will cover in your lecture), all key ideas clearly explained, examples that clearly illustrate points	20%
Technical correctness: No mathematical or conceptual errors, examples can be reproduced with information given	30%
Logical presentation: Development of ideas easy to follow, definitions presented when needed, ideas build on each other, no logical gaps or leaps	30%
Language quality: spelling, grammar, syntax, sentences and paragraphs well structured	20%

Originality of lecture notes: While I am not asking you to carry out original work, your lecture notes are expected to be **your** presentation of a topic. Your notes will be checked with Turnitin. Plagiarism will result in a grade of zero. You are encouraged to review my blog posts on plagiarism prior to writing your notes:

`https://blogs.ulethbridge.ca/roussel/2013/12/03/clean-room-writing`
`http://tiny.cc/lx4tbz`

The examples presented in your notes need not be original, but you should try to reproduce published results if you want to present them, for two reasons:

1. With proper citation, this avoids copyright issues when, e.g., presenting a figure that you made rather than just copying and pasting a figure from a paper.

2. More importantly, you will learn much more deeply by replicating someone's work than you would by just copying their results.

Once you have your graded lecture notes back, you will be expected to clean them up (based on my comments) for distribution to your classmates. Your finalized lecture notes should be sent to me no later than three days before your lecture. I will distribute them to your classmates. You will also be able at this point to start working on your lecture. Your lecture will be examinable material for all students in the class except yourself.

The choice of media used in your lecture is up to you. Over the course of the term, you will have seen me present slides, work on the board, and demonstrate procedures on the computer. You can use any or all of these presentation methods, or other appropriate methods as you see fit.

Evaluation criteria for the lecture:

Corrected lecture notes: The corrections I requested were made properly, and sent to me according to the established schedule.	10%
Quantity and depth of material covered: The lecture is neither too long nor too short, wraps up at a logical point, and contains a sensible amount of technical detail given the audience.	30%
Quality of presentation: Ideas clear, easy to follow, logically developed	40%
Technical correctness: No mathematical or conceptual errors	10%
Use of media: Appropriate medium (or media) chosen. Media used in a competent way (e.g. logical use of whiteboard space, computer use well planned and executed).	20%

Syllabus

The course will closely follow the textbook, covering roughly one chapter per week. We may or may not have time to cover the entire book.

In addition, the graduate students registered in the course will each present one lecture at the end of the course. This material will also be examinable. Notes prepared by the graduate student will be provided for each lecture.

Nonlinear dynamics is a subject best studied using a combination of analytical mathematics and computer calculations. All the software you need is installed in the Linux labs on level 5 of University Hall (C513 and D519). All of the software chosen, except Maple, is free and can be installed on your home computer or laptop. The textbook provides some information on installing this software. Because of the wide variety of computers out there, I am only able to offer limited technical support, but I will do my best to help if you have trouble installing or running the software. I am most likely to be able to help you if you have a laptop that you can bring to me.