

SEMESTER AT SEA COURSE SYLLABUS

May 2012

Discipline: Engineering (Systems Engineering)

ENGR 2595-101: Special Topics in Engineering: Environmental Sustainability and Systems Thinking

Division: Lower

Faculty Name: Reid Bailey

Pre-requisites: Algebra 2

COURSE DESCRIPTION

A lack of systems thinking has been blamed for nearly every major problem that humans have every faced. From poverty to pollution, systems thinking has been heralded as our savior.

In this course, we will examine what systems thinking is and if its potential lives up to its promise.

Some characteristics of this class:

- Authenticity – we will talk about real problems, work on real cases, and do real projects
- Collaboration – while you will have some individual assignments, the goal here is for us all to learn more through learning from each other
- Quantitative and Qualitative – systems thinking relies heavily on modeling systems ... and the models explored during this course will be both qualitative/conceptual and quantitative
- There is a lot of reading in this course. But, put some faith in us that the books and articles are good ones – enjoyable to read, informative, and intellectually stimulating.

COURSE OBJECTIVES

Immediately after this class, students should be able to:

- Explain what sustainability means/can mean
- Explain systems thinking conceptually
- Be able to apply systems thinking to make models, including causal flow models and systems dynamics simulation models
- Explain and effectively apply systemic thinking within a systematic approach to open-ended problems
 - formulate a problem and develop a clear statement of needs
 - *goals, objective trees, indices of performance*
 - *functional and design requirements*
 - identify solutions to a problem
 - evaluate and select solutions to a problem
 - explain and apply iteration as needed both within steps and through an entire process
 - explain and apply an error-embracing approach articulate their personal view of systems thinking and how it applies to sustainability

In 3-5 years, what should you have taken away from this class? You should be able to:

- Apply principles of systems thinking and sustainability to decisions in your personal and professional lives.

REQUIRED TEXTBOOKS

AUTHOR: Senge, Peter
 TITLE: The Fifth Discipline
 PUBLISHER: Crown Business
 ISBN #: 978-0385517256
 DATE/EDITION: 2006, Revised Edition
 COST: \$14.85

AUTHOR: Meadows, Donella
 TITLE: Thinking in Systems, A Primer
 PUBLISHER: Chelsea Green
 ISBN #: 978-1603580557
 DATE/EDITION: 2008
 COST: \$12.02

AUTHOR: McDonough, W., Braungart, M.
 TITLE: Cradle to Cradle: Remaking the Way We Make Things
 PUBLISHER: North Point Press
 ISBN #: 978-0865475878
 DATE/EDITION: 2002
 COST: \$15.80

Choose one of the following Dr. Seuss Books:

AUTHOR: Seuss, Dr.
 TITLE: The Lorax
 PUBLISHER: Random House Books
 ISBN #: 978-0394823379
 DATE/EDITION: 1971
 COST: \$9.11

AUTHOR: Seuss, Dr.
 TITLE: The Sneetches and Other Stories
 PUBLISHER: Random House Books
 ISBN #: 978-0394800899
 DATE/EDITION: 1961
 COST: \$9.11

TOPICAL OUTLINE OF COURSE

1	Sustainability and the UN Millennium Development Goals Read in class: UN 2011 report, Brundtland Commission <i>Chesapeake Bay Game Introduction</i>	
2	What is Systems Thinking? Read: Senge Selected Readings, Seuss <i>Chesapeake Bay Game Rounds 1 and 2</i>	

3	No really, What Is Systems Thinking? Read: Hardin, Systems Engr Primer <i>Chesapeake Bay Game Rounds 3 and 4</i>	Children's Story Storyboard
4	Systems And Sustainability Part 1 Read: Meadows Part 1, Coulter <i>Chesapeake Bay Game Rounds 5 and 6</i>	
5	STELLA Systems Modeling	Children's Story Final
6	Systems and Sustainability Part 2 Read: Meadows Part 2	
7	Systems and Ecology Read: Holling, Leopold	Chesapeake Bay Assignment
8	Systems, Sustainability, and Industry Read: Cradle to Cradle Part 1	
9	Systems, Sustainability, and Industry New Belgium Brewing Case	
10	Systems, Sustainability, and Industry Read: Cradle to Cradle Part 2, Anderson Excerpt, Gustashaw,	
11	Final Presentations	Final Presentation (individual assignment)

Children's Story

Write a children's story that emphasizes a Senge archetype. Completed in groups of two students.

Chesapeake Bay Game Assignment

Two-page essay reflecting on how your decision-making strategies changed throughout the game and implications for this on applying systems thinking to environmental sustainability.

Field Notes & Reflections

At each field excursion, students will take notes during the excursion. In this assignment, these notes are compiled and followed by a 1-2 page reflective essay on connections between their field excursion and class material.

