

ENGR 390
Information and Communication Technology for Sustainability (ICT4S)
Syllabus
Fall 2017

Professor: Dr. Birgit Penzenstadler

Class meetings: Tue/Thu lecture 9:30-10:20, activity 10:30-11:30

Office: 536 ECS

Email: birgit.penzenstadler@csulb.edu

Office Hours: Tue/Thu 11:30-12:30 and per individual appointment

DESCRIPTION

Catalogue description: Concepts for understanding and analyzing the sustainability of a given engineering context and how to support it by information and communication technology. Application domains relevant for sustainability engineering like climate change, smart systems, and gamification. Systems thinking for future scenarios.

In a few more words: This course aims to equip students with the foundational knowledge on sustainability and its relation to information and communication technology (ICT). It gives insights into the most important concepts for understanding, analyzing, and assessing the sustainability of a given engineering context. We will go through a list of application domains that are highly relevant for sustainability engineering, including but not limited to climate change, sustainable food production, smart systems, and gamification. Furthermore, we will learn about and experiment with systems thinking approaches and learn how to develop feasible future scenarios. This course is a general education writing-intensive capstone course.

Lecture: 2 hours per week.

Activity: 2 hours per week.

Grading: Individual and team assignments. Letter grade only (A-F).

COURSE OBJECTIVES

- **“Written Communication”:** Students enhance their writing skills with regard to the content development, disciplinary conventions, organization, language, global self-awareness, perspective taking, and understanding global systems – all in the context of sustainable development and ICT for sustainability.
- **“Oral communication”:** The ability to critically reflect upon the different dimensions of sustainability in a given context, specifically in any context that involves software-intensive systems or information and communication technology.
- **“Critical Thinking”:** Ability to define sustainability in a specific context with regard to what to sustain, for whom, for how long, and at what cost. Students will be able to define system scopes and understand causes of and dependencies between sustainability problems by seeing the bigger picture, by being able to expand a system’s scope to include further impact factors.
- **“Inquiry and Analysis”:** Ability to judge the quality of ICT solutions because they understand the wider impact these solutions may have on their operational environment and business as well as societal context. They can analyze the availability or scarcity of resources and judge their

consequences for ICT development and its wider context in business, society, and for the environment.

- “**Social Responsibility and Civic Engagement**”: Ability to translate sustainability concepts for their community and become visionaries and thought leaders that inspire actions. They can design sustainable solutions for their communities that fit the actual underlying needs.

FURTHER READING

You are not required to purchase these. I will make excerpts available for class.

- Hilty, Lorenz M., and Bernard Aebischer. *ICT Innovations for Sustainability*. Springer International, 2015.
- Booth Sweeney, L., Meadows, D. *The systems thinking playbook: Exercises to Stretch and Build Learning and Systems Thinking Capabilities*. Chelsea Green Publishing; 2010.
- Purdue University Online Writing Lab. 2015. Purdue University. (<https://owl.english.purdue.edu>)

Class notes and further resources will be available on Beachboard.

COURSE REQUIREMENTS

WRITTEN TASKS

- **Freewriting**: You will complete 5 freewriting tasks (approximately 1 page each), to begin exploring some key concepts and projects for this class. This gives you a lightweight introduction into writing and into putting your own reflective thoughts into words.
 1. Sustainability over the course of history
 2. Sustainability in relation to IT
 3. Exploring an example sustainability project
 4. Impacts of human systems on the planet
 5. Vision of a sustainable society
- **Definition**: Write your own definition of sustainability (200 words). This will help you reflect on the different definitions that you have heard and to compare and decide in which direction your personal understanding of the term develops.
- **Individual papers**: You will write 3 individual papers over the course of the semester, two with 1500 words and one with 1800 words. They let you explore concepts in more depth and work on your academic writing style.
 1. 5-Dimension Analysis: Analyze the five dimensions of sustainability for a case study (1500w)
 2. Leverage points analysis: Analyze leverage points for an example system (1500w)
 3. Final essay on chosen special topic with instructor consent (1800w)

PRESENTATION / DISCUSSION TASKS

- **Scenario exploration**: Discussion of scenarios with cultural factors, establish sustainability policies amongst a team and sum them up according to a template for the other teams at the end of the activity.
- **Presentation**: Oral presentation of 10 minutes duration on a selected topic (instructor will provide list to choose from) in class with a 1-page handout summarizing the key points.
- **Active participation**: You are expected to actively participate in class and in team discussions – it makes you learn better, reflect more, and trains your communication skills.

