

# Part C: Lie Algebras

Lecturer: Prof. Kevin McGerty

Michaelmas Term, 2022

This course introduces Lie algebras and studies basic features of their representation theory and structure theory, including the classification of semisimple Lie algebras. Although not all of the key theorems are proved in this course, should they need to, a student who has internalised the techniques used in these lectures should not have too much difficulty filling in these gaps using any of the standard textbooks on the subject.

## 1 Course Details:

This is a 16 lecture Part C course. It has comparatively limited prerequisites, all of which are contained in the Part A Linear algebra course, and the Part B Representation theory course. In fact, aside from the “cultural background” which the Part B representation theory course provides, we really only need from it the properties of the tensor product of vector spaces and the notion of a composition series (which also arose in the context of Groups in the Part A Groups short option).

**1.1 Lecture notes:** Typed-up [lecture notes](#) for this course are available on the Maths Institute website. There are older versions of these lecture notes from previous years, but the presentation in this year’s course differs in a number of ways from the approach of those notes, so I have not provided them here. If you have any queries about the notes, *e.g.* you spot typos or cut-and-paste errors or something simply does not make sense, please email me ([mcgerty@maths.ox.ac.uk](mailto:mcgerty@maths.ox.ac.uk)).

**1.2 Problem Sheets** The course has five problem sheets: the first of these, [Sheet 0](#), studies composition series and tensor products, topics which should be familiar from previous courses such as the Part B Representation theory course, but everything we use is developed in the appendices of the online notes. The remaining problem sets, Sheets 1 to 4, provide questions which should complement the lecture material.

**1.3 Classes:** There are two sets of classes you can sign up for. These are:

	Class 1	Class 2
Tutor and T.A. :	Finn Wiersig & Jakub Wiaterek	Kevin McGerty & Tommi Muller
Time:	Weeks 2,4,6 & 8, Thursdays 3pm.	Weeks 3,5,7 & HT1, Tuesdays 11:00am-12:30pm

**1.4 Reading:** There are a number of good reference texts for the material of this course, and the Moodle site now includes a reading list with some of these. Of those texts, the book by Erdmann & Wildon is probably the most approachable, though its approach differs from the one adopted in these lecture notes in a number of significant ways. The book by Roger Carter “*Lie Algebras of Finite and Affine type*” is closer in its approach to that of this course, and is carefully, though perhaps less engagingly, written.