ENGR 2392: Engineering Ethics and Its Impact on Society

Fall 2020

Instructor:

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Catalog Description:

ENGR 2392: Engineering Ethics and Its Impact on Society (3). Engineers and Computer Scientists play an increasingly important role in our complex, interconnected world. Their decisions have environmental, social, and economic impacts that resonate at local, national, and global levels. This course is designed to help students better understand themselves as decision makers as well as the social-ecological systems they operate within. This course will help improve ethical reasoning and critical thinking through the study of behavioral economics, systems theory, and philosophy. Students will engage several complex challenges facing engineers and computer scientists today.

Core Curriculum:

This course satisfies the Texas Tech University core curriculum requirement in Language, Philosophy, and Culture.

The objective of the humanities in a core curriculum is to expand the student's knowledge of the human condition and human cultures, especially in relation to behaviors, ideas, and values expressed in works of human imagination and thought. Through study in disciplines such as literature and philosophy, students will engage in critical analysis and develop an appreciation of the humanities as fundamental to the health and survival of any society.

Students graduating from Texas Tech University should be able to think critically and evaluate possible multiple interpretations, cultural contexts, and values.

Required Materials:

1) *Predictably Irrational* by Dan Ariely
2) *Thinking in Systems* by Donella Meadows
3) *On Virtue Ethics* by Rosalind Hursthouse

Additional course materials are presented on/available through Blackboard or via the Texas Tech Library.

Expected Learning Outcomes:

This course helps meet several ABET Program Outcomes for both Engineering and Computer Science. At the end of the course, students should:

1. Recognize the complex nature of engineering. Students should be able to both identify the complexity and develop skills to effectively grapple with this complexity.
2. Also recognize the constrained nature of engineering. Students should recognize not only economic constraints on design and implementation but social and ethical (e.g. public health and safety, environmental considerations, etc.) ones as well. Students should develop an enhanced ability to correctly balance these constraints.
3. Complete the course with a greater understanding of themselves as decision makers; including an awareness of potential biases and blind spots.
4. Complete the course with a greater understanding of the ethical foundations of their engineering/computer science codes of ethics.
5. Students should complete this course with a greater understanding of the local, national, and global impact engineering and computing has on individuals, organizations, and contemporary society as a whole. Students will grapple with local and global issues throughout the course with special emphasis in the CS/Engineering and International Practice content and Social Impact Analysis.
6. Improve their ability to express complex ideas as well as communicate effectively with those holding different, even contradictory, positions.

Expected Learning Outcome	**Engineering ABET Criteria**	**CS ABET Criteria**
1. Recognize complex nature of engineering	2, 4	1
2. Recognize social/ethical constraints on engineering	1, 2, 4	4
3. Better understanding of decision making	4, 5	1, 4, 5
4. Greater understanding of Codes of Ethics	2, 4	4
5. Greater understanding of local, national, and global impact of engineering and computing	2, 4	4
6. Improve ability to express complex ideas	3, 5	3, 5

Course Content Schedule & Description:

Theme	Week	Learning Module	Description
Know Thyself	1	Intuition	Examination of the role intuitions play in ethical decision making; especially viz. their reliability.
	2	Behavioral Econ.	Examination of decision making with an emphasis on biases & other blind spots that lead to problems.
Know the System	3	Systems Theory	Introduction to foundations of systems theory. Concepts such as equifinality, negative entropy, isomorphology are introduced. Also includes an introduction to systems biomimicry. All done with an eye towards understanding the ethical dimensions of systems.
	4	Systems Tools	Review of tools used to model systems in aid of understanding and effective interventions. Survey includes cross-impact analyses and causal loop diagrams.
	5	Systems Archetypes	Examination of the common, recurring patterns in the social systems around us. Important to both address current system pathologies and avoid future ones.
Intellectual & Moral Guidance	6	Intro to Virtue Ethics	An introduction to virtue theory; especially as it relates to the question: "What kind of engineer/computer scientist should I be?"
	7	Intellectual Virtue	An introduction to the framework and mechanics of intellectual virtue. The focus will be on both general intellectual virtues and role specific ones.
	8	Moral Virtue	Building on the insights from intellectual virtue, moral virtues (general and role) are examined.
	9	Codes of Ethics	An introduction to professional codes of ethics and examination of their philosophical underpinnings so that students might better understand the nature and extent of their professional obligations.

