Ethical Issues in Engineering

Instructor:

Robert McGinn

I. Course Description and Purpose

E131 is devoted to study of ethical issues in contemporary engineering work. The course has three general purposes: to enhance student awareness of ethical issues of the sorts that engineers are apt to face in engineering workplaces, to help students think more clearly, critically, and thoughtfully about such issues, and to explore intellectual and other resources for grappling with such conflicts. Topics covered include ethical responsibilities and rights of engineers in relation to employers, clients, colleagues, family members, and society; cost-benefit-risk analysis; safety and risk; informed consent; whistle-blowing; ethical conflicts of engineers as managers, consultants, and expert witnesses; ethical issues in engineering design, manufacturing, and operations; ethical issues arising from technology transfer to, and engineering work in, less developed countries; ethical issues in high-tech workplaces; and ethical issues arising from the social and environmental contexts of contemporary engineering work. The course will explore a number of real-life case studies of ethical issues from different fields of engineering, from civil and mechanical to electrical and biological. Students, working in pairs, will identify, research, and make presentations on original, real-life cases of ethical issues in engineering.

As stated in ExploreCourses.Stanford.edu, E131 is strictly limited to 60 students. There will be a 75-minute plenary interactive lecture each Tuesday afternoon at 3 PM. On Thursday afternoons, the class will divide up into four seminars of 15 students each for 75 minutes of discussion of both lecture content, if desired, and the day's assigned readings. Experience has shown that students derive significant intellectual value from exchanging views about course ideas and issues in a seminar setting. Thus, although E131 now includes weekly interactive lectures, the weekly seminars remain an integral and critical part of the course.

II. Course Requirements

1. Completion of and reflection upon the readings assigned for a given class session **before coming to that class session**. In particular, please read the articles assigned for a given lecture **before** attending that lecture.

2. Attendance at, and thoughtful, well-informed, and respectful participation in, the weekly seminar-format discussions.

3. An in-class presentation, with a partner, of a real-life case study of ethical issues in engineering.

4. A final examination.

III. Grading

1. Quality and quantity of participation in weekly seminar discussions: 40%.
2. Quality of in-class case-study presentation: 30%.
3. Final examination: 30%.

IV. Required Reading

1. R. McGinn, ed., *E131 Course Reader, Autumn Quarter 2017-18* (CR)

V. Calendar of Topics and Reading Assignments

Part I: Foundations

Week	Day/Date	Topic
1	Tu 9/26	Introduction to the Course -- Course structure and requirements -- What do contemporary engineering students associate with the phrase “engineering ethics”? -- Is there an “ethics gap” in contemporary engineering? -- Why is it important that engineering students study ethical issues in engineering? -- How should the study of such issues be incorporated into engineering education? -- COMPLETE APPLICATION FOR ADMISSION TO THE COURSE!
	Th 9/28	Seminar Reading: a. McGinn, Ch. 1
2	Tu 10/3	Ethics-Related Background on the Engineering Profession in the U.S.: Historical, Sociological, and Ethical Perspectives -- What are some key changes that have occurred in the engineering profession in the U.S. since the mid-19th century? -- For each such change, is it related to ethical issues in engineering? If so, how? -- What is a “profession”?

-- What makes certain occupations “professions” and others not?
-- Is engineering a “profession”?
-- Is that an important question for this class? Why?
-- What are the key points to be made about professional engineering society codes of ethics as regards using them as a basis for making ethical judgments about engineering conduct?

Reading:

a. Reynolds, "The Engineer in 19th-Century America"
b. Reynolds, "The Engineer in 20th-Century America"
c. Greenwood, "Attributes of a Profession,"
http://www.jstor.org.ezproxy.stanford.edu/stable/pdf/23707630.pdf
d. McGinn, Ch. 3 (read extra carefully!)

Th 10/5 Seminar
Reading:

a. reread McGinn, Ch. 3
b. National Society of Professional Engineers (NSPE), Code of Ethics for Engineers, 2007
c. Association for Computing Machinery (ACM), Code of Ethics and Professional Conduct, 1992
d. American Society of Civil Engineers (ASCE), Code of Ethics, 2009
e. IEEE Code of Ethics,
http://www.ieee.org/about/corporate/governance/p7-8.html
f. McGinn, Ch. 2

Part II: Case Studies and Their Key Ideas and Lessons

3 Tu 10/10 Engineering Design, Paradigm Departure, and the Ethics of Precaution
Reading:
a. Morgenstern, “The Fifty-Nine-Story Crisis”
http://www.uh.edu/ethicsinscience/Media/59Story.pdf
b. Petroski, “Accidents Waiting to Happen”

