课程详述

COURSE SPECIFICATION

以下课程信息可能根据实际授课需要或在课程检讨之后产生变动。如对课程有任何疑问，请联系授课教师。

The course information as follows may be subject to change, either during the session because of unforeseen circumstances, or following review of the course at the end of the session. Queries about the course should be directed to the course instructor.

1.	课程名称 Course Title	线性代数 LINEAR ALGEBRA
2.	授课院系 **Originating Department**	数学系 Department of Mathematics
3.	课程编号 **Course Code**	MA113
4.	课程学分 Credit Value	4 学分 4 Credits
5.	课程类别 **Course Type**	通识必修课程 General Education (GE)Required Courses
6.	授课学期 **Semester**	春季 Spring / 秋季 Fall
7.	授课语言 **Teaching Language**	英文 English / 中英双语 English & Chinese
8.	授课教师、所属学系、联系方式（如属团队授课，请列明其他授课教师） **Instructor(s),　Affiliation& Contact** （**For team teaching, please list all instructors**）	Yimao Chen M5006, College of Science Department of Mathematics SUSTech
9.	实验员/助教、所属学系、联系方式 **Tutor/TA(s), Contact**	待公布 To be announced
10.	选课人数限额(可不填) **Maximum　　　　Enrolment** （**Optional**）	

11.	授课方式 Delivery Method	讲授 Lectures	习题/辅导/讨论 Tutorials	实验/实习 Lab/Practical	其它(请具体注明) Other（Please specify）	总学时 Total
	学时数 Credit Hours	64	32	N/A	复习、考试（1周）4 Revision & Exam (1 week) 4-hours	100

12.	先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	无/None

13.	后续课程、其它学习规划 Courses for which this course is a pre-requisite	后续课程为线性代数精讲，是金融数学系的数值分析、常微分方程、偏微分方程、回归分析、金融数学及金融工程等课程的先修课程，同时也是其他工程学科多门专业课的先修课程。 Linear Algebra is a prerequisite for Advanced Linear Algebra. It's also a prerequisite for many mathematics courses including Numerical analysis, Ordinary differential equations, Partial differential equations, Regression analysis, Financial Mathematics and Financial Engineering and etc.

14.	其它要求修读本课程的学系 Cross-listing Dept.	

教学大纲及教学日历 SYLLABUS

15. 教学目标 Course Objectives

本课程的教学目的是培养学生严谨的逻辑推理和抽象思维能力。课程主要讲述线性代数基本的概念和理论，包括线性方程组、矩阵代数、行列式、向量空间、线性变换、正交性理论、特征值和特征向量、奇异值分解以及二次型等相关理论，为进一步学习线性代数精讲的内容打下坚实的基础。课程的重点包括矩阵运算、求解线性方程组、向量空间、线性变换的相关理论求解特征值和特征向量以及二次型。

To introduce the basic concepts in linear algebra including systems of linear equations, matrix algebra, determinants, vector spaces, linear transformations, eigenvalues and eigenvectors, singular value decomposition and quadratic forms. It is a prerequisite for Advanced Linear Algebra. The emphasis is on operations with matrices, solving systems of linear equations, fundamental theory of vector spaces and linear transformations, solving eigenvalues and eigenvectors problems, and quadratic forms.

16. 预达学习成果 Learning Outcomes

通过对本课程的学习，学生可以理解和掌握线性代数的基本理论和技巧,能够熟练掌握行列式的基本理论和求解方法；熟练掌握矩阵的基本运算和矩阵的逆；熟练掌握求解线性方程组的方法；熟练掌握矩阵特征值和特征向量的计算；熟练掌握斯密特(Schmidt)正交化方法；理解向量线性相关性的理论、n 维实空间的基和正交基、相似矩阵及矩阵可对角化、二次型的基本理论以及线性变换。

After completing this course, students should understand the basic methods and techniques in Linear Algebra. They should be able to compute determinants, manipulate matrices and do matrix algebra, solve systems of linear equations, compute eigenvalues and eigenvectors. After learning this course, students should be able to understand the basic concepts of linear independence and linear dependence, the basis and orthonormal basis of n-dimensional vector space, similar matrices and diagonalizable matrices, quadratic forms and linear transformations.

