

Social and Ethical Implications of Engineering LEAP 1501

*Social/Behavioral Science Foundation-3 credit hours (BF), Fulfills ABET Criteria
First Semester of Engineering Sequence for General Education*

Section 1: MWF, 8:35-9:25, WEB L114

Meg Harper, Ph.D.

Cell/Text: 801-557-8153

Email: m.harper@utah.edu

Office: 148 Sill Center

Office Hours: M 10:00-12:00, and by appointment

Peer Advisor	Phone	Email
Taylor York	714-318-7639	u1128953@utah.edu

Student Success Advocate	Phone	Email
Jon Bernal	385-232-5244	jon.bernal@utah.edu

Library Instructor	Phone	Email	Office
Shane Wallace	801-585-1990	shane.wallace@utah.edu	1705P Marriott Library

Course Description

This course provides an understanding of the role of ethics in the engineering profession by focusing on concerns and relationships among issues such as sustainability, technology, economics, political climate, and public safety. Case studies will inform your understanding of social, ethical, environmental, and financial implications and consequences of engineering designs, risks, flaws, and practices. Through application of social science concepts and approaches to engineering contexts, we will explore interactions and intersections among human institutions, decision-making processes, and ethics in national and global communities. Sustainable development, from an engineer's perspective, benefits from innovations in technology and science, but is also often at odds with the demands of a growing world population and consumption of natural resources.

Course readings, materials, discussions, and assignments—including a team research project—aim to support the LEAP Learning Outcomes and most of the student outcomes outlined by the Accreditation Board for Engineering and Technology (ABET) for 2016-2017:

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data

- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

In order to understand better the role of the engineer in local, national, and global settings, you will begin by asking:

- What is a society or community? How do engineers define a professional society? What is the purpose of professional engineering societies?
- How can engineers determine what is ethical while making decisions within different communities? Are traditional philosophical concepts about ethics applicable to engineering codes of ethics, or are there other ways to think about engineering ethics?
- What are some of the major questions and problems about communities studied by social scientists? What can engineers learn from social scientists and thus implement in dealing with other engineers, corporations, government agencies and/or the public?
- How do social scientists study human behavior and institutions? What should engineers know about social and organizational theory?
- What role do social scientists play in influencing public debate and policy? How does this relate to the role of engineers as citizens and as technical advisors in shaping progress or changes in technology?
- How do engineers and social scientists analyze and respond ethically to issues of globalization?

Learning Objectives for E-LEAP 1501

1. Critical Thinking
 - a. reading for main ideas
 - b. assessing issues from different perspectives
 - c. discussing topics in a thoughtful manner
 - d. evaluating arguments and evidence
2. Teamwork
 - a. collaboration
 - b. negotiation and compromise
 - c. building leadership skills

3. Information literacy
 - a. social and ethical implications of the creation and/or construction of technology and its uses domestically and globally by using social science methods of inquiry
 - b. knowledge of specific events and cases pertinent in the recent history of engineering technologies and designs
 - c. introduction to principles and issues of sustainability and “green engineering”
 - d. use of quantitative information and analysis
4. Communication
 - a. professional communication skills
 - b. practice and improvement in technical writing and presentations
 - c. practice and improvement in oral argumentation
 - d. ability to assess levels of technical expertise in audiences
5. Research
 - a. search strategies and familiarity with databases in the social sciences, applied sciences, and engineering
 - b. research methodologies
 - c. evaluation of internet sources
 - d. integration of library resources into a team research project
 - e. use of IEEE citation style
6. Personal development
 - a. exploration of campus activities, organizations, and opportunities in service and leadership
 - b. integration and sense of belonging in the university community and in the College of Engineering
 - c. friendships and social networks
 - d. engagement within the LEAP learning community—with classmates, peer advisor, faculty

