

# Smooth Manifolds Fall 2024

## PMATH 665

Published

### Class Schedule

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Course	Meet Days	Meet Time	Location	Instructor(s)
PMATH 665 001 [LEC]	Mon, Wed, Fri <i>Sep 4 - Dec 3</i>	09:30AM - 10:20AM	MC 2038	D. Park <i>bdpark@uwat...</i>

schedule data automatically refreshed daily

### Instructor & TA (Teaching Assistant) Information

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Professor Doug Park

Office: MC 5022

Office hours: to be announced on LEARN

### Course Description

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*Calendar Description for PMATH 665:*

Smooth manifolds, smooth maps, and tangent vectors; the tangent and cotangent bundles; vector fields, tensor fields, and differential forms; Stokes's theorem; integral curves, Lie derivatives, the Frobenius theorem; de Rham cohomology.

Antireq: PMATH 465

### Learning Outcomes

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**By the end of this course students should be able to:**

Understand how to perform multi-variable calculus in the setting of smooth manifolds.

## Tentative Course Schedule

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We will attempt to cover some of the following material from the textbook.

Chapter 1. Smooth Manifolds  
Chapter 2. Smooth Maps  
Chapter 3. Tangent Vectors  
Chapter 4. Submersions, Immersions and Embeddings  
Chapter 5. Submanifolds  
Chapter 8. Vector Fields  
Chapter 9. Integral Curves and Flows  
Chapter 10. Vector Bundles  
Chapter 11. The Cotangent Bundle  
Chapter 12. Tensors  
Chapter 14. Differential Forms  
Chapter 15. Orientations  
Chapter 16. Integration on Manifolds  
Chapter 17. DeRham Cohomology  
Chapter 19. Distributions and Foliations

## Texts / Materials

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Title / Name	Notes / Comments	Required
Introduction to Smooth Manifolds, John M. Lee	Second edition	Yes

## Student Assessment

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Component	Value
In-class tests	40%
Final exam	60%

The weight of any missed in-class test will be transferred to the final exam, provided that the student submits a valid medical note.

# Assignment Screening

No assignment screening will be used in this course.

## Administrative Policy

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### Generative AI

This course includes the independent development and practice of specific skills, such as mathematical proof writing. Therefore, the use of Generative artificial intelligence (GenAI) trained using large language models (LLM) or other methods to produce text, images, music, or code, like Chat GPT, DALL-E, or GitHub CoPilot, is **not** permitted in this class. Unauthorized use in this course, such as running course materials through GenAI or using GenAI to complete a course assessment is considered a violation of [Policy 71](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71) (<https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71>) (plagiarism or unauthorized aids or assistance). Work produced with the assistance of AI tools does not represent the author's original work and is therefore in violation of the fundamental values of academic integrity including honesty, trust, respect, fairness, responsibility and courage ([ICAI](https://academicintegrity.org/images/pdfs/20019_ICAI-Fundamental-Values_R12.pdf) ([https://academicintegrity.org/images/pdfs/20019\\_ICAI-Fundamental-Values\\_R12.pdf](https://academicintegrity.org/images/pdfs/20019_ICAI-Fundamental-Values_R12.pdf)), n.d.).

You should be prepared to show your work. To demonstrate your learning, you should keep your rough notes, including research notes, brainstorming, and drafting notes. You may be asked to submit these notes along with earlier drafts of their work, either through saved drafts or saved versions of a document. If the use of GenAI is suspected where not permitted, you may be asked to meet with your instructor or TA to provide explanations to support the submitted material as being your original work. Through this process, if you have not sufficiently supported your work, academic misconduct allegations may be brought to the Associate Dean.

In addition, you should be aware that the legal/copyright status of generative AI inputs and outputs is unclear. More information is available from the Copyright Advisory Committee: <https://uwaterloo.ca/copyright-at-waterloo/teaching/generative-artificial-intelligence> (<https://uwaterloo.ca/copyright-at-waterloo/teaching/generative-artificial-intelligence>).

Students are encouraged to reach out to campus supports if they need help with their coursework including:

- [Student Success Office](https://uwaterloo.ca/student-success/resources) (<https://uwaterloo.ca/student-success/resources>) for help with skills like notetaking and time management
- [Writing and Communication Centre](https://uwaterloo.ca/writing-and-communication-centre/services-0/services-undergraduate-students) (<https://uwaterloo.ca/writing-and-communication-centre/services-0/services-undergraduate-students>) for assignments with writing or presentations
- [AccessAbility Services](https://uwaterloo.ca/accessability-services/students) (<https://uwaterloo.ca/accessability-services/students>) for documented accommodations
- [Library](https://uwaterloo.ca/library/research-supports/quick-start-guide) (<https://uwaterloo.ca/library/research-supports/quick-start-guide>) for research-based assignments

# University Policy

**Academic integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [the Office of Academic Integrity \(https://uwaterloo.ca/academic-integrity/\)](https://uwaterloo.ca/academic-integrity/) for more information.]

**Grievance:** A student who believes that a decision affecting some aspect of their university life has been unfair or unreasonable may have grounds for initiating a grievance. Read [Policy 70, Student Petitions and Grievances, Section 4 \(https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70\)](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70). When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

**Discipline:** A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for their actions. [Check [the Office of Academic Integrity \(https://uwaterloo.ca/academic-integrity/\)](https://uwaterloo.ca/academic-integrity/) for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to [Policy 71, Student Discipline \(https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71\)](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71). For typical penalties, check [Guidelines for the Assessment of Penalties \(https://uwaterloo.ca/secretariat/guidelines/guidelines-assessment-penalties\)](https://uwaterloo.ca/secretariat/guidelines/guidelines-assessment-penalties).

**Appeals:** A decision made or penalty imposed under [Policy 70, Student Petitions and Grievances \(https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70\)](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-70) (other than a petition) or [Policy 71, Student Discipline \(https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71\)](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-71) may be appealed if there is a ground. A student who believes they have a ground for an appeal should refer to [Policy 72, Student Appeals \(https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-72\)](https://uwaterloo.ca/secretariat/policies-procedures-guidelines/policy-72).

**Note for students with disabilities:** [AccessAbility Services \(https://uwaterloo.ca/accessability-services/\)](https://uwaterloo.ca/accessability-services/), located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with AccessAbility Services at the beginning of each academic term.

**Turnitin.com:** Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, therefore students must be given an alternative (e.g., scaffolded assignment or annotated bibliography), if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin in this course.

It is the responsibility of the student to notify the instructor if they, in the first week of term or at the time assignment details are provided, wish to submit alternate assignment.