Th 10/12 Seminar
Reading:

a. reread the articles assigned for 10/10
b. Rubin, Banick, and Thornton, “The Hyatt Decision: Two Opinions – The Attorney/Engineers Speak”

c. McGinn, Case 6
d. McGinn, Case 14

4 Tu 10/17 Whistleblowing and Conflicts of Interest
Reading:

a. Strobel, “Ford Ignored Pinto Fire Peril, Secret Memos Show”; “Automakers Response: No Serious Hazard”; and “How Controversial Car Was Developed”
http://archives.chicagotribune.com/1979/10/13/page/43/article/ford-ignored-pinto-fire-peril-secret-memos-show
b. DeGeorge, “Ethical Responsibilities of Engineers in Large Organizations”
c. Bell and Esch, "The Fatal Flaw in Flight 51L"
d. Boisjoly, "Ethical Decisions: Morton Thiokol and the Space Shuttle Challenger Disaster"
e. Parnas, "SDI: A Violation of Professional Responsibility"

Th 10/19 Seminar
Reading:

a. reread the items assigned for Tuesday, 10/17
b. McGinn, Case 2
c. McGinn, Case 8
d. McGinn, Case 11

5 Tu 10/24 Technological Risk Communication; Ethics and the Engineering Consultant; and a Neglected Ethical Responsibility of Engineers
Reading:

a. Beder and Shortland, "Siting a Hazardous Waste Facility: the Tangled Web of Risk Communication" (CR)
b. Noble, "Environmental War Simmers in California Desert," NYT, November 19, 1995. (LN)
c. Brown, “Ethics and the Engineering Consultant: An Autobiographical Case Study” (CR)
d. Markoff, "Marketer’s Dream, Engineer’s Nightmare," NYT, 12/12/1993. (LN)

Th 10/26 Seminar
Reading:

a. reread and discuss the items assigned for Tuesday, 10/24
b. McGinn, Case 4

c. McGinn, Case 9

6 Tu 10/31 Ethically Responsible International Technology Transfer
Reading:

a. Stix, "Bhopal: A Tragedy in Waiting," *IEEE Spectrum*, 1989, Vol. 26, No. 6, 47-50. http://ieeexplore.ieee.org.ezproxy.stanford.edu/stamp/stamp.jsp?tp=&arnumber=29340
b. Diamond, "The Bhopal Disaster: How It Happened," NYT, Jan. 28, 1985. (LN)
c. Diamond, "The Disaster in Bhopal: Workers Recall Horror," NYT, Jan. 30, 1985. (LN)
d. Diamond, "The Disaster in Bhopal: Lessons for the Future," NYT, February 3, 1985. (LN)
e. Stevens, "Martin Makes a Middle Class" http://www.sfgate.com/magazine/article/Martin-Makes-a-Middle-Class-Stanford-grad-2747565.php

Th 11/2 Seminar
Reading:

a. reread and discuss the items assigned for Tuesday, 10/31
b. McGinn, Case 7 (CR)
c. McGinn, Case 16 (CR)

7 Tu 11/7 Privacy, Regulatory Compliance, and Software Design: EE and CS-Related Ethics Issues in Contemporary Society
Reading:

a. O'Brian and Streitfeld, "Swiss Court Orders Modifications to Street View," NYT, 6/8/1/2 (LN)
b. Lohr and Streitfeld, "Data Engineer in Google Case Is Identified," NYT, 4/30/12 (LN)
c. Ewing, "Inside VW's Campaign of Trickery," NYT, May 7, 2017 (LN)
d. Ewing, "Arrest of Former Audi Executive Highlights VW Investigators' Strategy," NYT, July 7, 2017 (LN)
e. Anderson *et al*., "Case 2: Privacy" http://www.acm.org/about/p98-anderson.pdf
f. N. Sharkey and A. Sharkey, "The Crying Shame of Robot Nannies: An Ethical Appraisal," https://www.lucs.lu.se/wp-content/uploads/2016/01/KKEG16_sem2_the-crying-shame-of-robot-nannies.pdf
g. Barnes, "Where Did You Go, Raggedy Ann? Toys in the Age of Electronics" (LN)

Th 11/9 Seminar Discussion
Reading:

a. reread and discuss the items assigned for Tuesday, 11/7
b. McGinn, Case 1
c. McGinn, Case 5
d. McGinn, Case 17

