

Spring 2024

## PHIL 334-102: Engineering Ethics

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# Engineering Ethics and Technological Practice: Philosophical Perspectives on Engineering

## SYLLABUS

### Course Information

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Course: Engineering Ethics and Technological  
Practice: Philosophical Perspectives on  
Engineering

Number/section: PHIL 334 – 102

Semester: Spring 2024

Time: Tuesday, 6 p.m. to 8:50 p.m.

Location: Faculty Memorial Hall 319

Instructor: Peter Heap

Email: peter.heap@njit.edu

Office hours: I am available before or after class.  
Email me if you want to set an  
appointment.

Prerequisites: HUM 102 with a grade of C or  
higher, and one History and Humanities  
GER 200 level course with a grade of C  
or higher.

### Learning Objectives

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At the end of this course, students will be able to:

- Identify ethical issues
- Describe different ethical decision-making approaches
- Analyze engineering ethics cases
- Apply different ethical decision-making approaches to engineering ethics cases
- Recognize the ethical responsibilities of engineers
- Evaluate the broader societal and environmental impacts of engineering
- Develop and defend positions about issues in engineering ethics

### Description

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Ethics is an integral part of the practice of engineering. Many, if not all, engineering tasks have an ethical component and incorporate a philosophical outlook. To engineer without an ethical and philosophical understanding is to engineer badly.

This purpose of this class is to help students become better engineers by giving them an understanding of how ethics and philosophy are an inseparable component of engineering. To do this, we will look at ethical and philosophical theories and see how they make the problems of engineering clearer.

The course will emphasize case studies of particular examples in engineering. Rather than dictating viewpoints to students, it aims to equip them with the tools and abilities to think through engineering problems from an ethical and philosophical perspective.

## Books

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You will need to buy the following books:

- Mike W. Martin and Roland Schinzinger, *Ethics in Engineering*, fourth edition, McGraw-Hill, 2005. ISBN 978-0-07-283115-3.
- Langdon Winner, *The Whale and The Reactor*, University of Chicago Press, 1989. ISBN 978-0-226-90211-0. Or second edition, University of Chicago Press, 2020. ISBN 978-0-226-69254-8.

Other readings will be available via URLs, from the NJIT library website or by email.

## Grading

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Grading will be as follows:

- Class participation and attendance: 14%
- Engineering as experimentation homework: 5%
- Forms of life homework: 5%
- Forms of life case study: 15%
- Ethics case study: 15%
- Mid-term exam: 12%
- Final exam: 34%

### Class participation and attendance

Discussion is an important part of improving our understanding, clarifying our ideas and discovering different points of view. It also helps develop the valuable skill of being able to explain and defend a point of view. Debate will be encouraged in this course. The grade is 1% per week for every week except the final exam week, divided between attendance and participation. Total: 14% of grade.

### Homework

There are two short homeworks. In the first you will analyze the Teton Dam case using the model of engineering as experimentation. The second will ask you to analyze the telephone as a form of life. Total: 5% each for a total of 10% of grade.

### Forms of life essay

To better understand the impact of technology, for this assignment you will go without a specific technology for a day. You will then report on your experience and analyze it using the perspective of forms of life. Total: 15% of grade.

### Ethics case study

The study will have two parts. Identification of a case and sources (minus 1% from grade if not done), and description and analysis using theories discussed in class. Total: 15% of grade.

### Mid-term exam

The mid-term exam will be made up of four short essay questions worth 3% per question. You will have a choice of questions. Total: 12% of grade.

## Final exam

The final exam will be made up of four short essay questions worth 3% per question, six multiple-choice questions worth 1% each and two longer essay questions worth 8% per question. You will have a choice of questions. The exam will cover the entire semester. Total: 34% of grade.

## Grades

The maximum grade for the class is 100%. Letter grades will be assigned as follows:

90 to 100:	A	70 to 74:	C
85 to 89:	B+	60 to 69:	D
80 to 84:	B	59 and less:	F
75 to 79:	C+		

## Deadlines

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Work is due on the dates shown in the class schedule. Numerical grades for late submissions will be multiplied by 0.95 for up to 48 hours late, 0.9 for up to a week late and 0.8 for up to two weeks late. No work will be accepted later than two weeks after the due date or after the start of final exams.

## Plagiarism and Academic Integrity

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Plagiarism or copying of any kind will not be tolerated. All work must be your own. Specifically, it must be your own thoughts and your own ideas expressed in your own words. Any use of others' efforts must be credited via a citation. This includes computer and artificial intelligence tools such as ChatGPT and Grammarly. If you use these tools you must credit their contribution via a citation and put direct quotations from these tools inside quotation marks. NJIT's policy is as follows:

Academic integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at:

<http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>

Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students' office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will be subject to disciplinary action. This may include a failing grade of F and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at [dos@njit.edu](mailto:dos@njit.edu)

# Class Schedule

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## January 16

**Introduction:** Plan of the course, introduction to ethics and to ethics in engineering

## January 23

**Key ideas for engineering:** Commitment, professionalism, responsibility

**Professional ideals and business demands:** Engineers' two roles, the purpose of a corporation, the Revolt of the Engineers

**Ethical theories:** Deontological ethics, utilitarianism, virtue ethics and more

Mike W. Martin and Roland Schinzinger, "Ethics and Professionalism," in *Ethics in Engineering*, 1-29.

