

## 上海交通大学硕士研究生课程教学大纲

课程基本信息 (Course Information)					
课程代码 (Course Code)	PO6012	*学时 (Credit Hours)	48	*学分 (Credits)	3
*课程名称 (Course Name)	(中文) 高等传热学				
	(英文) Advanced Heat Transfer				
课程性质 (Course Type)	低碳能源方向研究生核心必修课程 Compulsory core graduate course in Low Carbon Energy				
授课语言 (Language of Instruction)	英语 English				
*开课院系 (School)	中英国际低碳学院 China-UK Low Carbon College				
先修课程 (Prerequisite)	工程热力学, 传热学, 流体力学 Thermodynamics, Heat Transfer, Fluid Mechanics				
授课教师 (Teacher)	任涛 Ren Tao	联系方式 (Email)		<a href="mailto:tao.ren@sjtu.edu.cn">tao.ren@sjtu.edu.cn</a>	
*课程简介 (Description)	本课程涉及热传递基本原理及其应用, 内容包括: 导热基本方程, 特殊情况下二维和三维稳态导热问题解析解和数值解。非稳态导热问题的解析解和数值解; 对流换热基本方程(质量, 动量, 能量)的推导, 对流换热边界层概念, 外部流动强制对流换热的边界层求解, 内部流动强制对流换热层流关联式的求解, 自然对流、沸腾和凝结中的对流换热问题, 湍流基本概念及常用的湍流模型; 辐射换热基本概念, 面辐射和介质辐射换热计算。				
*课程简介 (Description)	This course is about basic principles of heat transfer and their application. Subjects include: heat conduction equations, analytical and numerical multi-dimensional steady-state heat conduction, analytical and numerical solutions for transient heat conduction systems; boundary layer theory for convective heat transfer, free and forced convection, turbulence and turbulent modeling for convection, boiling, and condensation; fundamental of thermal radiation, surface radiation and radiation in participating media.				
课程教学大纲 (course syllabus)					