8 Tu 11/14 Research Misconduct and Ethically Questionable Research Practices
Reading:

a. Beasley *et al*., "Report of the Investigation Committee on the Possibility of Scientific Misconduct in the Work of Hendrik Schön and Coauthors," pp. 1-19 + A1-3. Link: http://w.astro.berkeley.edu/~kalas/ethics/documents/schoen.pdf
b. McGinn, "Ethical Issues in Nanoscience and Nanotechnology: Reflections and Suggestions"
c. McGinn, "Ethics and Nanotechnology: Mapping the View of the NNIN Community" (text of questionnaire)
d. McGinn, "Nanotechnology and Ethics: A Short Guide to Ethical Responsibilities of Nanotechnology Researchers at NNIN Laboratories"
e. McGinn, "Stanford Nanofabrication Facility Ethics Module: 2013-15"

Th 11/16 Seminar Discussion
Reading:

a. reread the items assigned for Tuesday, 11/14
b. McGinn, Case 3
c. McGinn, Case 10
d. **Special Assignment for 11/16**: having carefully revisited the readings for 11/14, each student is to come to seminar section on 11/16 having chosen a **specific issue or question** discussed in or raised by one of the readings that s/he finds interesting and/or important. When called upon, each student will make 1-2 minutes of comments that s/he believes illuminates the item s/he has chosen.

In doing so, the student might….

- criticize some idea, thesis, or argument in an essay,
- call into question an item in one of the questionnaires,
- make an observation about some ethical issue related to nanotechnology covered (or not covered) in one of the assigned items, or,

- formulate a query about the responses to a specific questionnaire item that the student would like to know about. Please be prepared to indicate why you would find knowing the answer to that item interesting or noteworthy.

  The key thing is to **be creative and add value** to our discussion of ethical issues related to nanotechnology with your issue, question, critical comment, suggestion, etc.

9 Tu 11/28 Emerging Ethical Issues in Bioengineering
Reading:

a. Galanie *et al*., "Complete Biosynthesis of Opioids in Yeast," https://archive.ernstchan.com/w/src/1444205691954098.pdf (Copy this URL and paste it into your browser's address bar/location bar.) Read from p. 1095 through the 1st column on p. 1097, + p. 1100. Don't worry about grasping the fine technical details if unfamiliar with them!
b. Funk, Cary, Kennedy, Brian, and Podrebarac Sciupac, Elizabeth, "Public Opinion on the Future Use of Brain Implants," http://www.pewinternet.org/2016/07/26/public-opinion-on-the-future-use-of-brain-implants/
c. McGinn, Case 18

Th 11/30 Seminar: STUDENT DUO CASE PRESENTATIONS I

10 Tu 12/5 Resources and Options for Would-be Ethically Responsible Engineers + Conclusion
Reading:

a. McGinn, Ch. 5
b. McGinn, Ch. 6
c. McGinn, Case 15

Th 12/7 Seminar: STUDENT DUO CASE PRESENTATIONS II

12/? FINAL EXAM (date and time to be determined)

VI. The In-Class Presentations

Seminar members, having worked in pairs, will make joint in-class presentations. Each of you is welcome (but not required) to partner with a class member majoring in your field, so that the two of you can choose a case that relates to your area of specialization.

Each carefully timed presentation, lasting 15 minutes, must revolve around an **original case study** of an actual incident or episode involving *an interesting, non-obvious ethical issue or conflict in contemporary engineering work*. **Your presentation MUST focus on the conduct of actual engineers, NOT non-engineer managers.**

The case study may be based on one or more kinds of research, e.g., location and analysis of courtroom records, in-person or telephone interviews with one or more 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. 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 will speak with other parties, or received/will receive useful documents reflecting their perspectives and would find it useful to obtain views of the party with whom you wish to speak for the sake of doing justice to both sides in the case, or to do justice to the richness and complexity of the case in question.

Again, be sure that some **engineers** are centrally involved in your case and that an **ethical** issue is too, not a legal or economic issue.

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 to appreciate the situation that faced the engineer(s) in question; i.e., noteworthy aspects of how the technology in question is socially situated, either in an engineering work situation of design, manufacture, construction, or implementation, or in the social setting in which the technological product is operated and/or used;

3. explicit identification and characterization of the ethical issue or conflict in question;

4. probing analysis of the ethical issue or conflict (e.g., of its genesis, trajectory and outcome); evaluation of the strengths and weaknesses of the arguments made on both sides of the disagreement; etc.);

5. fruitful use of some course materials in your ethical analysis; and

6**. delineation of one or more noteworthy lessons** about ethical issues in engineering that you and your partner extracted from your case.