Final Creative Presentations

The final presentation will be a 4 minute video in which students articulate their personal view of systems thinking and how it applies to sustainability. Examples must be included. The video should look towards the future and how systems thinking may be helpful (or not) in achieving sustainability. Students should use a combination of pictures, video, audio and voice. At least one Field Visits must be incorporated into each presentation. Students can work in groups of two or individually.

Mini-quizzes

Mini-quizzes will be given several times throughout the course! These will be short and aimed at just making sure everyone understands the basics.

FIELD ASSIGNMENTS

(At least twenty percent of the contact hours for each course.)

Specific field assignments are TBD at this point. I would like to explore industrial site visits such as the one that Pam Norris conducted at a Chiquita plant during the June 2011 SAS voyage. Possible opportunities include the following

- Callou, Peru – a major port, we could take a tour of operations at the port
- Panama Canal – tour canal operations
- Havana, Cuba -- Partagas Cigar Factory

I would also very interested in setting up a visit to the “Chamber of Commerce” at some ports – what kind of businesses are they attracting to their region, what benefits do the people of their region get from such businesses, what kinds of natural resources are used by the businesses, etc.

Assignments:

- For each field visit, each student will keep notes throughout the day and be required to submit a write-up of these notes that connect what they see during the visit to class materials.
- In addition, students must integrate at least one of the site visits into their final creative presentation.

METHODS OF EVALUATION

Grades	
20%	Children’s Story (Storyboard: 5%, final 15%)
20%	Field Assignment Notes/Observations (10% each)
10%	Chesapeake Bay Game Assignment
25%	Final Presentation, including content from the field assignments
25%	Preparations for Class as measured by mini-quizzes, participation

RESERVE LIBRARY LIST

None

ELECTRONIC COURSE MATERIALS

AUTHOR: Leopold, Aldo
ARTICLE/CHAPTER TITLE: Thinking Like a Mountain
JOURNAL/BOOK TITLE: A Sand County Almanac
VOLUME: --
DATE: 1989

AUTHOR: Leopold, Aldo
ARTICLE/CHAPTER TITLE: Some Fundamentals of Conservation in the Southwest
JOURNAL/BOOK TITLE: Environmental Ethics
VOLUME: 1
DATE: Summer 1979
PAGES: 131-141

AUTHOR: Hardin, Garrett
ARTICLE/CHAPTER TITLE: The Tragedy of the Commons
JOURNAL/BOOK TITLE: Science
VOLUME: 162
DATE: 1968
PAGES: 1243-1248

AUTHOR: Coulter, Stewart; Bras, Bert; Foley, Carol
ARTICLE/CHAPTER TITLE: A LEXICON OF GREEN ENGINEERING TERMS
JOURNAL/BOOK TITLE: International Conference on Engineering Design
VOLUME:
DATE: 1995
Also at <http://www.srl.gatech.edu/education/ME4171/Final-ICED-paper.pdf>

AUTHOR: Gustashaw, D.; Hall, Robert.
ARTICLE/CHAPTER TITLE: From Lean to Green: Interface, Inc.
JOURNAL/BOOK TITLE: Target Magazine
VOLUME: 24, Issue 5
Also at http://www.leanandgreensummit.com/Lean_to_Green_Article.pdf

AUTHOR: Holling, C. S.
ARTICLE/CHAPTER TITLE: Resilience and Stability of Ecological Systems
JOURNAL/BOOK TITLE: Annual Review of Ecology and Systematics
YEAR: 1973
Also at <http://www.jstor.org/stable/2096802> (May need UVa VPN to access)

AUTHOR: Fredrik Moberg
ARTICLE/CHAPTER TITLE: Sustainability School: The Lazy Eight: Key to Sustainable Development
JOURNAL/BOOK TITLE: Sustainable Development Update
YEAR: 2008, Issue 5
Also at <http://www.albaeco.se/sv/images/stories/File/SDU5-08.pdf>

AUTHOR: Pimm, Stuart
ARTICLE/CHAPTER TITLE: The complexity and stability of ecosystems
JOURNAL/BOOK TITLE: Nature
VOLUME: 307
Also at
http://www.nicholas.duke.edu/people/faculty/pimm/publications/pimmreprints/28_Pimm_1984.pdf

I am not sure if I need to do this for websites, but if so:

Website: The Millennium Development Goals Report, 2011
URL: http://www.un.org/millenniumgoals/11_MDG%20Report_EN.pdf

Website: Our Common Future, Chapter 2: Towards Sustainable Development
URL: <http://www.un-documents.net/ocf-02.htm>

Website: New Belgium Brewing Company case study
URL:
<http://www.ucdenver.edu/academics/colleges/SPA/BuechnerInstitute/Centers/WirthChair/Publications/Documents/New%20Belgium%20Brewing%20Company.pdf>