Purdue's Engineer of 2020
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Final Report for

Development and Assessment of "Ethics in Engineering Practice": A New Technical Support Elective

Target Attribute(s) studied/implemented: Acting with high ethical standards in the global, social, intellectual and technological context

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Final Report and Assessment of "Ethics in Engineering Practice": A New Technical Support Elective

Background and Motivation for Course Development

The primary mission of the College of Engineering is to educate the next generation of engineering leaders from across the United States and abroad and to prepare them for work in technical fields. Purdue does a superior job of imparting technical knowledge to our students, as evidenced by employers' interest in our students and consistently high rankings by our peers and national news magazines. However, while technical competence is necessary, it is not a sufficient condition for the engineer of 2020 to be successful as noted in a recent NAE document,[1] and as acted upon recently in the Schools of Engineering.[2] Our students must possess other attributes if Purdue is to continue as a world leader in undergraduate education. Within the engineering and scientific community, it is difficult to overestimate the importance of acting with high ethical standards in global, social, intellectual and technological contexts. When this attribute is intrinsic in engineers and scientific personnel, we rarely take note, but when it is absent and ethical standards break down, the world notices.

In recent years, there have been many well-documented engineering failures, including the losses of the *Challenger* and the *Columbia*, the Kansas City Hyatt Regency skywalk collapse, and the Exxon Valdez oil spill, as well as several high-profile cases of academic and scientific dishonesty in research. While the circumstances for each example are different, the underlying theme of each is that an individual or group of company employees was faced with ethical dilemmas in the performance of their jobs. Poor choices made in each of these cases had substantial impact on many people and have been the subject of significant public scrutiny. James Kroll, Head of Administrative Investigations in the Office of Inspector General at the National Science Foundation, estimates that between 2003-2008 the number of substantial ethics inquiries at the NSF has increased from 3 per year to 37 per year.[3] These, he said, are "serious investigations where there are breeches of conduct regarding a NSF grant." The National Academy of Engineers has even developed a fairly comprehensive website to educate engineers about this issue.[4] According to a 1999 article by Stephan, nearly three-quarters of the engineering programs in the U.S. allow at least some students to graduate without taking a course whose catalog description mentions ethics.[5] The College of Engineering at Purdue University fall into this category.[a]

Course Structure and Organization

To meet the requirements for the engineer of 2020 and to address the need for formal training in ethics, Professors Trice and Krane proposed in 2009 to develop a semester-long course for our engineering undergraduates. We taught this course for the first time in Spring 2010. *Our objective was to demonstrate that exposure to and involvement in an ethics course specifically designed for engineers can mature the moral reasoning skills of those students who participate.* The course designed was as follows:

I. Present and discuss common ethical theories and applications
II. Investigate engineering-based case studies (Faculty-led case study investigations)
III. Teach students how to investigate and apply their knowledge to real situations (Student-led case studies and analysis)

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[a] Note that there are several course available on campus that contain a short ethics unit, including CE 394 and MSE 430. ME 492, *Technology and Values*, examines the role of technology in society rather than consideration of ethics on a personal scale, as is being proposed here.

In designing our course, we drew upon the observations of Haws[6] in his meta-analysis of 42 papers presented from 1996-1999 at American Society for Engineering Education (ASEE) conferences. Each of the papers he analyzed treated engineering ethics as a coherent educational objective. He noted six pedagogical approaches to teaching this class, including discussion of the professional engineer's code of ethics, humanist readings, theoretical grounding, ethical heuristics, case studies, and service learning. We used three of these approaches in the proposed class. Section I grounded the students in ethical theory. Haws[6] noted in his article that not grounding students in ethical theory is "probably the greatest single weakness in engineering ethics instruction." The remaining part of the course utilized faculty-led (Section II) and student-led case studies (Section III) to continue to mature their moral reasoning skills.

The final course schedule used in the course is present in Appendix I. We followed the original course design closely, with a few modifications. In particular, we found that students were motivated by an occasional faculty-led case study during the presentation of ethical theory (Section I of the course). For example, the Shiley Heart-Valve case was discussed during the virtue based ethics presentations. When this course is taught again, we will move 1-2 more case studies to the theory part of the course and integrate them better with the contemporaneous lecture topics.