## January 30

**Case studies:** Northern States Power, San Diego water purification

**Two models of engineering:** Engineering as experimentation, engineering as pragmatic participation

**Case studies:** Samsung Galaxy Note 7, the electricity grid

Mike W. Martin and Roland Schinzinger, "Engineering as Social Experimentation," in *Ethics in Engineering*, sections 4.1 and 4.2, 88-106

Anna Shedletsy, "Aggressive Design Caused Samsung Galaxy Note 7 battery explosions," Instrumental, Inc., Dec. 1, 2016. <https://instrumental.com/resources/failure-analysis/aggressive-design-caused-samsung-galaxy-note-7-battery-explosions/>

Olive Heffernan, "Bottoms Up," *Scientific American*, July 2014, 69-75. (Available from NJIT library website via JSTOR.)

Peter Fairley, "Building a Weather-Smart Grid," *Scientific American*, July 2018, 60-65.

[https://www.researchgate.net/publication/325891548\\_Building\\_a\\_Weather-Smart\\_Grid](https://www.researchgate.net/publication/325891548_Building_a_Weather-Smart_Grid)

*Homework due February 6:*

**Case study:** Teton Dam

Philip M. Boffey, "Teton Dam Verdict: A Foul-up by the Engineers," *Science*, Vol. 195, No. 4275, Jan. 21, 1977, 270-272 (Available from NJIT library website)

These pictures show what happened:

Wikipedia, "Teton Dam," [https://en.wikipedia.org/wiki/Teton\\_Dam#Collapse\\_and\\_flood](https://en.wikipedia.org/wiki/Teton_Dam#Collapse_and_flood)

## February 6

**Case study:** Challenger disaster

**Forms of life, political technology**

**Case study:** Cellphones, social media

Mike W. Martin and Roland Schinzinger, "Challenger," in *Ethics in Engineering*, 106-114.

Langdon Winner, "Technologies as Forms of Life," "Do Artifacts Have Politics?" in *The Whale and the Reactor*, 3-39.

- Teton Dam homework due

*Homework due February 13:*

**Forms of life:** The telephone

Ithiel de Sola Pool, *Forecasting the Telephone: A Retrospective Technology Assessment*, Ablex, 1983, 41-45 (Will be distributed).

## February 13

**Perceptions, safety, risk:** How technology changes perceptions, how we perceive technology, risks versus hazards

**Case studies:** Flight 965, Chernobyl and Three Mile Island

John Edward Huth, "Losing Our Way in the World," *New York Times*, July 21, 2013.

<https://www.nytimes.com/2013/07/21/opinion/sunday/losing-our-way-in-the-world.html>

Federal Aviation Administration, American Airlines Flight 965 near Cali: Accident Overview.

[https://www.faa.gov/lessons\\_learned/transport\\_airplane/accidents/N651AA](https://www.faa.gov/lessons_learned/transport_airplane/accidents/N651AA)

Mike W. Martin and Roland Schinzinger, "Commitment to Safety," in *Ethics in Engineering*, 117-143.

Langdon Winner, "On Not Hitting the Tar-Baby," in *The Whale and the Reactor*, 138-154.

- Forms of life homework due

## February 20

**Moral reasoning:** A five-step process

**Case study:** The Ford Pinto

Mike W. Martin and Roland Schinzinger, "Resolving Ethical Dilemmas" in *Ethics in Engineering*, 32-39

Mark Dowie, "Pinto Madness," *Mother Jones*, September/October 1977.

<http://www.motherjones.com/politics/1977/09/pinto-madness>

## February 27

### Review for mid-term exam

**Cost-benefit analysis and utilitarianism:** Working for a tobacco company, criticisms and responses

Steven Kelman, "Cost-Benefit Analysis: An Ethical Critique," *The American*, Feb. 7, 1981.

<https://www.aei.org/articles/cost-benefit-analysis-an-ethical-critique/>

James V. DeLong, Robert M. Solow, Gerard Butters, John E. Calfee, Pauline Ippolito and Robert A. Nisbet, "Defending Cost-Benefit Analysis: Replies to Steven Kelman," *The American*, April 11, 1981. <https://www.aei.org/articles/defending-cost-benefit-analysis-replies-to-steven-kelman/>

- Forms of life essay due

## March 5

### Midterm exam

#### Technological revolutions

Langdon Winner, "Mythinformation," in *The Whale and the Reactor*, 98-117 (If you are short of time: 106-115).

Optional: Langdon Winner, "Building the Better Mousetrap" and "The Whale and the Reactor," in *The Whale and the Reactor*, 61-84, 164-178 (These chapters will be discussed briefly but you are not expected to read them).

