uOttawa

SYLLABUS

INTRODUCTION TO DYNAMICAL SYSTEMS
MAT 3130 – FALL 2020

Instructor:	Diane Guignard (STEM 651, dguignar@uottawa.ca)
Personal webpage:	`https://mysite.science.uottawa.ca/dguignar/`
Course webpage:	on Brightspace
Classes:	We 10:00-11:20 via Zoom
	Fr 08:30-09:50 via Zoom
Office hours:	We 13:30-15:00, or by appointment, via Zoom

Note that all course-related material and information can be found on Brightspace including the lecture notes, the homework assignments and the links to the Zoom meetings. Important information might also be sent by emails.

Textbook:
Differential Equations, Dynamical Systems and an Introduction to Chaos, 2nd edition, by M. Hirsch, S. Smale, and R.L. Devaney.

An electronic copy is available online for free, see also the link provided on Brightspace. You may purchase a hard copy but be aware that only the third edition is available and all the references (e.g., some homework problems) will be made from to the second edition.

Lecture notes:
Lecture notes will be provided on Brightspace every week.

Catalog Description:
Systems of linear differential equations. Introduction to nonlinear systems; existence and uniqueness theorems, flow, stability of equilibria, invariant manifolds, periodic orbits, planar flows.

Prerequisites: (MAT 2120, MAT 2121) or (MAT 2120, MAT 2322) or (MAT 2122, MAT 2125), (MAT 2141 or MAT 2342), (MAT 2324 or MAT 2384).

Course Objectives:
Most physical phenomena varying in time (dynamical systems) can be described by (system of) differential equations. In some cases, linear differential equations provide good approximative models but in general, it is necessary to resort to nonlinear differential equations to obtain a more realistic model. Usually, it is not possible to solve exactly such nonlinear differential equations.

The goal of this course is to introduce the theory and mathematical tools that are used to analyze differential equations without actually solving these equations. At the conclusion of the course, the students should in particular be able to

- determine the existence and uniqueness of solutions;
- describe the geometry of solutions in the *phase plane*;
- discuss the stability of stationary solutions;
- analyze the effect of perturbation;

Course Outline and Schedule (tentative):
This course will cover the following topics from the textbook. The duration is tentative.

Chapters	Subjects	Duration
1.	Introduction	0.5 week
2. to 6.	Linear systems with constant coefficients	4 weeks
7. and 17.	Nonlinear systems - basic theory	2.5 weeks
8.	Equilibria in nonlinear systems	3 weeks
10.	Closed Orbits and Limit Sets	1.5 weeks

Homework and Quizzes:
Homework assignments will be posted on the course website throughout the term. The problems designated as *Hand-in* are to be turned in on Brightspace on the assigned due date. Additional problems, usually extracted from the textbook, will be given for extra practice but are not to be turned in and will not be graded. You are encouraged to work with others while solving homework problems, but you must write up your own solutions. Moreover, late homework will not be accepted except in the case of an excused absence.

15-minute quizzes with questions related to the assigned homework problems will be given on a biweekly basis during the class time, usually on Fridays. You will not have to turn in any homework solution for the material covered by the quizzes.

There will be about 5 hand-in homework assignments and 4 quizzes throughout the term.

Exams:
There will be one midterm exam and one final *comprehensive* exam. The midterm will take place Friday, October 23, during the usual class time, while the final exam will be held during the exam period (precise date to be determined). A detailed description of the material covered by each exam will be given on the course website in due time.

Grading Policy:
The final grade will be based on the homework/quizzes, the midterm exam and the *comprehensive* final exam. It will be computed according to the following distribution:

- homework/quizzes: 30% of your grade;
- midterm: 30% of your grade;
- final exam: 40% of your grade.

The homework and quizzes will be weighted equally. Moreover, the lowest grade will be dropped. Homework, quiz and exam scores will be posted on Brightspace so you can monitor your progress in the course. Your final letter grade will be computed according to the standard university scale:
A+ (90%-100%); A (85%-89%); A- (80%-84%); B+ (75%-79%); B (70%-74%); C+ (65%-69%); C (60%-64%); D+ (55%-59%); D (50%-54%); E (40%-49%); F (0%-39%).

Proctoring procedure:
The proctoring of the midterm and final exams will be done via Zoom using two electronic devices, for instance a computer and a cell phone:

- the first device (e.g., a computer) will be used to access the exam problems posted on Brightspace;
- the second device (e.g., a cell phone) will be used to log onto a Zoom meeting with the camera pointing on your work environment.

If two devices are not available to you, please contact me as soon as possible for alternative proctoring options.
For the quizzes, one device with camera capability and able to connect to Zoom will suffice.

Important Dates:

September 9	First day of class
October 12	Thanksgiving (no classes)
October 23	Midterm exam
October 25-31	Reading week (no classes)
December 9	Last day of class (redefined day, Monday course schedule)
December 10-22	Exam period (date to be determined)

Attendance and Make-up Policy:
Attendance is STRONGLY recommended. Make-ups for missed exams will only be allowed for a university approved absence in writing (for instance a medical note from the health services of the University of Ottawa). Wherever possible, students should inform the instructor before an exam is missed.

Make-ups will NOT be given for quizzes. However, if you miss a quiz due to an authorized absence and you contact me immediately, then the missed quiz will not count.

Materials Copyright:
All materials generated for this class are protected by Copyright laws. Distributing copies or sale of any of these materials is strictly prohibited.

Academic fraud:
Academic fraud is an act by a student that may result in a false evaluation. It is not tolerated by the University. Examples of academic fraud are: plagiarism, cheating of any kind or submit a work for which you are not the author, in whole or part. Any person found guilty of academic fraud will be subject to severe sanctions. Please consult the webpage `https://www.uottawa.ca/vice-president-academic/academic-integrity/resources-students` which contains regulations and tool to help you avoid plagiarism.

Academic Accommodations Service:
Students who have a disability or functional limitation and who need adaptive measures (changes to the physical setting, arrangements for exams, learning strategies, adaptive technologies, etc.) to progress or participate fully in university life should contact SASS Academic Accommodations immediately by:

- logging into the Academic Accommodations Portal (Ventus) at `https://sassit.uottawa.ca/ventus/student/` and completing the intake form
- by email at adapt@uottawa.ca or by calling the Academic Accommodations office at 613-562-5976.

The Academic Accommodations Service offers services and implements measures to break down barriers to learning for students with physical or mental health issues, visual impairments or blindness, hearing impairments or deafness, permanent or temporary disabilities, or learning disabilities.

Policy Prevention of Sexual Violence:
The University of Ottawa will not tolerate any act of sexual violence. This includes acts such as rape and sexual harassment, as well as misconduct that take place without consent, which includes cyberbullying. The University, as well as various employee and student groups, offers a variety of services and resources to ensure that all uOttawa community members have access to confidential support and information, and to procedures for reporting an incident or filing a complaint. For more information, please visit `www.uOttawa.ca/sexual-violence-support-and-prevention/`.