In Section I we presented the three basic ethical systems: consequentialist, principled, and virtue-based ethics. *Consequentialist* ethics asks the question, "What path produces the best results?" Consequentialist ethical theory includes discussions of Ethical Egoism, popularized by Ayn Rand, and Utilitarianism, first proposed systematically by Jeremy Bentham in the 18th and 19th centuries. A presentation of *principled* ethics followed, with an emphasis on Immanuel Kant. Principled ethics asks the question "What are my duties in these circumstances?" The final major ethical theory discussed was *virtue-based* ethics. Virtue-based ethics asks the question, "Whom should I become and what virtues should I habitually practice?" We used the sixth edition of *Ethics: Discovering Right and Wrong*, by Louis P. Pojman and J. Fieser (a Purdue graduate) and a translation of Aristotle's *Nichomachean Ethics* to supplement lectures.

For Section II of the course the following case studies were developed and presented by the Professors Trice and Krane:

1. Shiley Heart-Valve Case
2. Kansas City Hyatt Regency Skywalk Case
3. Desmarquest Ceramic Femoral Head
4. Bell Laboratories: Research Fraud by Jan Hendrik
5. Space Shuttle *Challenger*

We also applied the ethical theories taught in Section I to topics including risk and reliability, trust and loyalty, organization culture and its influence on decision making (including the role of authority) and research fraud. Readings from texts and the archival literature on ethics specifically in engineering practice were also used to supplement lectures. Invited speakers were also part of the course. Mr. Michael Lotus, a Chicago attorney who practices product liability law, discussed the possible interactions of engineers with the legal system, including how lawyers view the engineering profession, the role of the expert witnesses, and the importance of character in the courtroom. Dr. Laura Sands, a professor in the Purdue School of Nursing, discussed her approach to research on human subjects, including patient rights and informed consent.

In Section III of the course, student groups of 2 or 3 gave presentations on several high-profile engineering failures with potential ethical components. These included:

1. Ford Pinto Recall
2. DC-10 Cargo Hatch

3. Citicorp Building and Wm. LeMessurier
4. Chernobyl
5. Three Mile Island
6. Ford Explorer Rollover
7. Boston's Big Dig Ceiling Collapse

The presentations were 15-20 minutes long, with a total of 25 minutes allotted for each group's talk and Q&A. It was important that we see both technical understanding and understanding of ethical theory in their presentation. The overall average of the presentations was 75%.

Syllabus, Course Description and Marketing

The syllabus for the course is presented in Appendix II. In addition to the student-led group case studies, we also gave various writing assignments, a midterm exam, and required the students to keep a journal of their writing assignments. The exam and cumulative writing assignments are presented in Appendix III and IV, respectively.

The following course description was used to advertise the course:

> A new 3-cr hour course for junior and senior engineering majors will be taught this spring that will explore both the theory and application of ethics within the practice of the engineering discipline. This new course will include presentation and discussion of common ethical theories and their applications, with faculty- and student-led case studies from real engineering practice . Guest lecturers will also be invited to address key issues such as product liability law, engineering and public policy, etc.

This description, along with a flyer, was emailed to various academic advisors within the College of Engineering during the registration period for the Spring 2010 semester. We also included a short description of how this class would fit within the particular major's requirements for graduation. Twenty-one students enrolled in the course from MSE, ME, ECE, NE, and IDE.

ASSESSMENT OF STUDENT KNOWLEDGE AND APPLICATION

In terms of assessing the knowledge gained, we used a written exam (see Appendix IV) after Section I of the course to measure students' understanding of the basic ethical theories. A series of simple matching and definitions were used to measure basic knowledge. Several straight-forward scenarios were used where students were asked to adopt a particular ethical theory and comment on how you would respond. The exam was overall designed to be straightforward with at least 95% of the examined material covered in class (and the rest from the reading). Exam scores ranged from 36% through 93%, with an average of 60%. These were somewhat lower than desired and additional emphasis will be placed on the knowledge that was deficient. However, it should be noted that this is the first time that most of these students have every been exposed to a rigorous study of moral philosophies.

Writing assignments were used to assess a student's ability to formulate and defend an argument. This task was, frankly, very difficult for at least 50% of the class. Improvement was noted as the course progressed. If this class is taught again, we will spend 1 lecture on how to write and develop arguments in a philosophy paper.

Student-led group case studies were presented the last 2 weeks of the semester. Grades ranged from 60% to 87%, with an average of 75%. Students overall were able to address both the technical and ethical reasons for failure. However, some students struggled with clearly articulating the ethical analysis with

regards to decision making of the key groups or individuals in the study. We believe that we can ameliorate this deficiency by making this clearer in the case studies that we give to the class.

