

## 106 學年第 1 學期 線性代數 Linear Algebra for Scientist 課程綱要

課程名稱：（中文）線性代數		開課單位	分子碩					
（英文）Linear Algebra for Scientist		永久課號	IMO5108					
授課教師：魏恆理								
學分數	3	必/選修	選修	開課年級	*			
先修科目或先備能力：								
undergraduate mathematics (preferably)								
課程概述與目標：								
<p>This course is supposed to equip students with basic notions and concepts of linear algebra needed for performing scientific computations. The main objective of the class is to make students familiar with the structure of algebraic objects (vectors, matrices, vector spaces, bases, decompositions) to the level necessary for performing real calculations and solving real problems. This practical approach will be combined with formal mathematical character of exposition.</p>								
教科書（請註明書名、作者、出版社、出版年等資訊）	<p>for basic concepts: any of numerous textbooks for undergraduate algebra                      for higher level concepts:                      1. D. S. Bernstein "Matrix mathematics", Princeton University Press, second edition, 2009                      2. G. H. Golub and C. F. Van Loan "Matrix computations", Johns Hopkins University Press, third edition, 1996                      3. J. H. Wilkinson "The algebraic eigenvalue problem", Oxford Science Publications, 1965 (reprinted 2004)                      for problems: S. Lipschutz "Schaum's Outline of Linear Algebra", McGrawHill, fifth edition, 2012</p>							
課程大綱				分配時數				
單元主題	內容綱要			講授	示範	習作	其他	備註
Complex numbers	folk, formal, and geometric definitions, operations on complex numbers							
Vectors	definition, operations on vectors							
Matrices	definitions, basic operations on matrices, high-level operations on matrices, functions of matrices							

Vector spaces	definition, linear independence, basis, change of basis, orthonormalization process, dual basis, rank of matrices, tensor spaces					
Linear equations	basic methods of solutions, BLAS and LAPACK					
Linear operators	matrix representation, properties of linear operators, change of basis, functions of linear operators					
Eigenvalues and eigenvectors of linear operators	definitions, geometric interpretation, characteristic polynomial, deficiencies, Jordan form of linear operators, eigendecomposition					
Eigenvalue and generalized eigenvalue problem	methods of determination of eigenvalues and eigenvectors, diagonalization, LAPACK					
Singular value decomposition	definitions, interpretation of singular values, generalized inverse					
Practical approach to problems in huge vector spaces	methods of solving of huge linear equations (DIIS algorithm), methods of solving huge eigenvalue problems (Davidson method and related techniques)					
Elements of analytic geometry	coordinates, area and volume of geometric objects, crossing points for geometrical objects, translations and rotations of geometric objects					

**教學要點概述：**

1. 學期作業、考試、評量

The total score is composed of 4 parts:

1. midterm 25%

2. final 25%

3. every class starts with a short quiz, ten best quizzes count for 25% of the final score

4. there will be 6-7 homework problem sheets, which will be solved during the class by randomly selected students; average of the performance at the blackboard counts for 25% of the final score

2. 教學方法及教學相關配合事項(如助教、網站或圖書及資料庫等)

materials for homework will be published on e3 homepage

師生晤談	排定時間	地點	連絡方式
	Thursday EFG	SB202	by email: hwitek@mail.nctu.edu.tw

每週進度表

週次	上課日期	課程進度、內容、主題

※ 請同學遵守智慧財產權觀念及勿使用不法影印教科書。

備註：

1. 其他欄包含參訪、專題演講等活動。
2. 請同學遵守智慧財產權觀念及勿使用不法影印教科書。

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