جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Sustainable Engineering - CE 305

Division	Physical Science and Engineering Division
Course Number	CE 305
Course Title	Sustainable Engineering
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	02:30 PM - 04:00 PM | Mon Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
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Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	Engineers face growing pressure to incorporate sustainability objectives into their practice. In comparing two products/designs it is often not apparent which one is more sustainable. The course introduces concepts and method for determining the net environmental, economic, and social impacts of an engineering technology or process. Specific topics include life cycle assessment, cost/benefits analysis, energy auditing, materials accounting, and environmental assessment. These methods are examined and applied to current engineering issues such as global climate change, alternative-fueled vehicles, water and wastewater treatment, urban development, renewable energy (solar, wind, and biomass), and waste mitigation. Each student will be required to apply tools learned to assess the sustainability of a specific engineering system. This is a research based course and is suitable for students interested in researching in depth a particular topic. By the end of the course, students will have an awareness of analytical tools/resources for evaluating sustainability employing a systems perspective. This course assumes students have a background in an engineering discipline.
Course Description from Program Guide	Engineers face growing pressure to incorporate sustainability objectives into their practice. In comparing two (2) products/designs it is often not apparent which one (1) is more sustainable. The course introduces concepts and method for determining the net environmental, economic, and social impacts of an engineering technology or process. Specific topics include life cycle assessment, cost/benefits analysis, energy auditing, materials accounting, and environmental assessment. These methods are examined and applied to current engineering issues such as global climate change, alternative-fueled vehicles, water and wastewater treatment, urban development, renewable energy (solar, wind, and biomass), and waste mitigation. Each student will be required to apply tools learned to assess the sustainability of a specific engineering system. This is a research-based course and is suitable for students interested in researching in-depth a particular topic. By the end of the course, students will have an awareness of analytical tools/resources for evaluating sustainability employing a systems perspective.

Goals and Objectives	Upon completion of this course, students will be able to: 1. Understand the complex environmental, economic, and social issues related to sustainable engineering 2. Become aware of concepts, analytical methods/models, and resources for evaluating and comparing sustainability implications of engineering activities 3. Critically evaluate existing and new methods 4. Develop sustainable engineering solutions by applying methods and tools to research a specific system design 5. Clearly communicate results related to their research on sustainable engineering
Required Knowledge	An undergraduate or graduate degree in a Science, Math, or Engineering field is required.
Reference Texts	There is no required text for this course. The course will be taught through provided book chapters, handouts, software tools, and journal articles. **REFERENCE TEXTS** Heijungs, R., S. Suh (2002) The Computational Structure of Life Cycle Assessment, Kluwar Academic Publishers: Dordrecht, The Netherlands Hendrickson, C. T., Lave, L. B., Matthews, H. S. (2006). Environmental Life Cycle Assessment of Goods and Services: An Input-Output Approach. Resources for the Future Press.
Method of evaluation	**30.00**% - Exam 1 **10.00**% - Homework /Assignments **50.00**% - Research Project **10.00**% - Attendance and Participation
Nature of the assignments	HOMEWORK: Evaluated based on one assignment requiring the student to prepare a critical written review of a journal article. RESEARCH PROJECT – Evaluated based on the following three components of the course research project: a written project proposal (10%), a written final project report (30%), and a final oral presentation (10%).
Course Policies	In accordance with the University policy and professional standards, the highest levels of academic integrity are expected in this class. The code of student conduct is strictly enforced. Academic dishonesty will result in reductions in grades and/or expulsions from this class and/or the University. In the case of late submissions, 10% of grade will be deducted for each 24-hour period, or part thereof.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 08/26/2019	Introduction to the course and the importance of sustainable engineering
1	Wed 08/28/2019	Introduction to the course and the importance of sustainable engineering
2	Mon 09/02/2019	Sustainability indicators
2	Wed 09/04/2019	Sustainability indicators
3	Mon 09/09/2019	Material flow analysis tools
3	Wed 09/11/2019	Material flow analysis tools
4	Mon 09/16/2019	Round 1 of Oxford style debates around sustainability issues
4	Wed 09/18/2019	Life cycle inventory analysis
5	Mon 09/23/2019	Saudi National Day
5	Wed 09/25/2019	Life cycle inventory analysis
6	Mon 09/30/2019	Life cycle and cost-benefits analysis
6	Wed 10/02/2019	Economic input-output life cycle assessment
7	Mon 10/07/2019	Economic input-output life cycle assessment
7	Wed 10/09/2019	Round 2 of Oxford style debates around sustainability issues
8	Mon 10/14/2019	Environmental, economic, and social impact analysis
8	Wed 10/16/2019	Environmental, economic, and social impact analysis
9	Mon 10/21/2019	Case Study 1 – sustainability assessment of conventional energy systems
9	Wed 10/23/2019	Case Study 1 – sustainability assessment of conventional energy systems
10	Mon 10/28/2019	Mid semester break
10	Wed 10/30/2019	Case Study 2 – sustainability assessment of alternative energy systems
11	Mon 11/04/2019	Case Study 2 – sustainability assessment of alternative energy systems
11	Wed 11/06/2019	Midterm Exam
12	Mon 11/11/2019	Case Study 3 – sustainability assessment water and wastewater treatment systems
12	Wed 11/13/2019	Case Study 3 – sustainability assessment water and wastewater treatment systems
13	Mon 11/18/2019	Case Study 4 – sustainability assessment of urban development and waste management systems
13	Wed 11/20/2019	Case Study 4 – sustainability assessment of urban development and waste management systems
14	Mon 11/25/2019	Round 3 of Oxford style debates around sustainability issues
14	Wed 11/27/2019	Recent advances in sustainability assessment tools
15	Mon 12/02/2019	Final Projec presentations
15	Wed 12/04/2019	Final Projec presentations
16	Mon 12/09/2019	Exams

Note

The instructor reserves the right to make changes to this syllabus as necessary.