Assessment of Student Moral Reasoning

We measured the progress of moral reasoning skills using the Defining Issues Test (DIT2). The assessment was given during the second and the penultimate lectures to assess changes in moral reasoning after completing the course.[7] This test presented five moral dilemmas, each followed by 12 issue statements. In a 1998 paper, Self et al.[8] assessed student's moral reasoning using the DIT in a manner similar to our method, and measured statistical differences in reasoning skills before and after being taught some ethics content. They concluded that the effect of teaching ethics in engineering can be "rigorously measured."

Before describing these results, it is important to provide some background on the DIT2 test. A recent article in the *Review of Higher Education* [9] described the DIT2 test as measuring "the degree to which students use principles to guide their decision making when faced with a moral dilemma." The N2 score is reported presently; the N2 is comprised of two parts to include the degree to which respondents demonstrate more sophisticated thinking and the degree to which respondents reject simplistic or biased thinking when faced with moral dilemmas.[9] The article goes on to say that "higher N2 scores reflect an individual's increased capacity for reasoning about moral issues based on a system of fairness that serves the public good."[9]

The DIT2 test has been used extensively and correlations with educational levels have been noted. [10] senior high students average in the 30s, college students in the 40s, students graduating from professional schools in the 50s, and Moral Philosophy doctoral students in the 60s.

Table 1, then, shows an average "pre-class" N2 score of 40±13. This small student sample correlates very well with the N2 scores for first year college students in a large multi-university study. They measured N2 scores of 41±15.[9] After taking the course, we measured a N2 score of 51±11, indicating substantial improvement in their moral reasoning ability as defined by the DIT2 test.

Figure 1 compares the pre- and post-class scores of each of 19 students. (No data were kept on individual students by name. Each student selected an identification number that allowed this matching.) What is interesting is to note is that 17 of the 19 students demonstrated an increase in their moral reasoning skills; improvements ranged from a statistically insignificant value of 1 through a more impressive increase of 28. Furthermore, the number of students scoring at the same education level as graduating from a professional school jumped from 5 pre-class to 12 post-class. Overall, these results are encouraging, as it appears that the course experience has helped the students to mature their moral reasoning skills.

Table 1. Results of the DIT2 Tests Given to Students Participating in the Engineering Ethics Class.

Pre-Class N2 Score on DIT2	Post-Class N2 Score on DIT2	Number of Students With Increased N2 Scores	Number of Students Scoring Above 50
40.42 ± 13.56	50.72 ± 11.36	17 of 19	5 Pre-Class/12 Post-Class