Nolen Gertz, *Death by Robot*, ABC, July 12, 2016. <https://www.abc.net.au/religion/death-by-robot-the-ethics-of-turning-assistive-technologies-into/10096776>

Atlas, the Next Generation. <https://youtu.be/rVlhMGOgDkY>

Otto and Budweiser: *First Shipment by Self-Driving Truck*.  
[https://www.youtube.com/watch?v=BH2pQ\\_Uq77I](https://www.youtube.com/watch?v=BH2pQ_Uq77I)

## March 12

### Spring break – no class

## March 19

**Whistleblowing:** The ethical dilemma, when is it permissible, when is it required?

Dennis A. Gioia, "Pinto Fires and Personal Ethics: A Script Analysis of Missed Opportunities," *Journal of Business Ethics*, 1992, Vol. 11 (5), 379-389. (To be distributed)

Mike W. Martin and Roland Schinzinger, "Whistleblowing," in *Ethics in Engineering*, 172-184.

Jerry Knight, "Tylenol's Maker Shows How to Respond to Crisis," *The Washington Post*, Oct. 11, 1982.  
<https://www.washingtonpost.com/archive/business/1982/10/11/tylenols-maker-shows-how-to-respond-to-crisis/bc8df898-3fcf-443f-bc2f-e6fbd639a5a3/>

Russell Hotten, "Volkswagen: The Scandal Explained," *BBC News*, Dec. 10, 2015.  
<https://www.bbc.com/news/business-34324772>

## March 26

### Codes of ethics

**Ethical relativism:** Are ethical values the same everywhere and for everyone?

### International business and offshoring

**Case study:** Bhopal

**Case study:** Tesla

Mike W. Martin and Roland Schinzinger, "Codes of Ethics," in *Ethics in Engineering*, 44-52.

Mike W. Martin and Roland Schinzinger, "Multinational Corporations," in *Ethics in Engineering*, Sections 9.1.2, 9.1.3, 9.1.4 and 9.1.5, 245-252.

Cherri Pancake, "Programmers need ethics when designing the technologies that influence people's lives," *The Conversation*, Aug. 8, 2019. <https://theconversation.com/programmers-need-ethics-when-designing-the-technologies-that-influence-peoples-lives-100802>

Neil Boudette, "Tesla Says Autopilot Makes Its Cars Safer. Crash Victims Say It Kills," *New York Times*, July 5, 2021. <https://www.nytimes.com/2021/07/05/business/tesla-autopilot-lawsuits-safety.html>

Eric A. Taub, "Can Tesla's Autopilot be Trusted? Not Always," *New York Times*, Sept. 23, 2016. <http://nyti.ms/2d6WthQ>

Neil E. Boudette, "Big Carmakers Merge, Cautiously, Into the Self-Driving Lane," *New York Times*, Sept. 1, 2016. <http://nyti.ms/2c4RwWz>

## April 2

### Autonomous systems

Paul Scharre, "Autonomous Weapons and Operational Risk," *Center for a New American Security*, 1-40, (41-54 is optional). <https://www.cnas.org/publications/reports/autonomous-weapons-and-operational-risk>

Christopher Salge, "Asimov's Laws Won't Stop Robots Harming Humans So We've Developed a Better Solution," *The Conversation*, July 10, 2017. <https://theconversation.com/asimovs-laws-wont-stop-robots-harming-humans-so-weve-developed-a-better-solution-80569>

Daniel Dennett, "Consciousness in Human and Robot Minds," in *Cognition, Computation, and Consciousness*, ed. Masao Ito, Yasushi Miyashita and Edmund T. Rolls, Oxford University Press, 1997, 17-21, skim through 22-27, 28-29. <https://dl.tufts.edu/concern/pdfs/kk91fz19k>

- Ethics case study: Identify a case



## April 9

**Engineering and the environment:** Attitudes to nature, the Invisible Hand, the Tragedy of the Commons, externalities, theories of environmental responsibility

**Case study:** Southern Co.'s clean coal project

Langdon Winner, "The State of Nature Revisited" in *The Whale and the Reactor*, 121-137

Mike W. Martin and Roland Schinzinger, "Environmental Ethics," in *Ethics in Engineering*, 219-239.

Ian Urbina, "Piles of Dirty Secrets Behind a Model 'Clean Coal' Project," *New York Times*, July 5, 2016.  
<https://www.nytimes.com/2016/07/05/science/kemper-coal-mississippi.html>

## April 16

**Professionalism, responsibility, honesty**

Mike W. Martin and Roland Schinzinger, "Workplace Responsibilities and Rights" and "Honesty," in *Ethics in Engineering*, sections 6.1 to 6.3, 146-172, chapter 7, 189-216.

- Ethics case study: Analysis due

## April 23

**Review for final exam**

**Weapons:** Just war theory, examples

**Personal fulfillment, personal values**

Mike W. Martin and Roland Schinzinger, "Weapons Development," in *Ethics in Engineering*, 266-269.

Mike W. Martin and Roland Schinzinger, "Self-Realization and Self-Interest," in *Ethics in Engineering*, 72-79.

## April 30

**No class**

## May 7

**Final exam, 6 p.m. – 8:30 p.m.**