Required Readings—available on Canvas, in Modules-Readings

- [1] C.B. Fleddermann, *Engineering Ethics*, 4th ed. Upper Saddle River, NJ: Prentice Hall, 2012. (Excerpts)
- [2] D. Johnson, “Can Engineering Ethics Be Taught?” *The Bridge: Linking engineering and society*, National Academy of Sciences, Spring 2017, pp. 59-64.
- [3] A. Mandavilli, “The World’s Worst Industrial Disaster is Still Unfolding” *The Atlantic*, July 10, 2018.
- [4] E.M. Geist, “What Three Mile Island, Chernobyl, and Fukushima can teach about the next one,” *Bulletin of the Atomic Scientists*, April 28, 2014.
- [5] Earl Babbie, “Human Inquiry and Science,” in *The Practice of Social Research*, 14th ed. Boston: Cengage Learning, 2016, pp. 3-30.
- [6] J.M. Wetmore, “The value of the social sciences for maximizing the public benefits of engineering,” *The Bridge: Linking engineering and society*, National Academy of Sciences, Fall 2012, pp. 40-45.
- [7] S.B. Young and W.H. Vanderburg, “A materials life cycle framework for preventive engineering,” *IEEE Technology and Society Magazine*, v 11, no 3, pp. 26-31. Fall. 1992.

[8] P.T. Anastas and J.B. Zimmerman, "Design through the 12 principles green engineering," *Environmental Science and Technology*, v 37, no 5, 2003, pp. 94A-101A.

[9] D. Michelfelder and S. Jones, "Sustaining engineering codes of ethics for the 21st century," *Science and Engineering Ethics*, v 19, no 1, 2013, pp. 237-258.

Required Documentaries—listed on syllabus

[1] M. O'Brien, Writer and Director. *Nuclear Meltdown Disaster: Inside the Fukushima Crisis*. PBS NOVA, 2015. [Videorecording].

[2] A. Luthra and S. Condie, Writer and Director. *One Night in Bhopal*. BBC, 2004. [Videorecording].

[3] M. Gaviria and M. Smith, Writer. *The Spill*. PBS Frontline, 2010. [Videorecording].

[4] C. Penry-Davey and P. Chinn, Writer and Producer. *Hurricane Katrina: The Storm that Drowned a City*. PBS, 2006. [Videorecording].

Grading and Assignments

Individual Assignments **100 Points**

Newsletter: Interview with an Engineer	10
Homework (7/8)	35
Midterm	15
Library Classes	10
Attendance	10
Individual Critique of U Design Project	20

U Design Project-Team Assignments and Presentation **100 points**

Team Memo 1: Design/Research Proposal	10
Team Memo 2: Technology	10
Team Memo 3: Design, Technology, and Sustainability	10
Team Memo 4: Ethics and Policy	10
Team Presentation (15-20 minutes)	60

Grades are assigned by percentage.

Grade Scale

A = 93 and above	A- = 90-92	B+ = 87-89	B = 83-86	B- = 80-82
C+ = 77-79	C = 73-76	C- = 70-72	D+ = 67-69	D = 63-66
D- = 60-62	E = 59 or below			

Attendance: Number of Absences = Points for attendance grade

0-2 = 10	3 = 9	4 = 8	5 = 7	6 = 6
7-8 = 5	9 = 4	10 = 3	11 = 2	12 = 1

Policies on Assignments and Coursework

- **Late written assignments will be accepted but penalized 2 points.** Late = More than 24 hours past the due date. Homework is considered late if not checked at the beginning of class.
- Team assignments require collective collaboration, effort, and organization for a team grade. Any team member may receive a different grade based on absence or lack of work on a team assignment.
- Library sessions are designed to assist you in successfully completing your team research project in stages. Points for the library portion of the final grade are based on attendance and team participation in library classes.
- Readings and homework should be completed for class before the specified date. Homework will be checked by your Peer Advisor at the beginning of class.
- Directions, guidelines, and grading criteria for all written assignments, including homework, will be explained in class and available on Canvas.

Extra Credit

You may earn up to 4 extra credit points (1 point per event) by attending/participating in the following opportunities:

- An engineering activity or event sponsored by the College of Engineering or one of its departments
- A LEAP activity or event, including Convocation and Writing Workshops
- Supplemental films, readings or events designated as extra credit options
- Any pre-approved event, lecture, conference or activity that you can relate to course topics

To receive credit for any of these options, you must submit a typed, printed response (about 1 page) that describes the event, your participation, and what you gained from the experience. Please submit extra credit to me no later than Wednesday, December 5.

Classroom Policies

Attendance: Regular, punctual attendance in this course is mandatory and counts in your final grade. Attendance for library sessions, final team presentations, and in-class teamwork is also mandatory. Irregular presence and lack of preparation will adversely affect your grades.