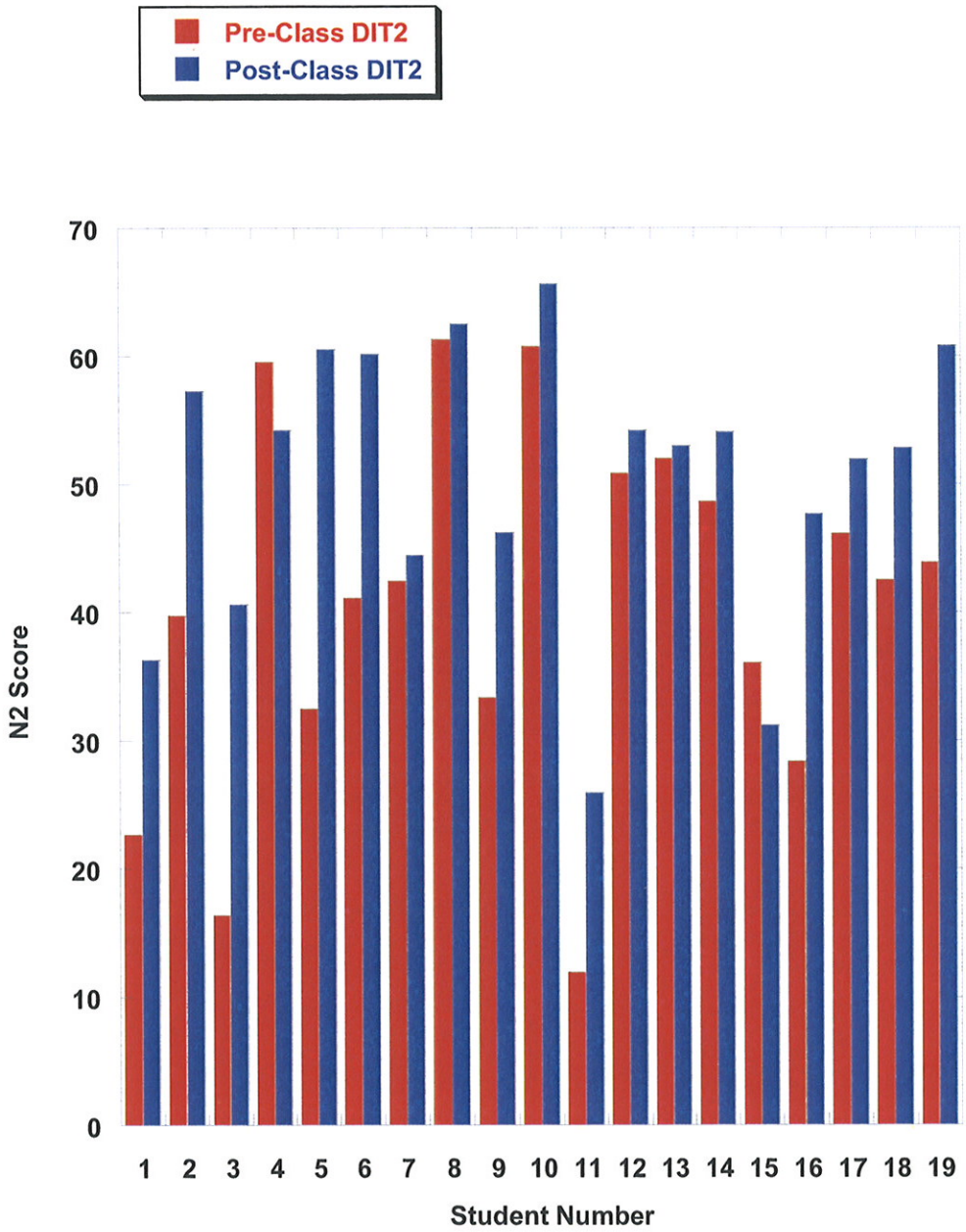

Figure 1. Bar graph of the N2 scores pre- and post-class indicating significant improvement in overall score.

CLASS SUSTAINABILITY, DISSEMINATION, AND FUTURE RESEARCH EFFORTS

While 21 students was a reasonable number for the first time this course was taught, a larger impact was desired. Thus, we will continue to promote this class among other engineering schools to increase class enrollment. In particular, discussions have been made with BME to include this course on their list of approved selections for their ethics requirement. Furthermore, presentation of the course and its assessment at a future undergraduate chairs meeting will provide an opportunity to publicize it.

The development of a shortened module that could be inserted into other senior capstone or other classes is also being considered. While we are somewhat hesitant that a 5-8 lecture module could have the same effect as a 15 week course, it might be an interesting research study to perform.

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[1] National Academy of Engineering, *The Engineer of 2020* (2004).
[2] Purdue EFD 15-06, Adoption of the Purdue Engineer of 2020 Target Attributes.
[3] J. T. Kroll, Office of the Inspector General at NSF, oral presentation at NSF-CMMI Grantees Conference, Knoxville, TN, January 8, 2008, and a phone call on January 25, 2008.
[4] www.onlineethics.org/
[5] Karl D. Stephan, "A Survey of Ethics-Related Instruction in U.S. Engineering Programs," J. Eng. Ed., **10** 459-64 (1999).
[6] David Haws, "Ethics Instruction in Engineering Education: A (Mini) Meta-Analysis," J. Eng. Ed, 4 223-9 (2001).
[7] Developed by James Rest; See the Center for the Study of Ethical Development, University of Minnesota; http://www.centerforthestudyofethicaldevelopment.net/index.html
[8] D. J. Self, and E. M. Ellison, "Teaching Engineering Ethics: Assessment of its Influence on Moral Reasoning Skills," J. Eng. Education, **87** [1] 29-34 (1998).
[9] M. J. Mayhew, T.A. Seifert, and E.T. Pascarella, "A Multi-Institutional Assessment of Moral Reasoning Development Among First Year Students," The Review of Higher Education, Spring 2010, **33** [3] 357-390.
[10] Guide for DIT-2 Test, provided by the Center for the Study of Ethical Development

