



Course Syllabus: Principles of Env.Sustainability - EnSE 205

Division	Biological and Environmental Sciences & Engineering Division
Course Number	EnSE 205
Course Title	Principles of Env.Sustainability
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	10:30 AM - 12:00 PM Mon Wed

Instructor(s)				
Name	Email	Phone	Office Location	Office Hours
Kim Choon NG	KIMCHOON.NG@KAUST.ED U.SA	+966128084955	4232, 4, Al-Jazri (bldg. 4)	16.00 to 17.00 pm, Thursday. The week 10, starting from 31st October to 5th December 2019
Matthew Francis McCabe	Matthew.McCabe@kaust.edu. sa	+966128082882		16:00 to 17:00, Wednesday from Week 1 to Week 8 (October 13). Email requests for other times.

Teaching Assistant(s)	
Name	Email
Muhammad W Shadzad and Muhannad Burhan	muhammad.shahzad@kaust.edu.sa; muhammad.burhan@kaust.edu.sa

Course Information

Comprehensive Course Description

The course provides a general introduction to fundamental aspects of sustainability, examining aspects of what constitutes the rates of renewable resource harvest, pollution creation, and non-renewable resource depletion, where these processes can be continued indefinitely, i.e., **without sacrificing the needs of future generations**. The course will explore a range of topics, including water and energy cycles, resource accounting and climate change. Studies on the water-food-energy nexus, the carbon cycle, emissions and sequestration, concepts of green design and life-cycle analysis will also be reviewed.

The course is designed to equip students with a more focused understanding of some of the key issues related to sustainability and earth system stewardship. While general in nature, it will provide students with the knowledge required to make informed decisions and evaluate economically feasible actions now that are in the interests of protecting the natural world.

The course is divided into two related sections, with material presented by Professors Matthew McCabe and Kim Choon Ng.

Part 1 will cover an understanding of the Earth's water and energy cycles, as well as describing, monitoring and modeling components of the Earth system. The course will develop knowledge on topics ranging from climatology, water resources, water and energy cycles, climate change and adaptation, and the linked food-water-energy system. A discussion on the consequences of a changing climate on Earth's water and energy cycles, particularly as relates to potential impacts on human-engineered systems (i.e. agriculture), will also be explored. An introduction into the physics behind some of these fundamental processes will also be examined.

Part 2 will cover the chronological activities of human activities by examining the quantifiable parameters such as the green-house gases, climate change, loss of agricultural land to erosion, etc. We want to generate awareness to the possible irreversible situations of the fragile world environment, with emphasis on preserving the capability of the environment to recover itself and not causing too much climate changes.

Environment sustainability remains a key topic for this current generation. Based on scientific evidence, we realize that damages to our world can be catastrophic if no appropriate actions are adopted now. For example, many human activities conducted hitherto can potentially be causing:

- damage rainforests and woodlands through logging and agricultural clearing,
- seawater pollution (acidification) and over-fishing of oceans, rivers and lakes,
- polluting the atmosphere through the burning of fossil fuels,
- damaging prime agricultural and cultivated land through the use of unsustainable farming practices, etc.

With clear environmental policy and targets (e.g., the < 2oC limit for average rise in the ambient temperature), there is a good chance that policy incorporated by countries to individual corporation can ensure indefinite growth in the businesses or economic growth without jeopardizing our environment and all countries can have GDP growth levels that are sustainable.

Students are required to conduct one assignments where they can exercise independent studies, either alone or in group of two or three students.

In the problem-based learning, they will analyze and propose solution(s), as well as articulate methodologies in solving problems of interest to our human activities that currently deemed "unsustainable". They are encouraged to conduct economic analysis, either simple life cycle analysis (LCA), or any suitable economic analysis, etc.

GOALS AND OBJECTIVES

Impart deeper understanding of environmental sustainability - a wiser use of resources in the context of economic, social and environment nexus.

REQUIRED KNOWLEDGE

Basic engineering science knowledge, concern for environment, and open mind to project-based learning.

REFERENCE TEXTS

As per prescription during the lectures.

