E 131/STS 115

Ethical Issues in Engineering

Spring, 2008-2009

Wednesdays, 2:15-4:30
Classroom: 240-110
Office hours: Tu 4:15-5:45; Weds 4:45-5:45

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I. Course Description and Purpose

E131/STS115 is devoted to study of ethical issues that arise in contemporary engineering work. Regarding its format, as indicated in the 2008-09 Stanford Bulletin, E131 is a limited enrollment class. The purposes of the seminar (see listing on Axess) are (i) to expose students to ethical issues of the sorts that engineers often face in engineering workplaces, (ii) to help students think more clearly and deeply about such issues, and (iii) to explore intellectual and other kinds of resources for grappling with such conflicts. Topics covered will include: moral responsibilities and rights of engineers in relation to employers, clients, colleagues, and society; cost-benefit-risk analysis, safety, and informed consent; the ethics of whistleblowing; ethical conflicts of engineers as managers, consultants, and expert witnesses; ethical issues in engineering design, manufacturing, and operations; ethical issues arising from engineering work in foreign countries; ethical issues in high-tech workplaces; and ethical implications of the social and environmental contexts of contemporary engineering. The course will make extensive use of published real-life case studies of ethical issues from different fields of engineering, and students working in pairs will research an original case of their own choosing.

The size of the class will be limited to about 25 students to maintain its seminar character. The reason for doing so is that students derive much more intellectual value from the class by actively analyzing and exchanging views about the course materials, something fostered by a seminar setting, than by taking notes on presentations or lectures delivered to a larger-than-seminar-sized group.

Note Well: E 131/STS 115 satisfies the Humanities component (Area 3a) of the Stanford General Education Requirements (GERs) AND the School of Engineering’s "Technology in Society Requirement." It does not satisfy the GER in Ethical Reasoning in 2008-09.

II. Course Requirements

1. Completion of and reflection on assigned weekly readings;
2. thoughtful, informed participation in class discussion; and
3. identification of and research into an original case study of a real-life ethical issue in engineering, presentation of one’s case and analysis in class, and write-up of that case.

III. Grading

1. Quality and quantity of participation in seminar discussions: 50%
2. Aptness and quality of analysis of the student’s original case study: 50%
   A. 40% for the in-class presentation;
   B. 10% for the post-presentation written report.

IV. Required Reading

V. Calendar of Topics and Reading Assignments

Part I: Foundational Considerations and Materials

1 We 4/01 Introduction to the Course

What do engineering students associate with the phrase “ethics and engineering”? What does “ethical issues in engineering” mean in this course? Why is this course being taught in the School of Engineering? Why is its subject matter worth studying? What makes some issues that arise in engineering work bona fide "ethical issues"? Have class members ever personally encountered or heard about a specific ethical issue that arose in engineering practice?

Course goals

2 We 4/08 Historical Background on the Engineering Profession, Codes of Engineering Ethics, and Moral Responsibilities of Engineers

What is important about the history of the engineering profession in the U.S.? What is a "profession"? Why is that an important question for this class? What are the main strengths and weaknesses of codes of engineering ethics? What are the fundamental ethical responsibilities of engineers? What is the basis for these responsibilities?

1. T. Reynolds, "The Engineer in Nineteenth-Century America"
2. T. Reynolds, "The Engineer in Twentieth-Century America"
3. E. Greenwood, "Attributes of a Profession"
4. Nat’l Society of Professional Engineers (NSPE), Code of Ethics for Engineers (1990)
5. American Society of Civil Engineers (ASCE), Code of Ethics (1993)
6. Institute of Electrical and Electronics Engineers (IEEE), Code of Ethics (1990)

Part II: Case Studies

3 We 4/15 Case Studies I: Aircraft and Missile Defense Systems

1. F. Sawyier, "The Case of the DC-10"
2. K. Vandivier, "Why Should My Conscience Bother Me?"


4 We 4/22

Case Studies II: Buildings and Bicycles

1. J. Morgenstern, "The Fifty-Nine Story Crisis"

2. H. Petroski, “Accidents Waiting to Happen”

3. H. Petroski, “The Kansas City Tragedy: There Is Not Always Strength in Numbers”


5. W. Wilson, "The Case of the Composite Material Bicycle"

5 We 4/29

Case Studies III: Space Shuttles and Cars

1. T. Bell and K. Esch, "The Fatal Flaw in Flight 51L"

2. R. Boisjoly, "Ethical Decisions: Morton Thiokol and the Space Shuttle Challenger Disaster”

3. W. Shaw, "Ford's Pinto"

4. M. Hoffman, "The Ford Pinto"

5. R. DeGeorge, "Ethical Responsibilities of Engineers in Large Corporations: The Pinto Case”


We 5/06

**Case Studies IV: A State-of-the-Art Chemical Plant in a Developing Country**

1. G. Stix, "Bhopal: A Tragedy in Waiting"

We 5/13

**Case Studies V: Hazardous Waste, Silicon Valley, and Appropriate Technology**

2. K. Noble, "Ecology War Brews in California Desert"
3. R. Ho, "Ethics and High-Tech Engineering: Unique Ethical Issues of the Silicon Valley Workplace"
5. J. Stevens, “Martin Makes a Middle Class”
6. Depts. of Philosophy and Mechanical Engineering, Texas A&M University, “A Plow for Mexican Peasant Farmers”

We 5/20

**Case Studies VI: Nanotechnology**

1. R. McGinn, “Ethical Issues in Nanoscience and Nanotechnology: Reflections and Suggestions” (no copyright)
2. R. McGinn, “Ethics and Nanotechnology: Mapping the Views of the NNIN Community” (text of questionnaire) (no copyright)

3. R. McGinn, “Nanotechnology and Ethics: A Short Guide to Ethical Responsibilities of Nanotechnology Researchers at NNIN Laboratories” (no copyright)


6. Student Mini Research Task (description follows):

   Working together with the person -- or, if part of a trio, persons -- with whom you are doing your final case study presentation, carefully read and ponder the instructor’s questionnaire “Ethics and Nanotechnology: Mapping the Views of the NNIN Community” (see item #2 above). The text of the questionnaire is contained in the STS 115/ E 131 Course Reader.

