

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	传热传质学 Heat and Mass Transfer
2.	授课院系 Originating Department	材料科学与工程系 Department of Materials Science and Engineering
3.	课程编号 Course Code	MSE209
4.	课程学分 Credit Value	3
5.	课程类别 Course Type	专业基础课 Major Foundational Course
6.	授课学期 Semester	春季 Spring
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)	项晓东, 讲席教授, 材料科学与工程系 Dr. Xiaodong Xiang, Chair Professor, Dept. of Materials Science and Engineering xiangxd@sustc.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
	48				48
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), 大学物理(下) Calculus II A, College Physics 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

本课程基于多年的工程实践，每章从一个实际案例出发，结合传热学物理模型，经验公式，实验设计以及解决的实际工程效果，培养学生解决实际工程问题的能力。这些大量的实际工程案例，可使得学生能够真实体会传热学理论是如何指导实践，理论又是如何被实践所验证的。充分让学生更偏向解决实际工程问题，掌握正确的理论应用方法，提高实际动手能力，培养学生的工程思维能力。

This course is based on years of engineering practice. Each chapter starts from a practical case, combines physical models of heat transfer, empirical formulas, experimental design, and practical engineering results to cultivate students' ability to solve practical engineering problems. These large number of actual engineering cases can enable students to truly experience how heat transfer theory guides practice, and how the theory is verified by practice. These efforts will fully make students more inclined to solve practical engineering problems, master correct theoretical application methods, improve practical skills, and cultivate students' engineering thinking ability.

16. 预达学习成果 Learning Outcomes

1. 学生掌握传热学的四大换热方式：传导换热，对流换热，辐射换热和相变换热。
 2. 学生能够分析实际工程问题中的传质和传热机理，能够运用数学模型分析进行分析。
 3. 学生能够运用传质和传热知识和数学模型来分析及设计实际的换热系统，比如太阳集热，储热保温，太空换热以及海水淡化等。
1. Students can understand 4 basic heat transfer concepts: conduction, convection, radiation and phase change.
 2. Students can analyze the mechanisms of mass and heat transports in practical engineering problems and can use mathematical models to analyze the transport phenomena.
 3. Students can apply mass and heat transfer knowledge and mathematical models to analyze and design practical heat transfer systems, such as solar heat collection, heat storage and insulation, space heat transfer, and seawater desalination.

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. 传热学概述
2. 传导换热
 - 2.1 导热介质传导原理
 - 2.2 传导换热在电子器件中的应用
 - 2.2.1 集成电路芯片外部翅片散热
 - 2.2.2 利用高导热材料的二维芯片散热
 - 2.2.3 高功率电池导热应用
 - 2.2.4 其他应用案例
3. 对流传热
 - 3.1 传质学原理
 - 3.1.1 层流
 - 3.1.2 湍流
 - 3.2 对流换热原理
 - 3.2.1 管内对流
 - 3.2.2 管外对流
 - 3.3 对流换热在电子器件中的应用
 - 3.3.1 微流道芯片散热
 - 3.3.2 电池外部对流散热
 - 3.3.3 其他应用案例
4. 辐射换热
 - 4.1 辐射换热原理
 - 4.1.1 黑体辐射
 - 4.1.2 灰体辐射
 - 4.1.3 热屏蔽
 - 4.2 辐射换热的应用
5. 相变换热
 - 5.1 相变换热原理
 - 5.1.1 腾沸相变换热
 - 5.1.2 一维相变换热
 - 5.1.3 三维相变换热
 - 5.2 相变换热在电子器件中的应用
 - 5.2.1 集成电路一维热管散热
 - 5.2.2 新型超算中心 GPU 芯片散热
 - 5.2.3 新型高功率电池散热
 - 5.2.4 其他相变换热应用案例

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

1. 《Fundamentals of Heat and Mass Transfer》, 8th Edition , Theodore L. Bergman, Frank P. Incropera, Adrienne S. Lavine, John Wiley & Sons
2. 《Thermal Management of Microelectronic Equipment Heat Transfer Theory Analysis Methods, and Design Practices》2rd Edition, Lian-Tuu Yeh, R.C. Chu , ASME 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		10		
课堂表现 Class Performance				
小测验 Quiz				
课程项目 Projects				
平时作业 Assignments		10		
期中考试 Mid-Term Test		30		
期末考试 Final Exam		50		
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