Participation: Class will consist largely of discussion, not lecture, and therefore, you must come prepared by completing the readings and assignments for that day and by approaching the material in a thoughtful, critical manner.

Absences: You are allowed 2 absences throughout the semester. A doctor's note does not excuse an absence. Under University policy, only absences for religious holidays and for required participation in a University-sponsored team/organization are excused.

Homework: Your Peer Advisor will routinely check completion of your work for credit at the beginning of class. Late homework is penalized 2 points.

Conduct: Your participation and engagement are important! Please raise your hand to speak in class and listen to others' contributions. Do not text or talk to other students while class discussions are in progress. Be courteous, pay attention, and take notes! For further information on student conduct, please refer to the University's Code of Student Rights and Responsibilities.

PLAGIARISM: The University defines plagiarism as "the appropriation of any other person's work [published or unpublished] and the unacknowledged incorporation of that work in one's own work offered for credit." The punishment for plagiarism is "0" on the plagiarized assignment, and possibly an automatic NC (no credit) in the course. Further disciplinary action may be taken.

Peer Advisor: Taylor York

Taylor's Mission Statement:

My mission as a Peer Advisor is to proactively guide and support the incoming LEAP students in three ways:

1. Assist and answer questions, whether it be adjusting to college life, study strategies or course curriculum.
2. Prepare for classes in advance to facilitate student learning.
3. Collaborate with Dr. Harper to support student issues or class concerns.

Writing Center (tutoring): 2nd Floor, Marriott Library; 801-587-9122

Accommodations Policy—Course Content

The values held most strongly by the University of Utah community are those of academic freedom and integrity as they are expressed collectively by the colleges and departments as well as individually through research and teaching and as they exist within the wider context of advanced study as commonly understood by all universities. The community also values diversity and respect, without which there can be no collegiality among faculty and students. In addition, the University community values individual rights and freedoms, including the right of each community member to adhere to individual systems of conscience, religion, and ethics. Finally, the University recognizes that with all rights come responsibilities. The University works to uphold its collective values by fostering free speech, broadening fields of inquiry, and encouraging generation of new knowledge that challenges, shapes, and enriches our collective and individual understandings.

Students must understand and be able to articulate the ideas and theories that are important to the discourse within and among academic disciplines. Personal disagreement with these ideas and theories or their implications is not sufficient grounds for requesting an accommodation. Accommodations requested on such grounds will not be granted. The University recognizes that students' sincerely-held

core beliefs may make it difficult for students to fulfill some requirements of courses or majors. It is the student's obligation to determine, before the last day to drop courses without penalty, when course requirements conflict with the student's sincerely-held core beliefs. If there is such a conflict, the student should consider dropping the class.

Addressing Sexual Misconduct

Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veteran's status, or genetic information. If you or someone you know has been harassed or assaulted, you are encouraged to report it to the Title IX Coordinator in the Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to the police, contact the Department of Public Safety, 801-585- 2677 (COPS).

Reasonable Accommodation for Disabilities

The Americans with Disabilities Act. *The University of Utah seeks to provide equal access to its programs, services, and activities for people with disabilities. If you will need accommodations in this class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in an alternative format with prior notification to the Center for Disability & Access.*

Student Names and Personal Pronouns

Class rosters are provided to the instructor with the student's legal name as well as "Preferred first name" (if previously entered by you in the Student Profile section of your CIS account). While CIS refers to this as merely a preference, I will honor you by referring to you with the name and pronoun that feels best for you in class, on papers, exams, group projects, etc. Please advise me of any name or pronoun changes (and update CIS) so I can help create a learning environment in which you, your name, and your pronoun will be respected. If you need assistance getting your preferred name on your UIDcard, please visit the LGBT Resource Center Room 409 in the Olpin Union Building, or email bpeacock@sa.utah.edu to schedule a time to drop by. The LGBT Resource Center hours are M-F 8am-5pm, and 8am-6pm on Tuesdays.

Wellness and Success

Personal concerns such as stress, anxiety, relationship difficulties, depression, cross-cultural differences, etc., can interfere with a student's ability to succeed and thrive at the University of Utah. For helpful resources contact the Center for Student Wellness at www.wellness.utah.edu or 801-581-7776.