VII. Details for Articles in the *E131 Course Reader:*

Week 1:

1. R. McGinn, Ch. 1. [Note: revised versions of Ch. 1, 2, 3, 5, and 6, and the assigned Cases will appear in R. McGinn, *The Ethical Engineer: Contemporary Concepts and Cases*, to be published by Princeton University Press in February 2018.]

Week 2:

2. T. Reynolds, "The Engineer in Nineteenth-Century America," in T. Reynolds, ed., THE ENGINEER IN AMERICA (Chicago: U. of Chicago Press, 1991), 7-26.
3. T. Reynolds, "The Engineer in Twentieth-Century America," in T. Reynolds, ed., THE ENGINEER IN AMERICA (Chicago: U. of Chicago Press, 1991), 169-190.
4. National Society of Professional Engineers (NSPE), Code of Ethics for Engineers (1990).
5. American Society of Civil Engineers (ASCE), Code of Ethics (1993).
6. Association for Computing Machinery (ACM), Code of Ethics (1993).
7. R. McGinn, Ch. 3.

Week 3:

8. H. Petroski, "Accidents Waiting To Happen," from Henry Petroski, TO ERR IS HUMAN (New York: Vintage, 1992), 85-97.
9. R. Rubin, L. Banick, and C. Thornton, "The Hyatt Decision: Two Opinions," CIVIL ENGINEERING, September 1986, 69-72.
10. R. McGinn, Case 14.

Week 4:

11. R. Boisjoly, "Ethical Decisions: Morton Thiokol and the Space Shuttle Challenger Disaster," *ASME*, 87-WA/TS-4, pp. 1-13.
12. D. L. Parnas, “SDI: Violation of Professional Responsibility,” ABACUS, Vol. 4, No.2, 1987 (Springer Verlag), pp. 46-52.
13. R. McGinn, Case 8.

Week 5:

14. S. Beder and M. Shortland, "Siting A Hazardous Waste Facility: the Tangled Web of Risk Communication," *Public Understanding of Science*, Vol. 1, 1992, pp. 139-160.

15. Brown, B. “Ethics and the Engineering Consultant: An Autobiographical Case Study” (1996) (no copyright).

Week 6:

16. R. McGinn, Case 7

Week 7:

17. O’Brian and Streitfeld, “Swiss Court Orders Modifications to Street View,” NYT, 6/8/1/2 (LN)
18. Ewing, Jack, “Inside VW’s Campaign of Trickery,” NYT, May 7, 2017 (LN)

19. Ewing, Jack, “Arrest of Former Audi Executive Highlights VW Investigators’ Strategy,” NYT, July 7, 2017 (LN)
20. Lohr and Streitfeld, “Data Engineer in Google Case Is Identified,” NYT, 4/30/12 (LN)
21. Anderson *et al*., “Case 2: Privacy” http://www.acm.org/about/p98-anderson.pdf
22. Sharkey and Sharkey, “The Crying Shame of Robot Nannies: An Ethical Appraisal,”
https://www.lucs.lu.se/wp-content/uploads/2016/01/KKEG16_sem2_the-crying-shame-of-robot-nannies.pdf
23. Barnes, “Where Did You Go, Raggedy Ann? Toys in the Age of Electronics,” NYT, 2/10/01. (LN)

Week 8:

24. M. Beasley *et al*., ““Report of the Investigation Committee on the Possibility of Scientific Misconduct in the Work of Hendrik Schön and Coauthors,” pp. 1-19 + A1-3. http://w.astro.berkeley.edu/~kalas/ethics/documents/schoen.pdf
25. R. McGinn, “Ethical Issues in Nanoscience and Nanotechnology: reflections and Suggestions” (2003) (no copyright)
26. R. McGinn, “Ethics and Nanotechnology: The NNIN Survey” (2005) (no copyright)
27. R. McGinn, “Nanotechnology and Ethics: A Short Guide to Ethical Responsibilities of Nanotechnology Researchers at NNIN Laboratories” (2008) (no copyright).
28. R. McGinn, “Stanford Nanofabrication Facility: Ethics Module (2013-2015)” (no copyright).

Week 9:

29. S. Galenie *et al*., “Complete Biosynthesis of Opioids in Yeast,” https://archive.ernstchan.com/w/src/1444205691954098.pdf
30. Funk, Cary, Kennedy, Brian, and Podrebarac Sciupac, Elizabeth, “Public Opinion on the Future Use of Brain Implants,” http://www.pewinternet.org/2016/07/26/public-opinion-on-the-future-use-of-brain-implants/
31. R. McGinn, Case 18

Week 10:

31. R. McGinn, Ch. 5
32. R. McGinn, Ch. 6
33. R. McGinn, Case 15