

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	数学物理方法 (H) Mathematical Methods in Physics (H)
2.	授课院系 Originating Department	物理系 Department of Physics
3.	课程编号 Course Code	PHY213
4.	课程学分 Credit Value	4
5.	课程类别 Course Type	专业基础课 Major Foundational 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)	吴紫辉, 副教授, 物理系 理学院大楼 P5100 WU Zihui, Associate Professor, Department of Physics College of Science P5100 wuzh3@sustech.edu.cn 0755-88018209
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
	58	6	0	0	64
学时数 Credit Hours					
12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	高等数学（下）（MA127）或数学分析 II（MA102a），大学物理（下）（PHY106）或普通物理学（下）（PHY102），线性代数（MA113）或高等代数 I（MA107）				
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	本课程为物理学专业基础课，是部分专业核心课的先修课程。 This course is a Major Foundation Course of physical courses, to prepare for the mathematics expected in more advanced physical courses.				
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

数学物理方法是物理学专业的基础课，旨在讲授物理学中常用的数学工具和技术，以及它们在解决物理问题中的应用。本课程强调将数学知识和物理现象相结合，既帮助学生学得相关纯数学知识，又培养学生将数学方法应用于解决实际物理问题的能力。

As the Major Foundation of physical courses, this course aims to introduce how to use mathematics as a tool & technique to deal with physical problems. From the course, students should transform from learning pure mathematics to using mathematics as a tool to treat real physical problems.

16. 预达学习成果 Learning Outcomes

掌握复变函数、数学物理方程、特殊函数和拓扑学的基本概念和理论，及其在物理学中的表现形式。通过课程学习，学生可以提高抽象思维能力和符号运算能力，并能够把物理问题转化为数学模型加以处理。

Master functions of a complex variable, ordinary and partial differentials closely related to physical problems and special functions. Master using the residue theorem to calculate definite integrals; improve abilities in abstract thinking and symbolic calculation, and formulate physical problems into mathematical language in differential equations and boundary conditions.

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.)

1) 复函数和双曲函数

第 1 周: 复数运算、极坐标表示、de Moivre 定理

第 2 周: 复函数 (对数、幂级数), 复数简单的应用、微分和积分, 双曲函数

2) 复变量函数的微积分

第 3 周: 复变函数、复变函数微分、Cauchy - Riemann 关系

第 4 周: 复数项幂级数、Taylor 级数、Laurent 级数、多值函数、函数的奇点、零点

第 5 周: 复变函数的环路积分, Cauchy 定理、Cauchy 积分公式

第 6 周: 留数定理、用留数定理计算定积分、

3) 偏微分方程: 通解和特解

第 7 周: 重要的偏微分方程、通解、通解和特解

第 8 周: 波动方程、扩散方程、解的特征

第 9 周: 期中考试

4) 偏微分方程: 分离变量法

第 10 周: 分离变量法、解的叠加

第 11 周: 极坐标系下的分离变量法

5) 常微分方程的级数解

第 12 周: 二阶线性常微分方程

第 13 周: 常点的级数解、奇点的级数解

6) 特殊函数

第 14 周: Legendre 函数, 连带 Legendre 函数

第 15 周: 球谐函数、Bessel 函数

第 16 周: 拓扑学入门

1) Complex numbers and hyperbolic functions

Week 1: Manipulation of complex numbers, Polar representation of complex numbers, de Moivre's theorem

Week 2: Complex logarithms and complex powers, Applications to differentiation and integration, Hyperbolic functions

2) Complex variables

Week 3: Functions of a complex variable, The Cauchy - Riemann relations

Week 4: Power series in a complex variable, Taylor and Laurent series, Multivalued functions and branch cuts, Singularities and zeros of complex functions,

Week 5: Complex integrals, Cauchy's theorem, Cauchy's integral formula

Week 6: Residue theorem, Definite integrals using contour integration ,

3) Partial differential equations: general and particular solutions

Week 7: Important partial differential equations, General form of solution, General and particular solutions

Week 8: The wave equation, The diffusion equation, Characteristics and the existence of solutions

Week 9: Midterm examination

4) Partial differential equations: separation of variables
 Week 10: Separation of variables: the general method, Superposition of separated solutions
 Week 11: Separation of variables in polar coordinates

5) Series solutions of ordinary differential equations
 Week 12: Second-order linear ordinary differential equations
 Week 13: Series solutions about an ordinary point, Series solutions about a regular singular point

6) Special functions
 Week 14: Legendre functions, Associated Legendre functions
 Week 15: Spherical harmonics, Bessel functions
 Week 16: Introduction to topology

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

教材:

Mathematical Methods in the Physical Sciences, by Mary L. Boas. The third Edition; Wiley

其他参考资料:

胡嗣柱、倪光炯:《数学物理方法》高教出版社

Mathematical Methods for Physics and Engineering; Third Edition; K.F. RILEY, M.P. HOBSON and S. J. BENICE;
 Cambridge university press

Essential Mathematical Methods for Physicists; Hans J. Weber and George B. Arfken; Academic Press

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)**

	任课教师可根据教学需要，按照公平、公正、公开的原则合理调整成绩分布比例。		

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

物理系教学指导委员会
 Education Instruction Committee of Physics department

