uOttawa

ORDINARY DIFFERENTIAL EQUATIONS I
MAT 5131/MATH 5405 – FALL 2024

Instructor:	Diane Guignard (STM 523, dguignar@uottawa.ca)
Personal Webpage:	`https://mysite.science.uottawa.ca/dguignar/`
Course Webpage:	`https://uottawa.brightspace.com/d2l/home` (Brightspace)
Classes:	Mo 1:00pm-2:20pm at 125 University (MNT), room 204
	We 11:30am-12:50pm at 57 Louis Pasteur (FTX), room 136
Office Hours:	Tu 10:30am-12:30pm in STM 523
	or by appointment (in person or on Zoom)

Course-related material, such as homework assignments, lecture notes, and topics covered per course, will be posted on Brightspace. Important information might also be sent by emails.

Main References:

[P] **L. Perko**, *Differential Equations and Dynamical Systems*, Springer, 2001.

A free electronic version is available online, see `https://link.springer.com/book/10.1007/978-1-4613-0003-8`.

[W] **W. Walter**, *Ordinary Differential Equations*, Springer, 1998.

A free electronic version is available online, see `https://link.springer.com/book/10.1007/978-1-4612-0601-9`.

Catalog Description:
One or two specialized Linear systems, fundamental solution. Nonlinear systems, existence and uniqueness, flow. Equilibria, periodic solutions, stability. Invariant manifolds and hyperbolic theory. topics taken from, but not limited to: perturbation and asymptotic methods, normal forms and bifurcations, global dynamics.This course is equivalent to MATH 5405 at Carleton University.

Course Objectives:
Most physical phenomena varying in time can be described by (systems 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. However, it is not possible in general to solve exactly such nonlinear differential equations.

The main goal of this course is to study the qualitative theory of ordinary differential equations (ODEs). That is to say, the goal is to introduce the theory and mathematical tools that are used to analyze ODEs without actually solving them.

Course Outline (tentative):
This course will cover the following topics (exact topics, order, and duration subject to changes).

Subject	Duration	Reference
Introduction	0.5 week	[W] Introduction, Section 1
Analysis of 1st order initial-value problem	2 weeks	[P] Sections 2.2-2.4, [W] Sections 5-6
Linear systems	2.5 weeks	[P] Sections 1.1-1.10
Nonlinear systems (local theory)	4 weeks	[P] Sections 2.5-2.10, 2.12, 2.14
Nonlinear systems (global theory)	2 weeks	[P] Sections 3.1-3.4, 3.7
Nonlinear systems (bifurcation theory)	0.5 week	[P] Sections 4.1-4.2

Homework:
Exercises will be posted on Brighspace. Throughout the term, there will be about 5 assignments to be turned in on the assigned due date directly on Brightspace. 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.

Exams:
There will be one midterm exam and one final *comprehensive* exam. The midterm will take place **Monday, October 28**, during the usual class time. 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 provided on Brighspace in due time.

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

- Homework: 20% of your grade;
- Midterm exam: 30% of your grade;
- Final exam: 50% of your grade.

Comprehensive Exam:
The final exam for the course may be counted towards the Comprehensive Exam requirement for PhD students in the Ottawa-Carleton Institute (MAT 9906 - Differential Equations I for uOttawa). The passing grade (Grade S - satisfactory) is a B, namely 70%.

Important Dates:
Below is a summary of the important dates for the fall 2024 term. You will find more informations at the website

https://www2.uottawa.ca/current-students/important-academic-dates-deadlines

September 4	First day of the term
September 9	**First day of this course**
October 13-19	Reading week (no classes)
October 28	**Midterm (1:00pm-2:20pm in MNT 204)**
December 2	**Last day of this class**
December 3	Last day of the term
December 5-18	**Exam period (date to be determined)**

Attendance Policy and Make-up Policy:
Attendance is STRONGLY recommended, but attendance will not be taken. There will be no make-up for the midterm. However, if you miss the midterm for a **valid reason**, then its wheight will be transferred to the final exam.

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.

Bilingualism:

Except in programs and courses for which language is a requirement, all students have the right to produce their written work and to answer examination questions in the official language of their choice, regardless of the course's language of instruction.

Academic GPS:

The Academic GPS hub is a one-stop shop for academic support. Whether you're an experienced student or just starting out, you'll find some great resources to help you succeed.

With the Academic GPS, you can:

- chat with a mentor seven days a week;
- register for study groups;
- take part in study methods workshops (note taking, time management, exam preparation, stress management, etc.);
- book an appointment with a mentor.

For more information: `https://www.uOttawa.saea-tlss.ca/en/academic-gps`.

Health and Wellness:

Your wellness is an integral part of your success. If you don't feel well, it can be hard to focus on your studies. Dedicated professionals and fellow students who care about you are always ready to provide advice and support. Depending on your needs, many activities and services exist to accompany you during your academic journey.

Services include:

- opportunities to connect;
- counselling sessions;
- peer support;
- physical activity;
- wellness activities and workshops;
- spiritual guidance.

If you want to connect with a counsellor, you can book an appointment online or go to their walk-in clinic at 100 Marie-Curie, fourth floor. You can also drop-in to our wellness space, chat online with a peer helper, or access 24/7 professional help through the website.

For more information and to access these services, go to `https://www.uOttawa.ca/wellness`.

Academic Accommodations:

We try to make sure all students with disabilities have equal access to learning and research environments, the physical campus and University-related programs and activities. The Academic Accommodations service works with other campus services to create an accessible campus learning environment, where students with disabilities have an equal opportunity to flourish. We offer a wide range of services and resources, provided with expertise, professionalism and confidentiality.

Services include:

- help for students with disabilities in making the transition;
- permanent and temporary accommodation measures;
- learning strategy development;
- adaptive exams;
- transcriptions of learning material;
- interpretation (ASL and LSQ);
- assistive technologies.

If you think that you might need any of our services or supports, email the Academic Accommodations service (adapt@uOttawa.ca).