《可持续发展与可持续能源系统》课程教学大纲（2021 版）

<table>
<tr><th colspan="6">课程基本信息（Course Information）</th></tr>
<tr><td>课程代码（Course Code）</td><td>RE343</td><td>*学时（Credit Hours）</td><td>32</td><td>*学分（Credits）</td><td>2</td></tr>
<tr><td rowspan="2">*课程名称 (Course Name)</td><td colspan="5">可持续发展与可持续能源系统</td></tr>
<tr><td colspan="5">Sustainability and Sustainable Energy Systems</td></tr>
<tr><td>课程类型 (Course Type)</td><td colspan="5">选修课/Elective Course</td></tr>
<tr><td>授课对象 (Target Audience)</td><td colspan="5">面向高年级本科生或研究生/The course is intended for advanced undergraduates and graduate students</td></tr>
<tr><td>授课语言 (Language of Instruction)</td><td colspan="5">英语/English</td></tr>
<tr><td>*开课院系 (School)</td><td colspan="5">农业与生物学院/School of Agriculture and Biology</td></tr>
<tr><td>先修课程 (Prerequisite)</td><td>物理，基础数学/Physics, basic mathematics</td><td colspan="2">后续课程 (post)</td><td colspan="2">无</td></tr>
<tr><td>*课程负责人 (Instructor)</td><td>农业与生物学院刘荣厚教授</td><td colspan="2">课程网址 (Course Webpage)</td><td colspan="2"></td></tr>
<tr><td>*课程简介（中文） (Description)</td><td colspan="5">本门课程主要包含两部分，由五位老师分别讲解：
1）第一部分为“能源、食品与城市化的可持续系统”，主要讲解人类社会面临的主要问题是创造一个政策支持并鼓励融合能源、环境与自然资源的可持续的社区。最关键的在于联通住房、交通、环境影响、经济发展与社会福利，使得其满足社区的目前要求且能够同时保护环境以供未来的需求。可供融合城市建设分析的系统解决方法是，“绿色”建筑、可再生能源、交通、经济发展、农业与食品系统、水资源管理、垃圾管理以及沟通/治理。学生将学会评估和接触到：i)发展可持续社区的不同方法；ii）节约能源和充分利用能源的好处；iii)替代能源：生物能源、太阳能、风能、地热设计等可再生能源。
2）“可持续工程设计”由 Sunghwan Jung 教授主讲。课程由讨论大自然中的可持续自然设计开始，主要以动物系统中的设计为例。然后讲解如何测算自然设计中的质、势、与能量平衡，根据能量与势的平衡测算目前的可持续能源系统，如太阳能板、风力涡轮等等。学生将会从技术层面学习到能量与质量的转换，并批判地学习作为可持续发展解决方法的生物启发设计。</td></tr>
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*课程简介（英文） (Description)	This course consists of 2 parts: 1)Sustainable Systems for Energy, Food and Urbanization The major challenge, facing our society, is to create sustainable communities that are supported and encouraged via policies that integrate energy, environment and natural resources. The focus is interconnectivity of housing, transportation, environmental impacts, economic development and social wellbeing “that meets a community’s current needs while preserving the environment so that these needs can continue to be met in the future.” A systems approach will be utilized to integrate analysis of urban design, “green” buildings, renewable energy, transportation, economic development, agriculture and food systems, water management, waste management and communication/governance. Students will be able to evaluate and assess: i) various practices needed to develop sustainable communities, ii) benefits of energy conservation and efficiency options, and iii) renewable energy options of bioenergy, solar, wind and geothermal designs. 2) Sustainable engineering designs This course starts with discussing sustainable natural designs in nature; mostly in animal systems. Mass, momentum, and energy balance will be introduced to learn how to quantitively evaluate the performance of natural designs. Also, we will practice to evaluate our current sustainable energy systems based on energy and momentum balances; e.g. solar panel, wind turbines, and more. Students will learn technical aspects of energy and mass transfer and will critically think about bio-inspired design as possible sustainable solutions.
课程目标与内容（Course objectives and contents）	
*课程目标 (Course Object)	1. The student will be able to identify anaerobic digestion, and evaluate and assess the value of biomass energy conversion technologies, thermochemical conversion of biomass, and various practices leading to development of sustainable and resilient communities. (A5, B2) 2. The student will be able to identify and determine benefits of energy conservation and efficiency options. (B2, B4) 3. The student will be able to evaluate the various options of bio-based energy systems (B5, C3) 4.The student will be able to evaluate renewable energy options of solar, wind and geothermal designs. (B4, C4) 5. Students will be able to identify, evaluate, and discuss mass, momentum, and energy balances of natural or sustainable engineering systems. (B2, C3) 6. Students will understand how biological systems achieve sustainable solutions.(B3, B4) 7. Students will evaluate the performance/efficiency of sustainable energy systems. (B4, C5) 8. Students critically think about addressing a problem or need related to sustainability. (C3, D1)

