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	偏微分方程 Partial Differential Equations
2.	授课院系 Originating Department	数学系 Mathematics
3.	课程编号 Course Code	MA303
4.	课程学分 Credit Value	3
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	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）	苏琳琳（sull@sustech.edu.cn），王学锋(wangxf@sustech.edu.cn)，王勇（wangy66@sustech.edu.cn），数学系 Linlin Su(sull@sustech.edu.cn), Xuefeng Wang(wangxf@sustech.edu.cn), Yong Wang（wangy66@sustech.edu.cn）, Department of Mathematics
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	48	0	0	0	48

12.	先修课程、其它学习要求 **Pre-requisites or Other Academic Requirements**	常微分方程 A（MA201a）或者常微分方程 B（MA201b） Ordinary Differential Equations A (MA201a) or Ordinary Differential Equations B (MA201b)
13.	后续课程、其它学习规划 **Courses for which this course is a pre-requisite**	本课程为大学理工科以及金融数学专业的基础课程。 This course is for undergraduates who are science, engineering, mathematics, or financial mathematics majors.
14.	其它要求修读本课程的学系 **Cross-listing Dept.**	无 None

教学大纲及教学日历 SYLLABUS

15. **教学目标 Course Objectives**

偏微分方程是以建立数学模型、进行理论分析和解释客观现象并进而解决实际问题为内容的一门数学分支学科。本课程将提供给学生偏微分方程中的基本概念、基本理论以及基本方法, 并着重于对偏微分方程模型的理解及其在其他学科中的应用。

Partial Differential Equations (PDEs) is a branch of mathematics which is concerned with the establishment of mathematical models, the theoretical analysis and interpretation of objective phenomena and the solution of practical problems. This course will provide students with the basic concepts, theories and methods of PDEs, with emphasis on the understanding of PDEs models and their applications in other disciplines.

16. **预达学习成果 Learning Outcomes**

通过本课程的学习，学生将掌握偏微分方程中的一些基本概念、基本理论以及基本方法。掌握输运方程、热方程、Laplace 方程、Poisson 方程和波方程的物理背景及其数学推导；掌握特征线法、分离变量法、能量方法、基本解法、Green 函数法和 d'Alembert 公式；掌握极值原理及其应用。

Through this course, students will master some basic concepts, theories and methods of Partial Differential Equations. Master the physical background and mathematical derivation of transport equation, heat equation, Laplace equation, Poisson equation and wave equation. Master the method of characteristics, method of separation of variables, energy methods, method of fundamental solution, method of Green's function and d'Alembert formula. Master the maximum-minimum principle and its applications.

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.)

第一章 介绍 (1 学时)
基本概念：偏微分方程，阶，线性，齐次性，叠加原理，通解，初边值问题，二阶偏微分方程的分类，偏微分方程举例
第二章 一阶偏微分方程（3 学时）
2.1 输运方程及其推导
2.2 一阶线性偏微分方程：特征线法，通解，爆破
第三章 抛物型方程(18 学时)
3.1 热方程和反应扩散方程及其推导
3.2 边界条件
3.3 解的唯一性（能量方法）
3.4 分离变量法
3.5 特征值问题： Sturm-Liouville 理论
3.6 非齐次问题
3.7 热方程的基本解
3.8 极值原理
第四章 椭圆型方程（16 学时）
4.1 Laplace 方程和 Poisson 方程
4.2 分离变量法
4.3 Laplace 方程的基本解
4.4 Green 公式及其应用
4.5 极值原理
4.6 Green 函数法
第五章 双曲型方程（10 学时）
5.1 波方程：弦振动
5.2 能量和唯一性
5.3 分离变量法
5.4 d'Alembert公式和波传播
Chapter 1 Introduction (1 Credit Hour)
Definition of Partial Differential Equations (PDEs); order, linearity, homogeneity, superposition principle; general solutions, initial and boundary conditions; classifications of second order PDEs; examples of PDEs
Chapter 2 First-order Partial Differential Equations (3 Credit Hours)
2.1 Transport equation: derivation
2.2 First-order linear PDEs: method of characteristics, general solutions and break-down of smoothness
Chapter 3 Parabolic Equations (18 Credit Hours)
3.1 Heat equation and reaction-diffusion equation: derivation
3.2 Boundary conditions for heat and diffusion equations
3.3 Uniqueness of solution of heat equation via energy method
3.4 Method of separation of variables
3.5 Eigenvalue problems: Sturm-Liouville theory and eigen-expansion
3.6 Non-homogeneous problem
3.7 Fundamental solution of heat equation
3.8 The Maximum principles
Chapter 4 Elliptic Equations (16 Credit Hours)
4.1 Laplace and Poisson equations
4.2 Separation of variables
4.3 Fundamental solution of Laplace equation
4.4 Green's identities and applications
4.5 Maximum-minimum principle
4.6 Method of Green's function
Chapter 5 Hyperbolic Equations (10 Credit Hours)
5.1 Wave equation: string vibration
5.2 Energy and uniqueness
5.3 Method of separation of variables
5.4 d'Alembert formula and wave propagation

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

Textbook:
Lecture notes on Partial Differential Equations, Tao Tang and Xuefeng Wang.

Reference:
1. A First Course in Partial Differential Equations with Complex Variables and Transform Methods, H. F. Weinberger, 1995.
2. 偏微分方程, 周蜀林编著, 北京大学出版社, 2005.
3. Partial Differential Equations: An Introduction, second edition, Walter A. Strauss, 2008.

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	3 hours per week	20		
期中考试 Mid-Term Test	2 hours	40		
期末考试 Final Exam	3 hours	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