UNIVERSITY OF THE FRASER VALLEY

**ORIGINAL COURSE IMPLEMENTATION DATE:** January 2019
**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 416 | **Number of Credits:** 3 Course credit policy (105) |
| **Course Full Title:** Partial Differential Equations<br>**Course Short Title:** Partial Differential Equations | |
| **Faculty:** Faculty of Science | **Department/School:** Mathematics & 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, and wave phenomena.

| | |
|---|---|
| **Prerequisites (or NONE):** | MATH 211, MATH 265, 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. Classify second order equations as elliptic, parabolic or hyperbolic, and discuss the main differences between the categories.
2. Determine if a given boundary value problem or initial value problem is well-posed.
3. Solve partial differential equations in finite domains with eigenfunction expansions.
4. Apply appropriate methods to construct solutions of partial differential equations on infinite domains.
5. Derive the properties of solutions using fundamental principles of PDEs, such as conservation of total energy, heat, and maximum principles.

**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.)*

Lectures.

**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 | Strauss, Walter A. | Partial Differential Equations | 2008 |
| **2.** | Textbook | Choksi, Rustum | Partial Differential Equations: A First Course | 2022 |
| **3.** | Textbook | Bleecker David and Csordas, George | Partial differential equations | 2018 |
| **4.** | OER | Ivrii, Victor | Partial Differential Equations | 2022 |
| **5.** | | | | |

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

**Course Content and Topics**

- First order partial differential equations (PDE), characteristics
- 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