ORIGINAL COURSE IMPLEMENTATION DATE: January 2019

REVISED COURSE IMPLEMENTATION DATE:

COURSE TO BE REVIEWED (six years after UEC approval)**:** May 2024

Course outline form version: 10/27/2017

OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

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

Course Code and Number: MATH 416	**Number of Credits:** 3 Course credit policy (105)

Course Full Title: Partial Differential Equations

Course Short Title:

(Transcripts only display 30 characters. Departments may recommend a short title if one is needed. If left blank, one will be assigned.)

Faculty: Faculty of Science	**Department (or program if no department):** Mathematics and Statistics

Calendar Description:

First order equations, characteristics, and shocks; classification of second order equations; well-posed problems; eigenfunction expansions; maximum principles and qualitative methods. Examples drawn from gas dynamics, heat flow, wave phenomena, and financial mathematics.

Prerequisites (or NONE):	MATH 211, one of (MATH 152 or MATH 221), MATH 255, and MATH 265.
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:

Dual-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 hours (7.5 hours every 2 weeks)	50
Tutorials/workshops	
Supervised laboratory hours	
Experiential (field experience, practicum, internship, etc.)	
Supervised online activities	
Other contact hours:	
Total hours	**50**

Labs to be scheduled independent of lecture hours: ☒ No ☐ Yes

Special Topics

This course is offered with different topics:

☒ No ☐ Yes *(Double-click on box to select it as checked.)*

If yes, different lettered courses may be taken for credit:

☐ No ☐ Yes, repeat(s) ☐ Yes, no limit

(The specific topic will be recorded when offered.)

Transfer Credit

Transfer credit already exists: *(See **bctransferguide.ca**.)*

☒ No ☐ Yes

Submit outline for (re)articulation:

☐ No ☒ Yes *(If yes, fill in transfer credit form.)*

Grading System

☒ Letter Grades ☐ Credit/No Credit

Expected Frequency of Course Offerings:

Every second year

(Every semester, Fall only, annually, every other Fall, etc.)

Department / Program Head or Director: Ian Affleck	**Date approved:**	January 22 2018
Faculty Council approval	**Date approved:**	March 2, 2018
Dean/Associate VP: Greg Schlitt	**Date approved:**	March 2, 2018
Campus-Wide Consultation (CWC)	**Date of posting:**	April 13, 2018
Undergraduate Education Committee (UEC) approval	**Date of meeting:**	May 18, 2018

Learning Outcomes:

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

- Classify second order equations as elliptic, parabolic or hyperbolic, and discuss the main differences between the categories
- Determine if a given boundary value problem or initial value problem is well-posed
- Solve partial differential equations in finite domains with eigenfunction expansions
- Apply appropriate methods to construct solutions of partial differential equations on infinite domains
- Prove uniqueness conditions with a maximum principle

Prior Learning Assessment and Recognition (PLAR)

☒ Yes ☐ No, PLAR cannot be awarded for this course because

Typical Instructional Methods *(Guest lecturers, presentations, online instruction, field trips, etc.; may vary at department's discretion.)*

Lectures

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

Typical Text(s) and Resource Materials *(If more space is required, download Supplemental Texts and Resource Materials form.)*

	Author (surname, initials)	Title (article, book, journal, etc.)	Current ed.	Publisher	Year
1.	Drabek, Pavel	Elements of partial differential equations	☐	De Gruyter	2014
2.	Guenther, Ronald B.	Partial differential equations of mathematical physics and integral equations	☐	Dover	1996
3.	Strauss, Walter A.	Partial differential equations	☐	Wiley	2008
4.			☐		
5.			☐		

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

Typical Evaluation Methods and Weighting

Final exam:	40%	Assignments:	30%	Field experience:	%	Portfolio:	%
Midterm exam:	20%	Project:	10%	Practicum:	%	Other:	%
Quizzes/tests:	%	Lab work:	%	Shop work:	%	Total:	100%

Details (if necessary):

Typical Course Content and Topics

First order partial differential equations (PDE), characteristics, shocks in gas dynamics.

Derivation of the PDE of mathematical physics: heat, wave, Laplace equation.

Classification of second order linear PDEs (canonical forms).

D'Alembert solution for the wave equation.

Eigenfunction expansions, separation of variables for PDEs on finite spatial domains.

Maximum principles for the Laplace equation.

Heat kernel and solution of the heat equation on the real line.

Energy estimates.