17. 课程内容及教学日历 （如授课语言以英文为主，则课程内容介绍可以用英文；如团队教学或模块教学，教学日历须注明主讲人）

Course Contents (in Parts/Chapters/Sections/Weeks. Please notify name of instructor for course section(s), if this is a team teaching or module course.)

Week 1:

1.1 Introduction

1.2 The geometry of Linear Equations

1.3 An example of Gaussian Elimination

1.4 Matrix Notation and Matrix Multiplication

1.1 简介

1.2 线性方程的几何理解

1.3 高斯消元

1.4 矩阵介绍和矩阵乘法

Week 2:

1.4 Matrix Notation and Matrix Multiplication

1.5 Triangular Factors and Row Exchanges

1.6 Inverses and Transposes

1.4 矩阵记号和矩阵乘法

1.5 矩阵的三角分解和行交换

1.6 矩阵的逆和转置

Week 3:

1.6 Inverses and Transposes

2.1 Vector spaces and subspaces

1.6 矩阵的逆和转置

2.1 向量空间和子空间

Week 4：

2.2 Solving $Ax=0$ and $Ax=b$

2.2 求解 *Ax=0* 和 *Ax=b*

Week 5:

2.3. Linear Independence, Basis, and Dimension

2.4 The Four Fundamental Subspaces

2.3. 线性无关性，基，维数

2.4 矩阵的四个基本子空间

Week 6:

2.6 Linear Transformations

2.6 线性变换

Week 7:

3.1 Orthogonal Vectors and Subspaces

3.2 Cosines and Projections onto Lines

3.3 Projections and Least Squares

3.1 正交向量和正交子空间

3.2 投影到直线上

3.3 投影和最小二乘

Week 8:

3.3 Projections and Least Squares--cont'd

3.4 Orthogonal Bases and Gram Schmidt

3.3 投影和最小二乘

3.4 正交基和施密特正交化

Week 9:

4.1 Introduction

4.2 Properties of The Determinant

4.3 Formulas for the Determinant

4.1 行列式简介

4.2 行列式的基本性质

4.3 行列式的计算

Week 10:

4.3 Formulas for the Determinant--cont'd

4.4 Applications of Determinants

4.3 行列式的计算

4.4 行列式的应用

Week 11:

5.1 Introduction

5.2 Diagonalization of a Matrix

5.1 特征值简介

5.2 矩阵的对角化

Week 12:

5.5 Complex Matrices

5.6 Similarity Transformations

5.5 复数矩阵

5.6 相似变换

Week 13:

5.6 Similarity Transformations--cont'd

6.1 Minima, Maxima, and Saddle Points

5.6 相似变换

6.1 极小值、极大值以及鞍点

Week 14:

6.2 Test for Positive Definiteness (Quadratic Forms)

6.2 正定性的判定(二次型)

Week 15:

6.3 Singular Value Decomposition

6.3 奇异值分解

Week 16:
6.4 Minimum Principles
Review
6.4 极小值原理
总复习

18. 教材及其它参考资料 **Textbook and Supplementary Readings**

教材（Textbook）: Linear Algebra and Its Applications, 4th Edition, Gilbert Strang.

推荐参考书（Supplementary Readings）:
1. Linear Algebra with Applications, 9th Edition, Steven J. Leon.
2. 高等代数，北京大学数学系前代数小组编，第 4 版，高等教育出版社，2013.

课程评估 ASSESSMENT

19.

评估形式 Type of Assessment	评估时间 Time	占考试总成绩百分比 % of final score	违纪处罚 Penalty	备注 Notes
出勤 Attendance		5		
课堂表现 Class Performance				
小测验 Quiz		15		
课程项目 Projects				
平时作业 Assignments		10		
期中考试 Mid-Term Test		30		
期末考试 Final Exam		40		
期末报告 Final Presentation				
其它（可根据需要改写以上评估方式） Others (The above may be modified as necessary)				

20. 记分方式 GRADING SYSTEM

☐ A. 十三级等级制 **Letter Grading** ☐ B. 二级记分制（通过/不通过） **Pass/Fail Grading**

课程审批 REVIEW AND APPROVAL

21. 本课程设置已经过以下责任人/委员会审议通过
This Course has been approved by the following person or committee of authority