

Introduction to Lie Groups and Lie Algebras Winter 2025

PMATH 863

Last edit:

Class Schedule

Course	Meet Days	Meet Time	Location	Instructor(s)
PMATH 863 001 [LEC]	Mon, Wed, Fri <i>Jan 6 - Apr 4</i>	01:30PM - 02:20PM	DWE 2527	N. Spronk <i>nspronk@uwaterlo...</i>

schedule data automatically refreshed daily

Instructor & TA (Teaching Assistant) Information

Nico Spronk, MC5322. Office hours TBA.

Course Description

Calendar Description for PMATH 863:

An introduction to matrix Lie groups and their associated Lie algebras: geometry of matrix Lie groups; relations between a matrix Lie group and its Lie algebra; representation theory of matrix Lie groups.

[View requirements for PMATH 863](https://acal.fast.uwaterloo.ca/course/1251/PMATH/863) (<https://acal.fast.uwaterloo.ca/course/1251/PMATH/863>).

Learning Outcomes

No explicit learning outcomes defined for this course.

Tentative Course Schedule

Introduction to (matrix) Lie groups, examples. (~2 weeks)

Exponent and logarithm maps, one-parameter subgroups, Lie algebra of a Lie group, closed subgroups. (~2 weeks)

Structure of Lie algebras, nilpotent, solvable, semi-simple. (~2 weeks)

Haar integral, examples. (~1 week)

General representation theory of compact Lie groups. (~1 week)

Representations of select simple compact Lie groups. (~4 weeks)

[The term is 13 weeks, and my estimates add to twelve; expect spillover.]

Texts / Materials

Note: Any prices provided in course outlines are best estimates based on recent online prices and do not include shipping or taxes. Prices may vary between retailers.

Title / Name	Notes / Comments	Required	Price (CAD)
Analysis on Lie groups, J. Faraut		No	~\$115 on Amazon
Lie groups, Lie Algebras, and Representations, B.C. Hall		No	~\$89 on Amazon
Structure and Geometry of Lie groups, J. Hilgert and K.-H. Neeb		No	~\$158 on Amazon

All of these books are in the library, and furthermore individual chapters may be retrieved online.

The course is intended to be self-contained, and reliant upon classroom notes.

Student Assessment

Component	Value
Assignments	75%
Talk	25%

I will aim for 3 assignments. I will encourage students to form pairs for assignment submission. You are allowed to switch work partners between assignments. If you exchange ideas with other individuals/groups, I ask that you acknowledge this in the assignment submission.

I will arrange a similar format for talks.

Assignment Screening

No assignment screening will be used in this course.

Administrative Policy

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.

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