   After due reflection, you and your partner(s) are to devise a question that you think would be interesting to ask about the data gathered from administering the survey questionnaire to over a thousand nanotech researchers at 13 universities.

   For example, one duo might design and pose the following question:

   “as far as how interested respondents claimed to be in ethical issues related to nanotechnology, do the views of responding nanotech researchers who are U.S. citizens differ significantly from those of who are not?”

   A prize will be given to the duo that comes up with the most interesting or intriguing question to ask about the data gathered in the author’s survey.

Part III: Student Presentations and Conclusions

9 We 5/27

Student Reports I

10 We 6/03

Student Reports II

Reflections and Conclusions

1. R. McGinn, “Ethical Issues in Engineering: Some Important Overarching Themes, Theses, Ideas, Concerns and Quotes”


3. S. Beder, "Making Engineering Design Sustainable"
VI. The In-Class Presentations

On Wednesday, May 27, and Wednesday, June 3, seminar members, having worked in pairs or trios, will make joint in-class presentations. While not required, you are encouraged to link up with a class member who is majoring in your field, so that the two of you will then be able to choose a case that relates to your area of specialization.

Each presentation, lasting 15 minutes (if a duo) or 23 minutes (if a trio), must take the form of an original case study of an incident or episode involving an interesting, non-obvious ethical issue or conflict in contemporary engineering work. The case study may be based on one or more kinds of research, e.g., location and analysis of courtroom records, in-person or telephonic interviews with engineer participants and others involved in the situation under scrutiny, a survey of engineers, etc. To secure the cooperation of reluctant participants, you may wish to assure potential interviewees that you will maintain confidentiality, and/or not cite them by name or other identifying particulars on paper. I have found that it sometimes helps to tell potential participants (truthfully) that you are doing a research project for a class at Stanford University, that you want to get all relevant sides of the story, and, if true, that you’ve already spoken or intend to speak with other parties, or received/will receive useful documents reflecting their perspectives and would find it useful to obtain theirs for the sake of doing justice to both sides in the case, or perhaps to do justice to the richness and complexity of the case in question.

Regardless of the kind of study undertaken, each presentation must include the following:

1. appropriate general background information about the case;
2. description of the socio-technical situation in the case in sufficient detail to enable the listener/reader to appreciate the situation that faced the engineer(s) in question;
3. explicit identification and characterization of the ethical issue or conflict in question;
4. unpacking and probing analysis of the issue or conflict (e.g., of its genesis, trajectory and outcome; evaluation of the strengths and weaknesses of the arguments made on both sides; etc.); and
5. delineation of noteworthy lessons about ethical issues in engineering that you and your partner extracted from the case presented.

Each duo/trio must also submit a carefully written report of between 1150-1200 words describing the case studied and specifying the resources used in putting together the presentation. The paper should not simply repeat what you did in the presentation. Feel free to pursue an issue you didn’t get into in the presentation or one that you did but now will explore in greater depth. Please attach any tapes, articles, transcripts, or other documents that you have gathered or generated in your research. A word count must be included at the end of your report. A word of advice: do not wait until shortly before your presentation date to identify or to start researching your case. That is a recipe for a mediocre presentation and will be graded accordingly.

VII. Publication Particulars for E131/STS 115 Course Reader Articles

Week 2:


National Society of Professional Engineers (NSPE), Code of Ethics for Engineers (1990)

American Society of Civil Engineers (ASCE), Code of Ethics (1993)

Association for Computing Machinery (ACM), Code of Ethics (1993)

Institute of Electrical and Electronics Engineers (IEEE), Code of Ethics (1990)

American Society of Mechanical Engineers (ASME), Code of Ethics (1996-2009)


Week 3:

F. Sawyier, "The Case of the DC-10," unpublished ms. (no copyright)


Week 4:


W. Wilson, "The Case of the Composite Material Bicycle" (unpublished ms.) (no copyright)


Week 5:


R. T. De George, "Ethical Responsibilities of Engineers in Large Corporations: The Pinto Case," copyright held by the author (Dept. of Philosophy, Univ. of Kansas)

Week 6:

Week 7:


R. Ho, "Ethics and High-Tech Engineering: Unique Ethical Issues of the Silicon Valley Workplace," unpublished ms. (no copyright)


Depts. of Philosophy and Mechanical Engineering, Texas A&M University, “A Plow for Mexican Peasant Farmers,” NSF Grant Number DIR-9012252. (no copyright)

Week 8:
R. McGinn, “Ethical Issues in Nanoscience and Nanotechnology: Reflections and Suggestions.” (no copyright)

R. McGinn, “Ethics and Nanotechnology: The NNIN Survey.” (no copyright)

R. McGinn, “Nanotechnology and Ethics: A Short Guide to Ethical Responsibilities of Nanotechnology Researchers at NNIN Laboratories.” (no copyright)

Week 10:
R. McGinn, “Ethical Issues in Engineering: Some Overarching Themes, Theses, Ideas, Concerns and Quotes.” (no copyright)


S. Beder, “Making Engineering Design Sustainable.” (no copyright)

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