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	数学分析精讲 Real Analysis
2.	授课院系 Originating Department	数学系 Department of Mathematics
3.	课程编号 Course Code	MA213-16
4.	课程学分 Credit Value	5
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	英文 English
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）	Jana Hertz Department of Mathematics, Block 3, Wisdom Valley Jana Hertz, Room 427, rhertz@sustech.edu.cn, 0755-8801-8121
9.	实验员/助教、所属学系、联系方式 Tutor/TA(s), Contact	
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	0		96

12.	先修课程、其它学习要求 **Pre-requisites or Other Academic Requirements**	高等数学（下）A　Calculus A II
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**

此课程为衔接高等数学与后期数学课程（如复分析、实变函数、泛函分析和概率论等）的桥梁。内容涵盖基本的点集拓扑概念，用 ε-δ 语言描述极限、连续、微分、积分和级数收敛等概念并严格推导相关的性质和证明定理。本课程也将介绍多元函数的连续性、可微性，反函数和隐函数定理， 多重积分，曲线积分与曲面积分

This course bridges Calculus and advanced math courses (such as Complex Analysis, Real Analysis, Functional Analysis and Probability). It covers basic theory of concepts of point set topology, using ε-δ language to describe concepts in Calculus, such as limit, continuity, differentiation, integration, convergence of series etc and to rigorously derive related properties and prove theorems. The course also introduces the continuity and differentiability of multivariate functions, inverse function theorem, implicit function theorem, multiple integrals, line integrals and surface integrals.

16. **预达学习成果 Learning Outcomes**

此课程为衔接高等数学与后期数学课程（如复分析、实变函数、泛函分析和概率论等）的桥梁。内容涵盖基本的点集拓扑概念，用 ε-δ 语言描述极限、连续、微分、积分和级数收敛等概念并严格推导相关的性质和证明定理。本课程也将介绍多元函数的连续性、可微性，反函数和隐函数定理， 多重积分，曲线积分与曲面积分

This course bridges Calculus and advanced math courses (such as Complex Analysis, Real Analysis, Functional Analysis and Probability). It covers basic theory of concepts of point set topology, using ε-δ language to describe concepts in Calculus, such as limit, continuity, differentiation, integration, convergence of series etc and to rigorously derive related properties and prove theorems. The course also introduces the continuity and differentiability of multivariate functions, inverse function theorem, implicit function theorem, multiple integrals, line integrals and surface integrals.

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.)

第 1 章 点集拓扑初步 (8 学时)

Chapter 1. Basic point set topology

第 2 章 数列和数项级数(10 学时)

Chapter 2. Numerical sequences and series

第 3 章 连续性(8 学时)

Chapter 3. Continuity

第 4 章 微分(6 学时)

Chapter 4. Differentiation

第 5 章 Riemann 积分(6 学时)

Chapter 5. The Riemann integral

第 6 章 函数的序列和级数(8 学时)

Chapter 6. Sequences and series of functions

第七章 多元函数(8 学时)

Chapter 7. Multivariate functions

第八章 曲线积分与曲面积分 (10 学时)

Chapter 8. Line integrals and surface integrals

每周进度 weekly schedule:

第 1 周： 度量空间(1 学时)，开闭集(3 学时)。

Week 1: Metric spaces (1 hours), open and closed sets (3 hours).

第 2 周：紧集(2 学时)，完美集(1 学时)，连通集(1 学时)。

Week 2: Compact sets (2 hours), perfect sets (1 hours), connected sets (1 hour).

第 3 周：收敛列(2 学时)，子列(1 学时)，柯西列(1 学时)。

Week 3: Convergent sequences (2 hours), sub sequences (1 hour), Cauchy sequences (1 hour).

第 4 周：上、下极限(1 学时)，特殊序列，级数(1 学时)，非负项级数，数 e (1 学时)， 检根法和检比法，幂级数(1 学时)。

Week 4:Upper and lower limits (1 hour), some special sequences, series (1 hour), series of nonnegative terms, the number e (1 hour), root and ratio test, power series (1 hour).

第 5 周：分部求和，绝对收敛(1 学时)，级数加法和乘法，重排(1 学时)，函数的极限(1 学时)， 连续函数(1 学时)。

Week 5: Summation by parts, absolute convergence (1 hour), addition and multiplication of series, rearrangement (1 hour), limits of functions (1 hour), continuous functions (1 hour).

第 6 周：连续和紧(2 学时)，连续和连通(1 学时)，不连续(1 学时)。

Week 6: Continuity and compactness (2 hours), continuity and connectedness (1 hour), discontinuity (1 hour).

第 7 周：单调函数(1 学时)，无穷极限和无穷远处的极限(1 学时)，实函数的导数(2 学时)。

Week 7: Monotonic functions (1 hour), infinite limits and limit at infinity (1 hour), the derivative of a real function (2 hours).

第 8 周：中值定理(1 学时)，导数的连续性，洛比达法则(1 学时)，高阶导数，泰勒定理(1 学时)，向量值函数的微分(1 学时)。

Week 8: Mean value theorems (1 hour), the continuity of derivatives, L'Hospital's rule (1 hour), derivatives of higher order, Taylor's theorem (1 hour), differentiation of vector-valued functions (1 hour).

第 9 周：积分的定义和存在性(2 学时)，积分的性质(2 学时)。

Week 9: Definition and existence of the integrals (2 hours), Properties of the integral (2 hours).

第 10 周：积分和微分，向量值函数的积分(1 学时)，可求长曲线(1 学时)，主要问题的讨论(1 学时)， 一致收敛(1 学时)。

Week 10: Integration and differentiation, integration of vector-valued functions (1 hour), rectifiable curves (1 hour), discussion of main problem (1 hour), uniform convergence (1 hour).

第 11 周：一致收敛和连续(2 学时)，一致收敛和积分(1 学时)，一致收敛和微分(1 学时)。

Week 11: Uniform convergence and continuity (2 hours), uniform convergence and integration (1 hour), uniform convergence and differentiation (1 hour).

第 12 周：等度连续的函数族(2 学时)，线性变换(1 学时)，微分(1 学时)。

Week 12: Equicontinuous families of functions (2 hours), linear transformations (1 hour), differentiation (1 hour).

第 13 周：微分，压缩原理(1 学时)，反函数定理(1 学时)，隐函数定理(2 学时)。

Week 13: Differentiation, the contraction principle (1 hour), the inverse function theorem differentiation (1 hour), the implicit function theorem (2 hours).

第 14 周：秩定理(2 学时)，多重积分(1 学时)，原映射(1 学时)。

Week 14: The rank theorem (2 hours), multiple integrals (1 hour), primitive mappings (1 hour).

第 15 周：单位分解，换元 (1 学时)，微分形式(3 学时)。

Week 15: Partition of unity, change of variables (1 hour), differential forms (3 hours).

第 16 周：单纯形和链(2 学时)，Stokes 定理(1 学时)，复习(1 学时)。

Week 16: Simplexes and chains (2 hours), Stokes' theorem (1 hour), review (1 hour).

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

教材 Textbook：

Principles of Mathematical Analysis, W. Rudin, 机械工业出版社, 第 1 版, 2004.

其他参考资料 Supplementary Readings：

Mathematical Analysis (I,II), Zorich, 世界图书, 第 1 版 , 2010.

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		0		
课堂表现 Class Performance		0		
小测验 Quiz		0		
课程项目 Projects		0		
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		0		
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