Make the most of your University of Utah experience! Student Success Advocates engage and empower undergraduate students in exploring and clarifying their interests and goals, overcoming personal and academic challenges, and connecting to campus resources and opportunities. For more information and drop in hours, go to ssa.utah.edu.

How to succeed in this course:

1. Attend regularly. Be on time. Repeated tardiness is bad etiquette in a university class.
2. Come to class ready to participate. This class emphasizes discussion and sharing of perspectives. You cannot contribute to discussion unless you have completed the reading on time. Complete homework with assigned readings.
3. Manage your time effectively.
4. Take notes in class.
5. Cultivate friendships with your peers. Ask for help and support from your peer advisor, student success advocate, and from me.

Your responsibilities:

1. Treat the professor, peer advisor, and other students with dignity and respect.
2. Be prepared for class: arrive on time with course readings and/or assignments.
3. Remain alert and focused in class. DO NOT: text; make phone calls; disrupt class in any way; do homework for other classes; pack up early; sleep.
4. Multitask in a constructive way: listen to others, take notes, participate, read the board.

Syllabus of Readings and Assignments

Please note that the reading and homework for any particular day should be done BEFORE you come to class. Assignments are subject to change with prior notice. You are responsible for completing all work by the due dates listed in the syllabus.

READINGS (PDFs) are in Canvas, Modules → Readings.

HOMEWORK is in Canvas, Modules → Homework.

Week I Innovative and Creative Thinking

M, Aug 20 Welcome! Introduction to the course, syllabus, PA, and SSA

W, Aug 22 Engineering Marvels and Failures
Class Activity: Get to know your LEAP 1501 classmates!

F, Aug 24 Decisions and Risks
Cases: Ford Pinto; Firestone Tires; KC Hyatt Regency Walkways

Read: [PintoFirestoneKCWalkways.pdf](#)
(Excerpts from *Engineering Ethics* pp. 1-6, 74-80, 84-87)
HOMEWORK 1

Week II Too Big to Fail: Safety, Government, and Economics

M, Aug 27 Challenger, Columbia, DC-10

Read: [ChallengerColumbiaDC10.pdf](#) (*Engineering Ethics* pp. 7-15, 91-93)
Read: D. Johnson, “Can Engineering Ethics Be Taught?”
HOMEWORK 2

Interview with an Engineer Assigned

W, Aug 29 Discussion of ethical problem solving during a disaster

Read: *Engineering Ethics*, Chapter 3 “Understanding Ethical Problems”
Watch: *Nuclear Meltdown Disaster: Inside the Fukushima Crisis*
(54 min, available on Kanopy app with U login or through Kanopy
Streaming online access through Marriott Library)
HOMEWORK 3

Extra credit: *Meltdown: The Fukushima Power Plant Disaster* (46 min,
Kanopy Streaming)

F, Aug 31 Class Activity

Week III **Assigning Responsibility: Who's to Blame?**

M, Sept 3 Labor Day Holiday—No class

W, Sept 5 Exportation of Risk: Chemical disaster in Bhopal, India

Watch: *One Night in Bhopal* (available on YouTube)

Read: A. Mandavilli, "The World's Worst Industrial Disaster is Still Unfolding"

HOMEWORK 4

LEAP CONVOCATION (Extra Credit), 4-5pm, Union Ballroom

F, Sept 7 Individual vs. Corporate Responsibility

Read: E.M. Geist, "What Three Mile Island, Chernobyl, and Fukushima can teach about the next one"

HOMEWORK 5**Week IV** **Risks/Cost-Benefit: Preventing and Preparing for the Worst**

M, Sept 10 BP Deepwater Horizon Spill: the worst environmental disaster in US history and the largest oil spill in the petroleum industry

Watch: *The Spill*, Available as Frontline episode on pbs.org (55 min)

W, Sept 12 Discussion: Choices and Consequences

Preparation and updates for Interview with an Engineer Assignment

F, Sept 14 Hurricane Katrina: the costliest natural disaster in US history

Watch: *Hurricane Katrina: The Storm that drowned a city*, Available on YouTube (56 min.)

