
Lie Algebras

Instructor and Class Information

Lecturer:	Course Num.:
Office:	Lecture Room:
Phone:	Lecture Times:
Email:	Office Hours:

About Course Goals

FORMAT

The course will meet three times a week for 55 minutes each meeting. Instructions will be mainly by lecture delivered by the instructor. It may also include occasional in-class discussion as well as short student presentations, particularly, by post-candidacy students.

CONTENT & GOALS

This course is intended to provide students with a solid knowledge of the structure theory of Lie algebras, as well as the representation theory of Lie algebras. The course is part of a year-long course sequence followed by Math 7162 on Lie Groups. The material is a basic tool in a wide range of research directions, including representations theory, number theory, harmonic analysis, ergodic theory, differential geometry and topology.

PREREQUISITES

Math 5112, or instructor permission.

Textbook

MAIN REFERENCE

James E. Humphreys: *Introduction to Lie Algebras and Representation Theory*. Springer, 1972.
ISBN:3540900527.

ADDITIONAL REFERENCES

W. Fulton and J. Harris: *Representation Theory – A first course*. Springer 1999.
ISBN:0387974954.

R. Carter, G. Segal, and I. MacDonald: *Lectures on Lie groups and Lie Algebras*. Cambridge University Press, 1995. ISBN:0521499224.

Assessments

HOMEWORK ASSIGNMENTS

There will be approximately 12 homework assignment sheets, which will typically contain several fully described problems as well as a list of numbers of textbook problems. Due dates of assignments will announced and set typically a week after the assignments are published

FINAL PROJECT

The final project is a more extensive written assignment that will draw on techniques acquired throughout the semester. It will be published about two weeks before the end of classes and will be due at the beginning of finals week.

CLASS PARTICIPATION AND ATTENDANCE

Although attendance is not regularly monitored frequent absences are likely to be noted and may factor into the grade in borderline cases.

Grading

COURSE SCORE

A course score will be computed from the above assessments. Homework assignments will count 70% towards the grade and the final project 30%.

LETTER GRADES

Letter grades will be determined based on the course score. The approximate minimum scores for letter grades are 80% for an "A", 73% for an "A-", 67% for a "B+", 55% for a "B-", and 40% for a "C-". The exact cut-off scores may vary depending on the difficulty of assignments.

Weekly Schedule

Week 1	Definitions and first examples; ideals and homomorphisms
Week 2	Solvable and nilpotent Lie algebras; Theorems of Lie and Cartan
Week 3	Killing form; Complete reducibility of representations
Week 4	Representations of $SL(2, F)$; Root space decompositions
Week 5	Root system axiomatics; Simple roots and Weyl groups
Week 6	Classification of root systems; Construction of root systems and automorphisms
Week 7	Abstract theory of weights ; Isomorphism theorem
Week 8	Cartan subalgebras; Conjugacy theorems
Week 9	Universal enveloping algebras; Generators and Relations
Week 10	Simple algebras; Weights and maximal vectors
Week 11	Finite dimensional modules; Multiplicity formula
Week 12	Characters; Formulas of Weyl, Kostant, and Steinberg
Week 13	Chevalley algebras; Kostant's theorem
Week 14	Admissible lattices

General Policies

ACADEMIC MISCONDUCT

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term "academic misconduct" includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with

examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct (http://studentaffairs.osu.edu/info_for_students/csc.asp).”

DISABILITY SERVICES

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone 292-3307, TDD 292-0901; <http://www.ods.ohio-state.edu/>.