	章节	教学内容（要点）	学时	教学形式	作业及考核要求	课程思政融入点	对应课程目标
*教学内容进度安排及对应课程目标（Class Schedule & Requirements & Course Objectives)	1	Overview of Waste-To-Energy Systems for Environmental Sustainability	3	Online materials, Lectures & Discussions	Reading of assigned materials and participation in discussion	引导学生掌握科学前沿理论知识，坚定理想信念，养成优良的思想品德、健康心理	课程目标 6
	2	Renewable Energy Outlook	3	Online materials, Lectures & Discussions	Reading of assigned materials and participation in discussion	引导学生掌握科学前沿理论知识，激发对专业的兴趣	课程目标 4
	3	Basic concept: Matter, Momentum, Energy	2	Online materials, Lectures & Discussions	Reading of assigned materials and participation in discussion		课程目标 5
	4	Life on earth: Metabolism, Allometry	3	Online materials, Lectures & Discussions	Reading of assigned materials and participation in discussion	厚植家国情怀，引导学生勤于思考、善于钻研，对推陈出新怀有浓厚兴趣，富有探索精神，并渴望解决社会实际问题。	课程目标 6

	5	Thermochemical Conversion of Biomass: Kinetics and Chemistry	3	Online materials, Lectures & Discussions	Reading of assigned materials and participation in discussion		课程目标 1，2
	6	Waste-To-Energy: Anaerobic Digestion	2	Online materials, Lectures & Discussions	Reading of assigned materials and participation in discussion	通过对厌氧消化的学习激起学生对推陈出新的浓厚兴趣，培养学生的探索精神和解决问题的能力	课程目标 2
	7	Mass, momentum, energy Balances	3	Online materials, Lectures & Discussions	Participation in group discussion		课程目标 5
	8	Overview of biomass energy conversion technologies	3	Online materials, Lectures & Discussions	Reading of assigned materials	培养学生对生物质能基础知识的专业兴趣，增强专业意识	课程目标 4
	9	Case studies; efficiency of solar panel and wind turbine	2	Online materials, Lectures & Discussions	Participation in group discussion	指导学生脚踏实地，勤奋努力，培养及增强学生的专业意识	课程目标 3
	10	Optimization in natural designs	3	Online materials, Lectures & Discussions	Reading of assigned materials		课程目标 7

	11	Overview of biomass energy conversion technologies	2	Online materials, Lectures & Discussions	Reading of assigned materials		课程目标 5
	12	Bio-inspired engineering designs	2	In-class exam	Reading of assigned materials	拓宽学生的国际化视野,具有对多元文化的包容心态,胸怀天下,以增进全人类福祉为己任	课程目标 6
	12	Final exam	1	In-class exam	Solving problems		课程目标 8
	注 1：建议按照教学周周学时编排。 注 2：相应章节的课程思政融入点根据实际情况填写。						
*考核方式 (Grading)	Homework (60%) Final exam (40%)						
*教材或参考资料 (Textbooks & Other Materials)	参考资料： The text, *'Energy Systems Engineering'*, Francis Vanek, Louis Albright and Largus Angenent, McGraw Hill, NY, 2016, ISBN 978-0-07-1787789-9 will be a major reference. However, students **will not be required** to purchase the book because specific course handouts will be provided to students from current and relevant sources and from refereed publications						
其它（More）							
备注（Notes）							

备注说明：

1．带*内容为必填项。

2．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。