MSE 497 Tentative Schedule

Red dates indicate assignment due

	Mtg	Date	Topics	Reading Assignments	Misc.
1	L1	Jan 11	Class Overview		K1
	L2	Jan 13	Defining Issues Test – Assessment		
	L3	Jan 15	General Case Studies		K/T
		Jan 18	MLK Day		
2	L4	Jan 20	What Elements Should Ethical Theory Consider?	Pojman, Ch. 1	T2
	L5	Jan 22	Ethical Relativism/Moral Objectivism	Rachels; Pojman Ch. 2	T3
3	L6	Jan 25	Ethical Relativism/Moral Objectivism		T4
	L7	Jan 27	writing		
	L8	Jan 29	Ethical Relativism/Moral Objectivism	Pojman Ch. 3	T5
4	L9	Feb 1	Consequentialist Ethical Systems	Pojman Ch. 6,7	T6
	L10	Feb 3	Consequentialist Ethical Systems	Pojman Ch. 8	T7
	L11	Feb 5	Consequentialist Ethical Systems		T8
5	L12	Feb 8	Consequentialist Ethical Systems		T9
	L13	Feb 10	Consequentialist Ethical Systems		T10
	L14	Feb 12	Virtue based ethics	Pojman Ch 9.; Aristotle, *Nic. Ethics I*	K3
6	L15	Feb 15	Faculty Case Study: Heart valves (T)		T11
	L16	Feb 17	Faculty Case Study: Heart valves (T)		T12
	L17	Feb 19	Virtue based ethics	Aristotle, *Nic. Ethics II, III*	K4
7	L18	Feb 22	Virtue based ethics	Aristotle, *Nic. Ethics IV*	K5
	L19	Feb 24	Virtue based ethics	Aristotle, *Nic. Ethics V, VI*	K6
	L20	Feb 26	Virtue based ethics	Aristotle, *Nic. Ethics VIII, X*	
8	L21	Mar 1	Virtue based ethics		
	L22	Mar 3	Virtue based ethics		
	L23	Mar 5	Virtue based ethics		
9	L24	Mar 8	Professionalism	Davis (1997); Harris (2008)	
	L25	Mar 10	**Midterm Exam (covers lectures 1-21)**		
	L26	Mar 12	Professional virtues, Professional Codes of Ethics	NSPE Code of Ethics	
10		Mar 15	Spring Break		
		Mar 17	Spring Break		
		Mar 19	Spring Break		
11	L27	Mar 22	Michael Lotus, attorney – product liability		
	L28	Mar 24	Case study, exam, project assignment		
	L29	Mar 26	Risk and Reliability	Harris Ch 7; Martin Schinzinger Ch 4	
12	L30	Mar 29	Risk and Reliability /Trust and loyalty	Martin Schinzinger Ch 5	
	L31	Mar 31	Trust and loyalty		
		April 2	**NO CLASS**		
13	L32	Apr 5	Faculty Case Studies: *Challenger* Launch (K), Femoral Head (T)		
	L33	Apr 7	The role of organizational culture	Pinkus	
	L34	April 9	Milgram experiments (focus on exp. results)	Milgram (1963)	
14	L35	Apr 12	Milgram experiments (focus on exp. design)	McArthur (2009), Milgram (1974)	
	L36	Apr 14	Laura Sands, Professor of Nursing - human subjects		
	L37	Apr 16	Research fraud	TBA	
15	L38	Apr 19	Strategies for dealing with ethical questions		
	L39	Apr 21	Student Project Presentations		
	L40	Apr 23	Student Project Presentations		
16	L41	Apr 26	Student Project Presentations		
	L42	Apr 28	Defining Issues Test – Assessment		
	L43	Apr 30	Class Wrap-Up		

Appendix II: MSE 497 Ethics in Engineering Practice Syllabus
Spring 2010

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Required Textbook:

Ethics: Discovering Right and Wrong (6th ed.), Louis P. Pojman and James Fieser, Wadsworth Publishing, 2008, ISBN-13: 978-0495502357.

(There will be other readings provided from a variety of sources.)

Syllabus:

The practice of engineering allows us many opportunities to aid our society and the individuals in it. However, it also presents many situations in which an engineer can do harm through incompetence, malice, or inaction. There have been many well-documented engineering failures, including the losses of the *Challenger* and the *Columbia*, the Kansas City Hyatt Regency skywalk collapse, and the Exxon Valdez oil spill, as well as several high-profile cases of academic and scientific dishonesty in research. In each case, an individual or a group was faced with ethical dilemmas in the performance of their jobs. Engineers and managers made poor choices that had substantial impact on many people and have been the subject of significant public scrutiny. The purpose of this course is to provide a venue where students can learn and discuss the application of ethics in their work and research environments.