HOMEWORK 6

Extra Credit: *The Storm*, Frontline episode on pbs.org (54 min)

Week V Bridging Engineering, Ethics, and Social Science

M, Sept 17 Social science inquiry and research

Read: BabbieCh1.pdf (Babbie, Chapter 1 of *The Practice of Social Research*)

HOMEWORK 7

W, Sept 19 Discussion—Interdisciplinary approaches to problem solving
Read: J.M. Wetmore, “The value of the social sciences for maximizing the public benefits of engineering”

F, Sept 21 Discussion: 21st Century Problems and Solutions

Sun, Sept 23 DUE: INTERVIEW WITH AN ENGINEER, by 11:59pm on Canvas

Week VI “Oh, the Places You’ll Go”: Engineering Design for the 21st Century

M, Sept 24 Begin Team Assignment 1: U Design Proposal

W, Sept 26 First Library Class, Meet in 1110 Marriott Library
Team Assignment 1: U Design Proposal

F, Sept 28 Review for midterm
Teams work on Memo 1

Week VII Application of Ethics and Critical Thinking

M, Oct 1 Teams work on Memo 1

W, Oct 3 **MIDTERM IN CLASS**

Th, Oct 4 Makeup Midterm, 12:30pm, 148 Sill Center

F, Oct 5 No LEAP 1501 Class

DUE: TEAM MEMO 1, by 11:59pm on Canvas

WEEK VIII FALL BREAK: October 8-12

Week IX **Design, Technology, and Life Cycle**

- M, Oct 15 Team Assignment 2: Research memo on technology
- W, Oct 17 Second Library Class, Meet in 1110 Marriott Library
- Read: S.B Young and W.H. Vanderburg, “A materials life cycle framework for preventive engineering”
- F, Oct 19 Teams work on Memo 2

Week X **Progress and Technology**

- M, Oct 22 Teams work on Memo 2
- W, Oct 24 Teams work on Memo 2 and PowerPoint slides
 Progress Report and Assessment
- Fri, Oct 26 Teams finalize Memo 2
- DUE: TEAM MEMO 2, with PowerPoint slides, by 11:59pm on Canvas**

Week XI **U Design: Go Green!**

- M, Oct 29 Team Assignment 3: Connections among design, technology, and sustainability
- Read: P.T. Anastas and J.B. Zimmerman, “Design through the 12 principles green engineering”
- W, Oct 31 Third Library Class, Meet in 1110 Marriott Library
- F, Nov 2 Teams work on Memo 3

Week XII Technology vs. Sustainability / Technology + Sustainability

M, Nov 5 Teams work on Memo 3 and PowerPoint slides

Read: Michelfelder and S. Jones, "Sustaining engineering codes of ethics for the 21st century"

HOMEWORK 8

W, Nov 7 Teams finalize Memo 3

Th, Nov 8 **DUE: TEAM MEMO 3, with PowerPoint slides, by 11:59pm on Canvas**

F, Nov 9 Sustainability and Policy
Team Assignment 4: Ethical and policy implications of technology and design/construction

Week XIII "Not in my backyard" (NIMBY): Engineering, Ethics, and Policy Issues

M, Nov 12 Teams work on Memo 4

W, Nov 14 Fourth Library Class, Meet in 1110 Marriott Library
Team Assignment 4: Research on ethical and policy implications of technology and design/construction

F, Nov 16 Teams work on Memo 4 and PowerPoint Slides
Assignment of Final Critique of U Design Project

Week XIV Power Presentation

M, Nov 19 Teams finalize Memo 4 and work on presentations

DUE: TEAM MEMO 4, with PowerPoint slides, by 11:59pm on Canvas

W, Nov 21 Fifth Library Class, Meet in regular classroom, WEB L114
Citing Sources and Images; Polish Presentations

F, Nov 23 Thanksgiving Holiday

Week XV U Design Presentations

M, Nov 26 Teams work on presentations

W, Nov 28 2 Team Presentations (1 & 2)

F, Nov 30 2 Team Presentations (3 & 4)

Week XVI U Design Presentations

M, Dec 3 2 Team Presentations (5 & 6)

W, Dec 5 Synthesis, Reflection on projects
E-LEAP 1501 Class Celebration

DUE: Extra Credit

W, Dec 12 DUE: Final Critique of U Design Project, by 11:59pm on Canvas

Th, Dec 27 Course Grades Available on CIS