

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	实变函数 Real Analysis				
2.	授课院系 Originating Department	数学系 Department of Mathematics				
3.	课程编号 Course Code	MA201				
4.	课程学分 Credit Value	3				
5.	课程类别 Course Type	专业核心课 Major Core Courses				
6.	授课学期 Semester	秋季 Fall				
7.	授课语言 Teaching Language	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)	邱雁南 Yannan QIU 数学系 Department of Mathematics qiuyun@sustech.edu.cn				
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	3				

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	数学分析 I-III Mathematical Analysis I-III 或 or 数学分析精讲 Selected topics in Mathematical Analysis
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	
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**

This course introduces the Lebesgue theory for doing integration and differentiation on real spaces.

本课程引入在实空间上做微分与积分运算的 Lebesgue 理论。

16. 预达学习成果 **Learning Outcomes**

The students will understand the construction of Lebesgue measure and Lebesgue integral on real spaces, know how to correctly apply basic theorems such as the dominated convergence theorem and Fubini's theorem, and acquire basic skills to analyze the behavior of real-valued functions on real spaces.

学生将理解实空间上 Lebesgue 测度与 Lebesgue 积分的构造，知道如何正确使用控制收敛定理与 Fubini 定理等基本定理，并掌握分析实空间上实函数行为的基本技术。

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.)

The course covers the properties of real numbers, the construction of measure, measurable functions, integration theory, the relation between differentiation and integration, and L^p spaces. It comprises 24 lectures, with each lecture lasting 2 hours.

Topic 1: The construction of real numbers as the completion of rational numbers, cardinality of sets, the topology of a complete metric space, Baire category theorem (4 lectures);

Topic 2: The construction of the Lebesgue measure on \mathbb{R}^n , measurable sets and non-measurable sets (3 lectures);

Topic 3: Measurable functions, almost everywhere convergence, convergence in measure, the approximation of measurable functions (3 lectures);

Topic 4: Lebesgue integral, dominated convergence theorem, Fubini's theorem, the relation between Riemann integral and Lebesgue integral (4 lectures);

Topic 5: Differentiation of the integral, the Lebesgue differentiation theorem, differentiability of functions, functions of bounded variation, absolutely continuous functions, the formula for integration by parts, the change-of-variables theorem (5 lectures);

Topic 6: The theory of L^p spaces (4 lectures);

Review. (1 lecture)

本课程讲授实数的性质、实空间上测度的构造、可测函数、积分理论、微分与积分的关系，以及 L^p 空间的理论，包括 24 次课，每次课 2 小时。

主题一：实数的构造，集合的序数，完备度量空间的拓扑，Baire 纲定理（4 次课）；

主题二：Lebesgue 测度的构造，可测集与不可测集（3 次课）；

主题三：可测函数，几乎处处收敛，依测度收敛，可测函数的逼近（3 次课）；

主题四：Lebesgue 积分的构造，控制收敛定理，Fubini 定理，Riemann 积分与 Lebesgue 积分的关系（4 次

课)；
 主题五：不定积分的微分，Lebesgue 微分定理，函数的可微性，有界变差函数，绝对连续函数，分部积分公式，积分换元公式（5 次课）；
 主题六： L^p 空间（4 次课）；
 复习（1 次课）

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

教材 Textbooks:
 1. Real Analysis (ISBN 9780691113869), by Elias M. Stein & Rami Shakarchi;
 2. 实变函数论 (ISBN 9787301276471), 周民强著。

参考文献 References:
 1. Real Analysis (ISBN 9780134689494), by Halsey Royden;
 2. 实变函数论 (ISBN 9787040292213), 伊西多尔·巴甫洛维奇·那汤松著。

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				
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		30%		
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)

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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

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