The course includes:

- Presentation and discussion of common ethical theories;
- Application of these theories to the practice of engineering;
- Faculty- and student-led presentation and discussion of case studies of failures of engineering products and organizations.

Case studies are drawn from across the engineering profession and include discussion of the interrelated technical and ethical issues. We will also invite additional lecturers to address key issues possibly including product liability law, engineering and public policy, and research on human subjects.

Evaluation:

35%	final project presentation/report
35%	midterm exam (lectures 1-21)
25%	writing assignments
5%	journal from reading assignments

Reading journal:

The reading in this class should be done *before* the class period in which it will be discussed. Completion of the reading will allow the students to better understand the lecture, to participate in discussions, and to ask pertinent questions. To aid in reading comprehension, the students are *required* to keep a journal of the reading assignments. In this journal, a summary of each assignment will be made which will not be graded for style, but for coverage. The purpose is to compel the careful reading and aid in committing the major ideas to memory. Students will be responsible for the material in the readings, although not all of it will be covered in the lecture.

Appendix III

Homework Assignments for MWE 497 Ethics Class

Question 1:

"Now each man judges well the things he knows, and of these he is a good judge. And so the man who has been educated in a subject is a good judge of that subject, and the man who has received an all-round education is a good judge in general. Hence a young man is not a proper hearer of lectures on political science; for he is inexperienced in the actions that occur in life, but its discussions start from these and are about these; and further, since he tends to follow his passions, his study will be vain and unprofitable, because the end aimed at is not knowledge but action. And it makes no difference whether he is young in years or youthful in character; the defect does not depend on time, but on his living, and pursuing each successive object, as passion directs. For to such persons, as to the incontinent, knowledge brings no profit; but to those who desire and act in accordance with a rational principle knowledge about such matters will be of great benefit."

Aristotle from *Nicomachean Ethics*, quoted in *Ethics: History, Theory, and Contemporary Issues* (4th ed), Steven M. Cahn and Peter Markie (eds), Oxford Univ. Press, 2009, p.125.

Make an argument defending or refuting Aristotle's opinion. (≈½ page)

Question 2:

Whom do you admire? Compare and contrast the reasons why you admire two different people, while making an argument that both these people are admirable. (≈1 page)

Question 3:

Can you separate the anthropological claim that different cultures have different moral principles (the diversity thesis – called cultural relativism) from the judgment that therefore they are all equally good (ethical relativism)? Are there independent criteria by which we can say that some cultures are "better" than others? (from Pojman, Chapter 2, Problem 5) (2-3 pages)

Question 4:

Discuss what you consider are the 2 strongest arguments in favor of and the 3 strongest arguments against ethical egoism. Which argument is the most compelling and why? (adapted from Pojman, Chapter 6, Problems 3 and 4) (2-3 pages)

Question 5:

Consider the three purposes of morality mentioned in Chapter 1 of Pojman: (a) to promote human flourishing, (b) to lessen human suffering, and (c) to resolve conflicts of interest justly.

Which of these does utilitarianism fulfill, and which does it fail to fulfill? (from Pojman, Chapter 7, Problem 1) (2-3 pages)

Question 6:

The late Christopher Reeve, in his wheel-chair with a breathing tube, testified before a Senate committee. Reeve dismissed moral objections to embryonic stem-cell research, claiming that the purpose of government is "to serve the greatest good for the greatest number." Without arguing for or against stem-cell research, what ethical system is intrinsic in his words? A response to Mr. Reeve might be, "the greatest good for the greatest number would be to take all of the money spent on those with disabilities and spend it on the healthy that represent most people in society." What ethical system is intrinsic in this response? Explain your answer and address the weakness of Christopher Reeve's initial statement. (1 page)

Question 7:

Aristotle writes that ignorance can be an excuse to mitigate or eliminate responsibility. Under what conditions does he say ignorance is and is not such an excuse? Does it matter if we are discussing responsibility for good or bad acts? (1-2 pages)

Question 8:

Is it a moral fault to want to be liked at all costs? Depending on your answer, outline how one might develop or correct this character trait. Make your arguments using virtue based ethics. (1 page)

Question 9:

Locate the Code of Ethics most connected with your major or discipline and answer these two questions: 1. What ethical theory(s) do you see embodied in the Code of Ethics for your major? 2. How would you add or subtract to the Code? Justify your answer. Be sure and include the particular Code of Ethics with your homework. (2 pages)

Question 10:

Describe the ethical system(s) you would use, personally and as a practicing engineer, and how that choice has been altered by what you have learned in this class. Defend that system and explain the reasons for any change (or lack or change) in light of what you learned this semester. Your ~2 page essay will be graded based on how well you make your argument.

