ORIGINAL COURSE IMPLEMENTATION DATE:	September 2005
REVISED COURSE IMPLEMENTATION DATE:	September 2026
COURSE TO BE REVIEWED (six years after UEC approval)**:**	December 2031

Course outline form version: 29/08/2024

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

Note: The University reserves the right to amend course outlines as needed without notice.

Course Code and Number: MATH 415

Number of Credits: 3 Course credit policy (105)

Course Full Title: Ordinary Differential Equations II

Course Short Title: Ordinary Differential Equat II

Faculty: Faculty of Science

Department/School: Mathematics and Statistics

Calendar Description:

Qualitative properties of differential equations and systems of differential equations. oscillation and comparison theorems for second-order linear equations, matrix techniques for linear systems, diffeomorphisms for nonlinear systems, and stability analysis. Examples drawn from mechanical vibrations, lasers, biological rhythms, superconducting circuits, insect outbreaks and chemical oscillators.

Prerequisites (or NONE):	MATH 211, MATH 255, and (MATH 152 or MATH 221).
Corequisites (if applicable, or NONE):	
Pre/corequisites (if applicable, or NONE):	

Antirequisite Courses *(Cannot be taken for additional credit.)*

Former course code/number:

Cross-listed with:

Equivalent course(s):

(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)

Typical Structure of Instructional Hours

Lecture/seminar	50
Total hours	**50**

Scheduled Laboratory Hours

Labs to be scheduled independent of lecture hours: **No**

Course Details

Special Topics course: **No**

(If yes, the course will be offered under different letter designations representing different topics.)

Directed Study course: **No**

(See policy 207 for more information.)

Grading System: **Letter grades**

Delivery Mode: **Face-to-face only**

Expected frequency: **Every three years**

Maximum enrolment (for information only)**: 36**

Prior Learning Assessment and Recognition (PLAR)

PLAR is available for this course.

Transfer Credit *(See **bctransferguide.ca**.)*

Transfer credit already exists: **No**

Submit outline for (re)articulation: **Yes**

(If yes, fill in transfer credit form.)

Department approval	**Date of meeting:**	April 28, 2025
Faculty Council approval	**Date of meeting:**	May 30, 2025
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	December 19, 2025

Learning Outcomes *(These should contribute to students' ability to meet program outcomes and thus Institutional Learning Outcomes.)*

Upon successful completion of this course, students will be able to:

1. Discuss the proofs and relevance of fundamental theorems of ODE theory.
2. Perform linear stability analysis of fixed points of one-dimensional flows.
3. Perform phase plane analysis of linear systems.
4. Use diffeomorphisms to analyze local behaviour of nonlinear systems.
5. Convert a differential equation to an equivalent integral equation and solve by Picard iteration.
6. Sketch diagrams of different types of bifurcations such as saddle-node, transcritical, pitchfork and imperfect.

Recommended Evaluation Methods and Weighting *(Evaluation should align to learning outcomes.)*

Final exam:	40%	Assignments:	40%	Quizzes/tests/midterm:	20%
	%		%		%

Details:

NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.)*

Primarily lecture based.

Texts and Resource Materials *(Include online resources and Indigenous knowledge sources. Open Educational Resources (OER) should be included whenever possible. If more space is required, use the Supplemental Texts and Resource Materials form.)*

	Type	Author or description	Title and publication/access details	Year
1.	Textbook	Strogatz, S.	Nonlinear Dynamics and Chaos	2015
2.	Textbook	Perko, L.	Differential Equations and Dynamical Systems	2006
3.	Textbook	Hirsch, M.W., S. Smale	Differential Equations, Dynamical Systems and Linear Algebra	1974
4.				
5.				

Required Additional Supplies and Materials *(Software, hardware, tools, specialized clothing, etc.)*

Course Content and Topics

1. One-dimensional flows
   a. Flows on the line
   b. Bifurcations
   c. Flows on the circle
2. Two-dimensional flows
   a. Linear systems
   b. Phase plane analysis
   c. Poincaré-Bendixson theory
3. Qualitative and approximate asymptotic techniques.
   a. Saddle-Node, transcritical, and pitchfork bifurcations
   b. Hopf bifurcations