<p>*学习目标 (Learning Outcomes)</p>	<p>经过本课程学习，学生们将：</p> <ol style="list-style-type: none"> <li>1. 理解日常生活和工程实践中的热传递现象的基本原路</li> <li>2. 获得热传递问题的解析和数值求解的技能</li> <li>3. 获得解决能量传递系统中所遇到的问题的能力</li> <li>4. 学会开展关于传热的研究项目并撰写科学项目报告</li> </ol> <p>After successful completion of this class, the students will:</p> <ol style="list-style-type: none"> <li>1. Understand the fundamentals of heat transfer processes occurring in natural and engineered systems.</li> <li>2. Be able to apply analytic procedures and numerical tools in the analysis of heat transfer problems.</li> <li>3. Have problem solving abilities applied to energy transfer analysis.</li> <li>4. Be able to conduct heat transfer related projecst and produce written scientific project reports.</li> </ol>																										
<p>*教学内容、进度安排 及要求 (Class Schedule &amp; Requirements)</p>	<table border="1"> <thead> <tr> <th data-bbox="472 779 1086 860"> <b>教学内容 Topics</b> </th> <th data-bbox="1086 779 1257 860"> <b>授课学时 Hours</b> </th> <th data-bbox="1257 779 1473 860"> <b>考核安排 Assignments</b> </th> </tr> </thead> <tbody> <tr> <td data-bbox="472 860 1086 1025">           教学大纲和课程简介；导热、对流，辐射 基本理论和概念 Syllabus and Introduction, fundamentals of conduction, convections and radiation         </td> <td data-bbox="1086 860 1257 1025">           3h         </td> <td data-bbox="1257 860 1473 1025">           HW#1         </td> </tr> <tr> <td data-bbox="472 1025 1086 1191">           导热基本方程和多维稳态导热问题分析 求解方法 Heat conduction equation and multi-dimensional steady state conduction         </td> <td data-bbox="1086 1025 1257 1191">           6h         </td> <td data-bbox="1257 1025 1473 1191">           HW#1 due         </td> </tr> <tr> <td data-bbox="472 1191 1086 1272">           非稳态导热分析方法 Transient heat conduction         </td> <td data-bbox="1086 1191 1257 1272">           6h         </td> <td data-bbox="1257 1191 1473 1272"></td> </tr> <tr> <td data-bbox="472 1272 1086 1352">           导热问题的数值求解方法 Numerical methods in heat conduction         </td> <td data-bbox="1086 1272 1257 1352">           3h         </td> <td data-bbox="1257 1272 1473 1352">           HW#2 due         </td> </tr> <tr> <td data-bbox="472 1352 1086 1433">           对流换热基本方程 Fundamental equations for heat convection         </td> <td data-bbox="1086 1352 1257 1433">           3h         </td> <td data-bbox="1257 1352 1473 1433">           HW#3 due,         </td> </tr> <tr> <td data-bbox="472 1433 1086 1693">           边界层理论和概念，层流和湍流边界层的 概念，内部和外部层流流动对流换热边界 层分析求解方法 Boundary layer theory, Laminar and turbulent boundary layers, External and Internal convective heat transfer         </td> <td data-bbox="1086 1433 1257 1693">           9h         </td> <td data-bbox="1257 1433 1473 1693"> <b>Midterm Assign Project</b> HW#4 due         </td> </tr> <tr> <td data-bbox="472 1693 1086 1937">           自然对流，沸腾和凝结换热，湍流计算模 型 Natural Convection, Convective heat transfer in condensation and boiling, Introduction of turbulence modeling in convection         </td> <td data-bbox="1086 1693 1257 1937">           6h         </td> <td data-bbox="1257 1693 1473 1937">           HW#5 due         </td> </tr> </tbody> </table>			<b>教学内容 Topics</b>	<b>授课学时 Hours</b>	<b>考核安排 Assignments</b>	教学大纲和课程简介；导热、对流，辐射 基本理论和概念 Syllabus and Introduction, fundamentals of conduction, convections and radiation	3h	HW#1	导热基本方程和多维稳态导热问题分析 求解方法 Heat conduction equation and multi-dimensional steady state conduction	6h	HW#1 due	非稳态导热分析方法 Transient heat conduction	6h		导热问题的数值求解方法 Numerical methods in heat conduction	3h	HW#2 due	对流换热基本方程 Fundamental equations for heat convection	3h	HW#3 due,	边界层理论和概念，层流和湍流边界层的 概念，内部和外部层流流动对流换热边界 层分析求解方法 Boundary layer theory, Laminar and turbulent boundary layers, External and Internal convective heat transfer	9h	<b>Midterm Assign Project</b> HW#4 due	自然对流，沸腾和凝结换热，湍流计算模 型 Natural Convection, Convective heat transfer in condensation and boiling, Introduction of turbulence modeling in convection	6h	HW#5 due
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	<p>辐射换热概念和基本方程 Fundamentals of thermal radiation.</p>	3h	
	<p>面对面以及腔体内辐射换热的计算, 气体介质辐射光谱计算, 介质辐射换热的计算 (RTE 求解和光谱模型) Radiative heat exchange between surfaces and in enclosures, Gas spectral calculations, Radiative heat transfer in participating media (radiative transfer equation and spectral models)</p>	9h	<p>HW#6 due <b>Final Project due</b></p>
*考核方式 (Grading)	<p>6 作业/Homework, 20% 1 期中考试/Midterm, 20% 1 期末考试/Final, 20% 1 课程设计/Project, 40%</p>		
*教材或参考资料 (Textbooks & Other Materials)	<p>L.M. Jiji, <i>Heat conduction</i>. 3<sup>rd</sup> Ed. (2009) L.M. Jiji, <i>Heat convection</i>. 2<sup>ed</sup> Ed. (2010) M.F. Modest, <i>Radiative Heat Transfer</i>, 3<sup>rd</sup> Ed. (2013) Faghri, Zhang, Howell; <i>Advanced Heat and Mass Transfer</i>; Global Digital Press; 2010 T.L. Bergman, A.S. Lavine, F.P. Incropera and D.P. Dewitt, <i>Fundamentals of Heat and Mass Transfer</i>, 7<sup>th</sup> Ed. (2011)</p>		
其它 (More)	<p>每周答疑时间: 周四下午 2:00-4:00, 低碳学院 A-405。其他时间如需答疑请提前发邮件预约。 Weekly Office Hours: <b>Thursday, 2:00-4:00pm, A-405</b>, or by appointment through email in advance.</p>		
备注 (Notes)	<p>和课程相关的所有资料将会上传到上海交大在线教学平台 (Canvas 系统) All the course related materials will be uploaded to Canvas system: <a href="https://oc.sjtu.edu.cn/login/canvas">https://oc.sjtu.edu.cn/login/canvas</a></p>		

备注说明:

1.课程大纲一般为教师网上填写, 填写要求会自动提示; 对于新开课程, 需要填着纸质大纲, 并经院系教学委员会或专业委员会通过。

2. 带\*内容为必填项。

3. 课程简介字数为 300-500 字; 课程大纲以表述清楚教学安排为宜, 字数不限。