Appendix IV

Purdue University
School of Materials Engineering

MSE 497
Spring 2010
Midterm Exam

March 10, 2010

Your Name: _____

Your Major: _____

1. _____/11	11. _____/4
2. _____/4	12. _____/6
3. _____/5	13. _____/1
4. _____/5	14. _____/1
5. _____/4	15. _____/3
6. _____/5	16. _____/5
7. _____/5	17. _____/8
8. _____/6	18. _____/5
9. _____/12	19. _____/3
10. _____/6	

Total _____/100

1. (11 points) Match the people with the ethical system they developed or embraced. You can use the ethical systems more than once.

_____ Mother Teresa
_____ Tuskegee Health Officials
_____ Miep Gies
_____ William Ross
_____ "Truth is with a crowd"
_____ Ted Bundy
_____ Enron
_____ Ayn Rand
_____ Kant
_____ Christopher Reeve
_____ John Stuart Mill

a. Utilitarianism
b. Duty-Based Ethics
c. Ethical Relativism
d. Subjective Ethical Relativism
e. Virtue-Based Ethics
f. Ethical Egoism

2. (4 pts) What is the difference between moral absolutism and moral objectivism (define both)?

3. (5 pts) Can natural law be used to judge individual societies or not? Briefly Explain.

4. (5 pts) What are the key weaknesses of utilitarianism?

5. (4 pts) An ethical egoist is on his way to pick up his date during a cold spell in December. He sees a young woman and her two kids stranded on the highway beside their broken car. They are clearly in need of help. As an ethical egoist, what does he think his obligation or duty is to the young family and why?

6. (5 pts) What is the primary weakness of the ethical system devised by Kant? What important modification did William D. Ross make to Kant's ethical system?

7. (5 pts) What is Kant's Principle of the Law of Nature?

8. (6 pts) Use Kant's 3 steps for determining morality to analyze this situation: "I am hungry and considering whether it is moral or not to take some of my employer's products home to eat without paying for them."

Step 1:

Step 2:

Step 3:

9. (12 pts) What question does each of the following ethical systems ask to help them know how to act?

Utilitarianism

Ethical Egoism

Principled Ethics

Virtue-Based Ethics

Cultural Ethical Relativism

Subjective Ethical Relativism

10. (6 pts) List 3 of the 8 categories of ethical dilemmas and briefly explain them.

11. (4 pts) How might Pfizer/Shiley argue from a utilitarian position that they were justified to keep the defective valves on the market?

12. (6 pts) Circle correct answers.

(T/F) According to Aristotle, if life has a purpose, we cannot know it.

(T/F) Aristotle believes that being a success at life can be achieved by the time one is 25 years old.

(T/F) For Aristotle, desire can never conflict with reason.

(T/F) Aristotle's expectation for ethics is that it is a precise science.

(T/F) For Aristotle, pleasure and pain are not important to the moral life.

(T/F) For Aristotle, since virtuous actions are voluntary and in accordance with choice, it follows that virtue and vice are also within our power.

13. (1 pt) Virtue is produced in a person by:

a. a gift of the gods b. chance c. by habitation d. natural disposition

14. (1 pt) According to Aristotle, *actions* are *involuntary* if they are due to:

a. force b. desires c. reason d. ignorance e. a,b and d f. a and d

15. (3 pts) Match 3 of the 4 causes to questions they answer:

____formal cause a. What made it?

____material cause b. What is its purpose?

____efficient cause c. What is its shape?

____final cause

16. (5 pts) Write the definition of moral virtue. How does pleasure play a role in a virtuous life?

17. (8 pts) Name the four cardinal virtues and describe their corresponding vices. To what impulses do these virtues respond?

18. (5 pts) Name and describe three of the five intellectual virtues discussed in class. How do they differ from the moral virtues? What is the relationship between moral and intellectual virtues?

19. (3 pts) Define what Aristotle means by happiness.