课程大纲
COURSE SYLLABUS

1.	**课程代码/名称** **Course Code/Title**	**太阳能热利用技术** **Solar Thermal Energy Utilization Technologies**
2.	**课程性质** **Compulsory/Elective**	专业选修课 Major Elective Courses
3.	**课程学分/学时** **Course Credit/Hours**	3 学分/48 学时
4.	**授课语言** **Teaching Language**	英语
5.	**授课教师** **Instructor(s)**	林蒙
6.	**是否面向本科生开放** **Open to undergraduates or not**	是
7.	**先修要求** **Pre-requisites**	（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.） 研究生：无 本科生：高等数学 A
8.	**教学目标** **Course Objectives**	

（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

本课程系统的介绍了太阳能热利用技术的基本原理以及应用前景。通过讲解非聚光和聚光太阳能热利用系统的光学设计、热力学分析、部件热性能、以及系统集成技术，让学生全面掌握太阳能热利用技术的基本知识，了解该领域的研究现状和应用前景。通过实际案例分析、理论计算项目、以及实验课程，夯实学生分析解决实际太阳能热利用工程实际问题的能力，为未来从事太阳能热利用相关科研和工程工作打下坚实的基础。课程主要目标有：

1. 能利用常用的编程语言（matlab / python）实现预测太阳辐射模型,
2. 能够根据需求设计太阳能利用中的光学系统,
3. 能够对太阳能热利用系统进行稳态及动态性能分析,
4. 熟悉太阳能热发电技术及其系统设计,
5. 熟悉太阳能海水淡化技术。
6. 熟悉太阳能热化学制氢技术。

对于选修该课程的本课生：动态性能分析以及太阳能热化学制氢技术不做要求。

This course systematically introduces the fundamental knowledge as well as their practical applications of solar thermal utilization technologies. The course covers the detailed optical designs for non-concentrating and concentrating systems, thermodynamic analysis, thermal behaviour of sub-components, as well as system integration techniques. This will facilitate the understanding of the solar thermal energy conversion systems in a comprehensive manner and help students to get familiar with the state-of-art of research and future applications. The course will expect to build a solid base for students to perform future research or industrial related to renewable energy based on real-world case analysis, theoretical calculation, and experimental practices. Major objectives of this course are:

1. Able to implement the solar radiation prediction model in Matlab or Python,
2. Able to conduct detailed optical design for solar energy conversion systems,
3. Proficient in steady-state and dynamic analysis,
4. Familiar with concentrated solar power systems and their design principles,
5. Familiar with emerging water desalination technologies.
6. Familiar with solar thermochemical fuel generation technologies.

The system dynamic behaviour analysis and the thermochemical fuel generation technologies are not mandatory contents.

9. 教学方法
Teaching Methods

（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

1. 教授讲座
2. 太阳能前沿应用案例分析与汇报
3. 实验课
4. 小组讨论
4. 考试

选修本课程的本科生用太阳能基础文献阅读和汇报替代前沿应用案例分析与汇报。

1. Lectures
2. Emerging applications of solar thermal energy case study and reporting
3. Laboratory practice
4. Group discussion
5. Mid- and Final- exam

Undergraduates in this course will report basic typical solar thermal systems instead of emerging application case studies.

10. 教学内容
Course Contents
（如面向本科生开放，请注明区分内容。 If the course is open to undergraduates, please indicate the difference.）

Section 1	Overview of solar thermal energy utilization (2 学时)
Section 2	Solar radiation and heat transfer fundamentals (4 学时)
Section 3	Flat Plate collector systems (4 学时)
Section 4	Concentrating collector systems (4 学时)
Section 5	Solar thermal power systems (4 学时)
Section 6	Mid-term exam (2 学时)
Section 7	Solar Cooling technologies (4 学时)
Section 8	Solar Drying and Desalination (4 学时)
Section 9	Solar thermochemical fuel production (4 学时) （本科生不做要求/Optional for undergraduates）
Section 10	Solar material processing (2 学时)

		（本科生不做要求/Optional for undergraduates）
	Section 11	Course project report　I (2 学时)
	Section 12	Course project report　II (2 学时)
	Section 13	Final exam (2 学时)
	Section 14	Lab course 1: Demonstration of a solar dish Stirling engine system (2 学时)
	Section 15	Lab course 2: Solar steam generation system design and demonstration (2 学时)
	Section 16	Lab course 3: Digital lab complete solar tower system design using System Advisor Model (SAM) (4 学时)

11. 课程考核
Course Assessment

（①考核形式 Form of examination；②.分数构成 grading policy；③如面向本科生开放，请注明区分内容。If the course is open to undergraduates, please indicate the difference.）

考勤 10%； 作业 20%；期中考试：10%；小组汇报：20%；期末考试：40%
本科生考核形式一致，对于小组汇报题目会有区分。 本科生要求汇报典型太阳能热利用系统。 研究生要求汇报新型太阳能热利用系统。

Attendence 10%; Assignments 20%; Mid-term exam:10%; Group report: 20%; Final exam: 40%

Undergraduates will have the same type of evaluation procedures. The difference comes in the topics in group report. Undergraduates are required to report on basic typical solar thermal systems. The graduates are required to report on emerging technologies.

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

Textbook 1: Duffie, J. A., & Beckman, W. A. (2013). Solar engineering of thermal processes. John Wiley & Sons.

Textbook 2: 何梓年 (2009),《太阳能热利用》, 中国科学技术大学出版社.

Reading 1: K Lovegrove W Stein (2012), Concentrating Solar Power Technology, Principles, Developments and Applications. Elsevier Science.

Reading 2: Kalogirou, S. A. (2013). Solar energy engineering: processes and systems. Academic Press.

Reading 3: Lewerenz, H. J., & Peter, L. (Eds.). (2013). Photoelectrochemical water splitting: materials, processes and architectures. Royal Society of Chemistry.