GRADING

<i>Assignment</i>	<i>Output</i>	<i>Revision</i>	<i>Final version</i>
5 freewriting tasks on key concepts (individual)	1 page each	n.a.	10% in sum
Definition of sustainability (individual)	200 words	n.a.	10%
5-Dimension analysis (individual)	1500 words	5%	5%
Scenario exploration (team)	Oral summary	n.a.	10%
Oral presentation (team)	Slides & Handout	n.a.	10%
Leverage points analysis (individual)	1500 words	10%	10%
Final essay (individual)	1800 words	n.a.	20%
Active participation in class and in team discussions			20%

Base calculation for grades: 90-100: A, 80-89: B, 70-79: C, 60-59: D, <60 F

Attendance policies and provision for makeup of assignments: I expect continuous course attendance outside of excused absence. No late work will be accepted outside of excused exceptions that were given at least 2 days before the deadline.

UNIVERSITY POLICIES

Academic Honesty:

Cheating and plagiarism will not be tolerated in this course. Any individual caught cheating on quizzes, homework, lab projects, or the final exam will be punished to the full extent allowed under University regulations. Plagiarism on papers or assignments is not acceptable and work that is plagiarized will not receive credit. Plagiarism is considered cheating. Note: any time another person's work is used without giving them proper credit, it is considered plagiarism and cheating. It is also considered plagiarism if you try to reuse work from other courses for the deliverables in this course. At a minimum, any student caught cheating will receive no credit for the work concerned, and will receive a reduction of one letter grade from their final course grade. The official CSULB Policy on Cheating and Plagiarism can be found here:

http://web.csulb.edu/divisions/aa/catalog/current/academic_information/cheating_plagiarism.htm

1

Reasonable Accommodation:

Individuals with disabilities who need assistance or modification to the University's programs and/or activities should inform the person(s) responsible for these programs and/or activities immediately upon knowing that such modification is necessary. Individuals registered with the California Department of Rehabilitation may be eligible for assistance through that agency. Students may be eligible for assistance through the Office of Disabled Student Services, located in Brotman Hall 270, telephone (562) 985-5401. For evaluation and service, contact that office directly. If the modification or accommodation provided is inappropriate or insufficient, you may seek the assistance of the Office of Equity and Diversity, located in University Student Union 301, telephone (562) 985-8256. If a reasonable accommodation has been requested but was not provided, the individual may access the complaint resolution process.

COE Tutoring Center Announcement

Take advantage of free peer tutoring to keep up your grades in the most challenging classes. Tutoring is available for undergraduate engineering students in departmental courses for Electrical Engineering, Mechanical & Aerospace Engineering, Civil Engineering, Computer Engineering/Science, and Chemical Engineering.

Tutoring is on a first-come-first-serve, walk-in basis. Tutors are available Monday-Thursday in the Fall and Spring terms. All tutoring sessions take place in the Engineering Student Success Center (ESSC) in EN2, Room 300 between the hours of 9:00 a.m. – 6:00 p.m.

Visit the website for detailed tutoring schedules:

http://web.csulb.edu/colleges/coe/views/essc/academic_success/engineering_tutor.shtml#asp_ETP