COURSE REQUIREMENTS

Part 1: (Matthew McCabe)

The course will be structure around lectures and open discussion, with an assessment scheme that follows below:

- Tutorials (5%)
- Assignment (15%)
- Presentation (10%)
- Exam (20%)

Part 2: (Kim Choon Ng)

One assignment will be given. The first assignment is presented on 30th Oct 2019. In the subsequent lessons, there will be class discussion to address any difficulties or aspects of assignment problem.

	<p>A 3-5 page report is expected for the assignment and it must be submitted by 27th November 2019. The report can be an individual effort or a combined effort from a group of 2 or 3 student.</p> <p>Reading materials are as prescribed in the lecture slides, open literature (google, Wikipedia, etc.).</p> <p>Course Policies Submission of assignment must be on time (typically 4 weeks) unless a good reason is offered.</p> <p>Additional Information None.</p> <p>NOTE The instructor reserves the right to make changes to this syllabus as necessary.</p>
Course Description from Program Guide	Fundamental aspects of sustainability, energy cycles and accounting. Carbon cycle, emissions and sequestration. Concepts of green design. Life-cycle analysis.
Goals and Objectives	The objectives of this introductory course are to provide awareness to students on the "stresses" created by human activities, often driven by relentless economic development with no regards to the environment. We will also gain an understanding of earth system dynamics and the key processes that sustain our existence. Student are encouraged to explore ways to protect our environment through the assignment problems.
Required Knowledge	General readings from open literature. Material will be provided in class or via directed learning.
Reference Texts	No particular text book. Follow the slides of professor.
Method of evaluation	<p>40.00% - Research Project 5.00% - Problem sets 10.00% - Presentation 15.00% - Homework /Assignments 20.00% - Exam 1 5.00% - Attendance 5.00% - Active participation</p>
Nature of the assignments	<p>Part 1 (Matthew McCabe) Tutorials (5%) Assignment (15%) Presentation (10%) Exam (20%)</p> <p>Part 2 (Kim Choon Ng) Class attendance (5%) Class participation and discussion (5%) Homework /Assignments (40%)</p> <p>Written assignments (with analysis) are to be submitted within 3 to 4 weeks from the date of issue. The report for Part 2 can be an individual effort or a combined effort by a group up to 3 students.</p>
Course Policies	A zero mark will be given to non-submission of written report.
Additional Information	None

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 08/26/2019 Wed 08/28/2019	Global water cycles and water accounting, freshwater availability, food-water nexus
2	Mon 09/02/2019 Wed 09/04/2019	Hydrological processes: rainfall, evaporation, floods, droughts
3	Mon 09/09/2019 Wed 09/11/2019	Climate change and variability (the past)
4	Mon 09/16/2019 Wed 09/18/2019	Climate change and variability (the present and future)
5	Mon 09/23/2019 Wed 09/25/2019	Saudi National Day
6	Mon 09/30/2019 Wed 10/02/2019	Global environmental challenges and issues: review and analysis
7	Mon 10/07/2019 Wed 10/09/2019	Global environmental challenges and issues: case studies and discussion
8	Mon 10/14/2019 Wed 10/16/2019	Mid-semester exam scheduled for Mon October 14 (Part 1). Begin Part 2. Chapter 1: A layman's introduction to Environmental Sustainability and Assignment Discussion
9	Mon 10/21/2019 Wed 10/23/2019	Chapter 2: Sustainability, Society and Environment, Further discussion on assignment #1– reading materials. Formulation of an excel work sheet preparation, objective function, optimization, etc.
10	Mon 10/28/2019 Wed 10/30/2019	Mid-semester break
11	Mon 11/04/2019 Wed 11/06/2019	More discussion on assignment #1 to solve any difficulty encountered, report preparation and writing.
12	Mon 11/11/2019 Wed 11/13/2019	Chapters 3: Sustainable Development (SD) and measuring SD
13	Mon 11/18/2019 Wed 11/20/2019	Chapter 4: Aspects of Sustainable engineering. Submission of Assignment report
14	Mon 11/25/2019 Wed 11/27/2019	Presentation of assignment by 3 groups
15	Mon 12/02/2019 Wed 12/04/2019	Presentation of assignment by 3 groups Summary and feedback.
16	Mon 12/09/2019	Exams

Note

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