北京理工大学研究生课程教学日历

课程名称 Linear Algebra with Applications in Automatic Control

课程代码 0600003 课程性质 必修

主讲教师 宋卓越 2017—2018 学年第 一 学期

辅导教师 路平立 自动化 学院

授课对象 研究生

时数 教学计划	全总学时期数	学时分配				每周时数
		讲授	实验	习题	考核	
教学计划	48	44	0	2	2	6

周次	上课方式	时数	授课内容	课外阅读和书面的作业		学习检查		参考书名和章节
				时数	内 容	检查方式	所需时间	
4	讲授	6	Chapter1.Linear Space and Mapping 1. Basic abstract algebra 2. Linear space 3. Basis of Linear space 4. Linear subspace 5. Linear transfo-rmations	3	课外阅读： 参考书第一章第六节 作业： Example 1.8 Example 1.27 Example 1.30	批阅	2 小时	Linear Algebra with Applications in Automatic Control 第一章
5	讲授	6	Chapter2.Polynomials and matrix polynomials 1. Linear algebras 2. Polynomial ring 3.Ideals of polynomials 4.Matrix polynomials-Smith canonical form	4	课外阅读： 参考书第二章第八节 作业： Example 2.17 Example 2.25 Example 2.26	批阅	2 小时	Linear Algebra with Applications in Automatic Control 第二章
6	讲授	6	Chapter3. Linear transformation 1.The eigenvalues of linear transformation 2. Similarity reduction, the Natural normal form	4	课外阅读： 矩阵分析特征值相关内容 作业： Example 3.2 Example 3.4	批阅	2 小时	Linear Algebra with Applications in Automatic Control 第三章第一、二节

7	讲授	6	Chapter3. Linear transformation 3. The Jordan Canonical forms 4 . Minimal polynomials and the first decomposition of a linear space 5. The cyclic invariant subspaces and the second decomposition of a linear space	4	课外阅读： 线性系统理论中约旦标准型及应用相关内容 作业： Example 3.5-3.9	批阅	4 小时	Linear Algebra with Applications in Automatic Control 第三章第三、四、五节
8	讲授	6	Chapter4.Linear transformation in unitary spaces 1． Euclidean and unitary spaces 2. Orthonormal basis and the Gram-Smith process 3.Unitary transformations 4. Projectors and idempotent matrices 5. Adjoint transformation	4	课外阅读： 矩阵分析同构变换、酉矩阵相关内容 作业： Example 4.3-4.5	批阅	2 小时	Linear Algebra with Applications in Automatic Control 第四章前五节
9	讲授	6	Chapter4.Linear transformation in unitary spaces 6.Normal transformations and normal matrices 7.Hermitian matrices and Hermitian forms Chapter5.Decomposition of linear transformations and matrices 1.Spectral decomposition of simple linear transformation and matrices	4	课外阅读： 矩阵分析正定矩阵及 Lyapunov 稳定性理论相关内容 Example 4.11 Example 5.2-5.3	批阅	2 小时	Linear Algebra with Applications in Automatic Control 第四章第六节至第五章第一节

10	讲授	6	Chapter5.Decomposition of linear transformations and matrices 2. Singular value decomposition of linear transformations between unitary spaces and the associated matrices 3.Full rank factorization of linear transformations and matrices 4.UR and QR factorization of matrices	5	课外阅读： 奇异值在鲁棒与非线性控制中的应用相关内容 Example 5.4-5.7	批阅	2 小时	Linear Algebra with Applications in Automatic Control 第五章第二节至第四节
11	讲授和答疑	6	Chapter6.Norms for vectors and matrices 1.Norms for vectors 2. Norms of matrices 3. Induced norms of matrices Review and exercise	4	课外阅读： 矩阵分析中矩阵范数相关内容 Theorem6.6 证明推导及 Example 6.6	批阅	3 小时	Linear Algebra with Applications in Automatic Control 第一章至第六章

一、 教学目的

The Linear Algebra with Applications in Automatic Control is one of the main specialized core courses for master students majoring in Automation and Electrical Engineering & Automation. The objective of this course is to familiarize students with the basic concepts and knowledge of linear algebra and matrices and background material that is useful in systems and control theory.

This course consists of two parts: The first part includes a thorough treatment of material in standard courses on linear algebra, and the main topics for this part include linear space and mapping, polynomials and matrix polynomials, linear transformations and the canonical forms for the corresponding matrix representations, linear transformations in unitary spaces; the second part is devoted to develop material that is useful in systems and control theory, the main topics of this part include decomposition of linear transformations and matrices, norms for vectors and matrices, short introduction of function of matrices and matrix-valued functions and applications to differential equations.

二、 授课方法和方式

Classroom teaching and discussions

三、 成绩评定方式

English problems and English answers. The final score is made up of daily performance (30%) and final exam performance (70%).

四、 教材和必读参考资料

1.Defense Industry Press, 2011

2. 黄琳. 系统与控制理论中的线性代数，科学出版社，1984

3. Roger A. Horn, Charles R. Johnson, Matrix Analysis, The Cambridge University Press, (1985-1st Edition, 2013-2nd Edition)

4. Lancaster, Peter, & Tismenetsky, Miron. The Theory of Matrices (2nd Edition). Academic Press: Orlando San Diego 1997

5. MIT-open course on linear algebra

任课教师_____ _____年___月___日

教学院长_____ _____年___月___日

注：

1. 此教学日历由授课教师填写，教学院长签字后执行，学院留存一份。