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**	**能源科学基础** **Introduction to Energy Science**
2.	**授课院系** **Originating Department**	机械与能源工程系 Department of Mechanical and Energy Engineering
3.	**课程编号** **Course Code**	ME273
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**	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）**	郭亮，机械与能源工程系 guol3@sustech.edu.cn Liang Guo Department of Mechanical and Energy Engineering guol3@sustech.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）**	50

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				48

12. 先修课程、其它学习要求 Pre-requisites or Other Academic Requirements	PHY106 大学物理（下）， CH105 大学化学 或 CH103 化学原理， ME271 热工基础或 MAE305 工程热力学 或 MAE308 传热学。 PHY106 College Physics II, CH105 Chemistry: the Central Science/ CH103 General Chemistry, ME271 Fundamentals of Thermodynamics and Heat Transfer/ MAE305 Engineering Thermodynamics/ MAE308 Heat Transfer
13. 后续课程、其它学习规划 Courses for which this course is a pre-requisite	ME373 能源材料化学
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

本课程的学习，使学生深入思考能源与社会发展之间的关系，帮助学生获得必要的能源科学与技术学科的基础知识与方法，使学生比较系统地了解先进能源转化技术及挑战，熟悉典型化石能源、新能源的资源特性与应用前景。本课程希望为能源科学与技术领域的后继英才们起到引领作用，鼓励他们关注前沿，拓宽他们的视野，加强学科交叉意识。

This course intends to help the undergraduates to have a deep thinking on the relationships between energy and social development, to learn necessary fundamental knowledge and methods of energy engineering and technologies, to establish an overview on the advanced energy conversion technologies, and to understand the characteristics and application prospect of typical fossil energy sources and renewable energy technologies. This course intends to train the future leaders for the field of energy technology with a broad and cross-field perspective and without constraints by disciplinary boundaries.

16. 预达学习成果 Learning Outcomes

1）理解能源在社会可持续发展中的重要意义与现有挑战，对能源科学与技术产生兴趣

2）掌握能源工程的科学原理与常用分析工具

3）了解先进能源转化技术及瓶颈

4）熟悉常用能源系统的研究分析、设计与优化过程

1) To well understand the importance of energy sources in sustainable social development and existing challenges, and to kindle interest in energy engineering and technology

2) To master the scientific principles and analysis tools of energy engineering

3) To understand the advanced energy conversion technologies and existing bottlenecks

4) To be familiar with analysis, design and optimization of common energy systems

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.)

课程内容 **Contents**	学时分配 **Hours**
能源简介 能源的形式和分类，能源的使用现状，能源产业的发展趋势 Overview of energy sources Forms and classification of energy sources, current situation of energy utilization, future development of energy industry	2
热力学基础 热力学基本概念和四大定律，理想气体，卡诺循环，狄塞尔循环，奥图循环 Basics of thermodynamics Basic concepts and the four laws in thermodynamics, ideal gas, Carnot cycle, Diesel cycle, Otto cycle	5
化石燃料－煤炭，油气 煤的形成和开采，煤的清洁燃烧，高效气化和高效液化，石油，天然气，页岩气，可燃冰的形成，开采和利用 Fossil fuels-coal Formation and exploration of coal, clean combustion of coal, efficient gasification and liquefaction of coal, formation, exploration and utilization of petroleum, natural gas, shale gas, and gas hydrates	4
半导体物理基础 波函数，单原子的电子能级，半导体能带结构，电子、空穴、声子、光子及载能粒子之间的相互作用 Basics of semiconductor physics Wave function, electronic levels of a single atom, band structure of semiconductors, electrons, holes, phonons, photons and interaction between energy carriers	4
光电转化技术－太阳能电池 半导体 PN 结中的光电转化，太阳能电池功率的影响因素，太阳能电池的材料选择，太阳能电池的器件结构 Photoelectric conversion technology-solar cells Light-to-electricity conversion in semiconductor PN junctions, factors affecting the power of solar cells, selection of solar cell materials, device structures of solar cells	4

光电转化技术－电致发光器件 光的吸收和自发发射，光的受激发射和激光的产生，发光二极管的工作原理，激光器的基本结构，激光的性质，电致发光器件性能的影响因素，电致发光器件的材料选择 Photoelectric conversion technology-electroluminescent devices Absorption and spontaneous emission of light, stimulated emission of light and generation of laser, mechanisms of light emitting diodes, basic structures of lasers, properties of laser, factors affecting the performance of electroluminescent devices, selection of electroluminescent device materials	4
期中考试 Mid-term exam	2
期中试卷讲评 Analysis of mid-term exam papers	2
热电转化技术 热传导基础，热电转化效应，热电材料的选择与改性 Thermoelectrics Basics of heat conduction, thermoelectric effects, selection and property tuning of thermoelectric materials	2
电化学基础 化学反应中的热力学，原电池的放电和充电过程，标准电极电势，能斯特方程 Basics of electrochemistry Thermodynamics in chemical reactions, discharging and charging processes in cells, standard electrode potentials, Nernst equation	2
锂离子电池 电池的分类，电池的评价标准，锂离子电池的发展历史，锂离子电池的结构，锂离子电池电极材料的比较 Li-ion batteries Classification of batteries, evaluation standards of batteries, development history of Li-ion batteries, structures of Li-ion batteries, comparison of Li-ion battery electrode materials	4
燃料电池 燃料电池中的化学反应，氢燃料电池的结构，储氢技术面临的挑战	3

Fuel cells Chemical reactions in fuel cells, structures of hydrogen fuel cells, challenges of hydrogen storage techniques	
核能 原子核结构，爱因斯坦质能方程，核裂变反应与核聚变反应的原理，核反应堆的结构，切尔诺贝利核泄漏事故分析 Nuclear energy Structures of nuclei, Einstein's mass energy equation, mechanisms of nuclear fission and fusion reactions, structures of nuclear reactors, analysis of the Chernobyl nuclear leakage accident	3
补充知识 黑体辐射，肖克利-奎伊瑟极限，非标准吉布斯自由能 Supplementary knowledge Blackbody radiation, Shockley-Queisser Limit, non-standard Gibbs free energy	3
期末报告 Final presentation	4

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

主要参考书 References：

1) Introduction to Heat Transfer (6th Edition), Theodore L. Bergman, Adrienne S. Lavine, Frank P. Incropera, and David P. Dewitt, *John Wiley & Sons*, 2011

2) Thermodynamics: An Engineering Approach, Yunus A. ÇENGEL, Michael. A. Boles, *McGraw-Hill*, 2009

3) Electrochemical Methods: Fundamentals and Applications, Allen J. Bard, Larry R. Faulkner, *John Wiley & Sons*, 2000

4) PEM Fuel Cell Theory and Practice (2nd Edition), Franco Barbir, *Elsevier*, 2005

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		5		
小测验 Quiz		5		
课程项目 Projects				
平时作业		20		

Assignments				
期中考试 **Mid-Term Test**		30		
期末考试 **Final Exam**				
期末报告 **Final Presentation**		40		
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