



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 & 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 $sl(2, \mathbb{C})$	
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 Industry-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:

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	其他
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. Knap, Basic Algebra, Digital Second Edition. Available on the author's website (https://www.math.stonybrook.edu/~aknapp/) -- Anthony W. Knap, 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)									