



## 教學計劃表 Syllabus

課程名稱(中文) Course Name in Chinese	數學專論(一)			學年/學期 Academic Year/Semester	114/1			
課程名稱(英文) Course Name in English	Topics in Mathematics (I)							
科目代碼 Course Code	AM_53200	系級 Department & Year	碩士	開課單位 Course-Offering Department	應用數學系			
修別 Type	選修 Elective	學分數/時間 Credit(s)/Hour(s)	3.0/3.0					
授課教師 Instructor	/李自然							
先修課程 Prerequisite								

## 課程描述 Course Description

This course is an introduction to Lie groups and Lie algebras.

## 課程目標 Course Objectives

由任課教師專長區分，設定個別目標。

Course objectives are subject to the expertise of the instructor.

系專業能力 Basic Learning Outcomes		課程目標與系專業能力相關性 Correlation between Course Objectives and Dept.'s Education Objectives
A	具備專業數學知識及邏輯推理能力。Have well-founded expertise in mathematics and be capable of logical reasoning.	●
B	具備學習其它學科的能力，以期能邁向跨領域研究。Be able to study other fields of science so as to conduct interdisciplinary research in the future	○
C	具備獨立思考與解決問題的能力。 Be capable of independent thinking and have the problem-solving skills.	●

圖示說明 Illustration : ● 高度相關 Highly correlated ○ 中度相關 Moderately correlated

## 授課進度表 Teaching Schedule &amp; Content

週次 Week	內容 Subject/Topics	備註 Remarks
1	2025/9/9: Introduction: Galois theory and Lie theory	
2	9/16: Prolongation	
3	9/23: (No class due to typhoon)	
4	9/30: Symmetry groups of differential equations	
5	10/7: Lie algebras. The matrix exponential	
6	10/14: Matrix Lie groups	
7	10/21: The Baker - Campbell - Hausdorff formula	
8	10/28: The exponential map. Local homomorphisms	

9	11/4: Midterm Exam	
10	11/11: (No class due to typhoon)	
11	11/18: Lie group homomorphisms, SU(2) and SO(3) (I)	
12	11/25: SU(2) and SO(3) (II). Fundamental groups	
13	12/2: Covering spaces (I)	
14	12/9: Covering spaces (II). Universal covering groups (I)	
15	12/16: Universal covering groups (II). Homotopy groups	
16	12/23: Representations of sl(2, C)	
17	12/30: Final Exam	
18	2026/1/6: Representations of SU(2) and SO(3)	

### 教 學 策 略 Teaching Strategies

課堂講授 Lecture       分組討論 Group Discussion       參觀實習 Field Trip  
 其他Miscellaneous:

### 教 學 創 新 自 評 Teaching Self-Evaluation

#### 創新教學 (Innovative Teaching)

問題導向學習 (PBL)       團體合作學習 (TBL)       解決導向學習 (SBL)  
 翻轉教室 Flipped Classroom       磨課師 Moocs

#### 社會責任 (Social Responsibility)

在地實踐 Community Practice       產學合作 Industy-Academia Cooperation

#### 跨域合作 (Transdisciplinary Projects)

跨界教學 Transdisciplinary Teaching       跨院系教學 Inter-collegiate Teaching

業師合授 Courses Co-taught with Industry Practitioners

#### 其它 other:

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學期成績計算及多元評量方式 Grading & Assessments

配分項目 Items	配分比例 Percentage	多元評量方式 Assessments						
		測驗 會考	實作 觀察	口頭 發表	專題 研究	創作 展演	卷宗 評量	證照 檢定
平時成績(含出缺席) General Performance (Attendance Record)								
期中考成績 Midterm Exam	25%							
期末考成績 Final Exam	25%							
作業成績 Homework and/or Assignments	50%							
其他 Miscellaneous (_____)								

評量方式補充說明  
Grading & Assessments Supplemental instructions

教科書與參考書目 (書名、作者、書局、代理商、說明)

Textbook & Other References (Title, Author, Publisher, Agents, Remarks, etc.)

References:

- John C. Baez, The Octonions, Bulletin (New series) of the American Mathematical Society, Volume 39, Number 2, Pages 145–205
- Brian C. Hall, Lie Groups, Lie Algebras, and Representations: An Elementary Introduction, Second Edition, Springer International Publishing
- Allen Hatcher, Algebraic Topology. Available on the author's website (<https://pi.math.cornell.edu/~hatcher/>)
- Alexander A. Kirillov, Jr, An Introduction to Lie Groups and Lie Algebras, Cambridge University Press
- Anthony W. Knapp, Basic Algebra, Digital Second Edition. Available on the author's website (<https://www.math.stonybrook.edu/~aknapp/>)
- Anthony W. Knapp, Lie Groups Beyond an Introduction, Digital Second Edition. Available on the author's website (<https://www.math.stonybrook.edu/~aknapp/>)
- Yvette Kosmann - Schwarzbach (translated by Stephanie Frank Singer), Groups and Symmetries: From Finite Groups to Lie Groups, Second Edition, Springer Nature
- Peter J. Olver, Applications of Lie Groups to Differential Equations, Second Edition, Springer-Verlag
- Peter J. Olver, Introduction to Partial Differential Equations, Springer International Publishing

課程教材網址(含線上教學資訊,教師個人網址請列位於本校內之網址)  
Teaching Aids & Teacher's Website (Including online teaching information.  
Personal website can be listed here.)

其他補充說明 (Supplemental instructions)