Social-Ecological Systems	10	Environment I	Discussion of the arguments underpinning views of the value of the environment. Codes of Ethics are revisited with a focus on those portions dealing with the environment and/or sustainable development. Also includes an introduction to lifecycle thinking that will be revisited in the International II module.
	11	Environment II	Review of the Tragedy of the Commons (ToC) by Garret Hardin with an eye towards identifying commons resources in different engineering/CS disciplines. Strategies for avoiding the ToC are examined.
Global Citizenship	12	International I	A review of different strategies for adjudicating differences (real or perceived) in values in an international setting. Emphasis placed on the Cultural Transcending Norms developed by Harris et al.
	13	International II	An examination of how engineering decisions can affect the global community; even when made domestically. A discussion of the impact of cobalt mining (cradle) an/or the growing e-waste problem (grave) on international communities.
Synthesis	14	Reflection on Method I	A review and class discussion of a complex moral thought experiment intended to highlight the importance of determining which information is and is not relevant to ethical analysis. Additional discussion about how values are and should be encoded into technology.
	15	Reflection on Method II	Last week of class – introduction of a heuristic for unpacking and analyzing complex, open-ended cases referred to as the 7-Step Method.

Assessment:

Method of Assessment	**Percent of Grade**
1. Quizzes	10%
2. Eng. Ethics in the News	10%
3. Social Impact Analysis (SIA) – *Proposal*	10%

4. SIA – *Annotated Bibliography*	20%
5. SIA – *System Diagram*	15%
6. SIA – *Paper (Peer review)*	10%
7. SIA – *Paper (Instructor assessment)*	25%

Social Impact Analysis (Capstone Assignment)

The best professional ethic is a proactive, preventative one. The ideal is to anticipate and solve problems before they occur. This kind of forward-looking problem solving can be complex. It requires a thorough understanding of the situation or technology under consideration as well as a sophisticated view of the potential positive *and* negative consequences of the situation/technology. All technology, even the most beneficially intended, has both positive and negative consequences.

In the Social Impact Analysis (SIA), students are given the opportunity to develop some of these forward-looking skills as they analyze a leading-edge design, product or concept related to their field of study or that they are otherwise interested in. Students are given a high degree of latitude in choosing a topic. Students are expected to conduct the relevant, rigorous research necessary to understand the positive and negative implications of the design/product/concept they choose. They are expected to consider the most credible arguments for and against the topic. Students must develop a well-reasoned position and explain why or why not the design/product/concept should be deployed. In developing a position, students are required to anticipate, explain, and respond to the most forceful objection to it (position). Students are reminded that any given technology can and often does have psychological, financial, and social impacts over and above its immediate physical impacts.

Students are required to synthesize the material learned throughout the course. Specifically, they are required to incorporate an ethical framework (e.g. virtue theory) into their analysis as well as a characterization of the social-ecological system the design/product/concept will be deployed within. The SIA is the capstone project for this course and is composed of several assignments. See table below summarizing each assignment as well establishing its relative weight.

Component	Description	% of Grade
Proposal	After preliminary research, student submits proposal describing tech, summarizing 2-3 potential benefits, and 2-3 potential drawbacks. Students do *not* take a position.	10

Annotated Bib.	Students read and complete an annotated bibliography on 8 peer reviewed sources. 3 of these sources must feature a critical analysis of their topic.	20
System Diagram	Students construct a causal loop diagram to model the dynamics associated with the tech and its deployment. This includes identifying balancing and reinforcing loops as well as delays. All of this is done with an eye towards understanding the system's behavior, its leverage points, and potential secondary or unintended consequences.	15
Peer Review	Students will be required to read and evaluate two of their peers' papers. This will help them see the importance of clarity in writing as well as expose them to new ideas and topics.	10
Paper	Students synthesize the insights developed in the three assignments above in a paper critically analyzing the leading-edge tech they have chosen. Students must adopt and defend a position on the tech as well as anticipate and respond to the strongest counterargument to their positions. Paper score will be based upon a combined weighting of Instructor evaluation and the peer review.	25