DETAILED EXAMPLE TIMELINE

Week	Lecture a	Activity a	Deliverable a	Lecture b	Activity b	Deliverable b
1: The concept of sustainability	Introduction: Sustainability as it developed over time in history	Introduction to freewriting, draft of 1 st freewriting task (1 page)	Freewrite 1 due, feedback in 48h, revision due by Activity 2a	The most common definitions and how they relate	Freewrite 1 feedback returned; Brainstorm on definitions in teams, submit draft of 200 words	Draft definition due, feedback in 48h, revision due after Activity 2b
2: ICT and sustainability	Sustainability in ICT and ICT for sustainability (environmental informatics, computational sustainability, sustainable HCI, Green IT and Green ICT, and ICT for sustainability)	Definition (1b) feedback returned; Find more examples and classify them, 2 nd freewriting task (1 page)	2 nd freewrite due (feedback in 48h, revision due by Activity 3a), plus revision of freewrite 1	Renewable energy and smart grids: production and potentials	Freewrite 2 feedback returned; Discussion on renewable energy production in CA	Revision of Sustainability Definition due
3: The five dimensions of sustainability	The five dimensions of sustainability (potentially including goal modeling)	Analyze the five dimensions for a case study, discussion with peers, start writing up the analysis in class, draft as homework by Activity 3b	Revision of freewrite 2	Student mini presentations on case study (preliminary results of dimension analysis)	Rough draft workshop on 5-Dimension Analysis paper, editing to be completed as homework, to be submitted by end of week	5-Dimension Analysis 1000 word draft, feedback by Activity 4b, revision due by Activity 5b
4: The orders of effect and rebound effects	The orders of effect (LES model)	5-Dimension Analysis draft feedback; Analyze the orders of effect for a case study, discuss in team	-	Rebound effects	Analyze potential rebound effects in case study, discuss in team	
5: Peak oil and climate change	Peak Oil presentation	Discussion on peak oil and relations to renewable energy and future alternatives		Climate change, homework to be completed before: watch "An inconvenient truth"	Discuss "An inconvenient truth" and the reactions and follow-up initiatives	Revision of 5-Dimension Analysis due
6: Sustainable food production and permaculture	Sustainable agriculture (available for student presentations)	Team discussion on food habits		Permaculture (available for student presentations)	Team discussion on challenges for permaculture and the relation to our high-tech society	Handout (for those students who did a presentation)
7: Smart X – green product and service development	Overview of smart technology and service development	Individual research on gaps and open challenges in smart technology	Topic idea for final essay, feedback by Activity 7b	Smart systems (available for student presentations)	Reflection on effectiveness of presentation and discussion on final essay ideas	Handout (for those students who did a presentation)

8: Behavior change and gamification of sustainability	Behavior change	3 rd freewrite task	Freewrite 3 due, (feedback in 48h, revision due by Activity 9a)	Gamification	Freewrite 3 feedback; Discuss Jane McGonagall TED talk and discuss lecture & talk	-
9: Sustainable development concepts	Concepts - The Karlskrona Manifesto	Comparing different designs / solutions, freewrite task 4	Revision of freewrite 3, draft of freewrite 4 (feedback in 48h, revision due by Activity 10a)	Concepts of decoupling, dematerialization and substitution	Find other solutions and discuss them, short student presentations	-
10: Sustainable development process	Sustainable development with the IMAGINE approach	Case study analysis: Try out with scenario, short student presentations	Revision of freewrite 4	Organizational and cultural factors during development	Group writing: Play through a number of scenarios with cultural factors, establish policies	-
11. Introduction to systems thinking	Introduction to Systems thinking	Exercises from systems thinking playbook	-	Recap of the Sustainable Development Goals	Free writing for topic ideas for the final essay, followed by peer feedback session	-
12. System dynamics and leverage points	Introduction to System dynamics	Case study analysis: System dynamics modeling of example case study, freewrite task 5	Draft of freewrite 5 (feedback in 48h, revision due by Activity 13a)	System dynamics continued	Rough draft workshop for the final essays with feedback by peers	-
13: Leverage points	Leverage points overview	Case study analysis: Analyze leverage points for sample system, start drafting Leverage Points paper		Leverage points interaction and in-depth	Group writing: Rework and refine leverage points for sample system	Complete 1500 word draft of Leverage Points paper by end of week
14: Sustainability Assessment	Measuring & Metrics and ISO standards (ISO 14000 & 26000)	Feedback on Leverage points draft; Define metrics in all dimensions for a case study and discuss in team	-	Introduction of LCA	Try out LCA with a small example, short student presentations	-
15: Future concepts, saving the world, and the like	Utopias	Develop your own scenario, short student presentations	Revision Leverage Points paper due	Latest trends in research and innovations in sustainability	Write your own research questions and discuss research design with peers	Final essay due by end of the week