Social and Ethical Aspects in Engineering IME-251

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Week1 Agenda

- Course Discussion
  - Objectives
  - Course Contents
  - Course CLOs and PLOs
  - Grading Policy
  - Suggested Texts
- Importance of Course
- Introduction to Ethics and Ethical Theories

Course Objectives

- Human Values and Ethics
- Engineering Ethics
- Workplace Responsibilities and Rights
- Safety Responsibilities and Rights
- Global Issues

Course Contents

- The course covers:
  - Ethics and various Ethical Theories
  - Accepting and Sharing Responsibilities
  - Ethical Dilemmas and making Moral Choices
  - Importance, limitations, abuse and justifications of Code
  - Utilitarianism, Right, Duty and Virtue Ethics
  - Socially conscious engineering; Engineering, Ecology and Economics
  - Ethical frameworks
  - Safety and risk, assessing and reducing risk
  - Team work, Confidentiality and Conflict of Interest
  - Trustfulness and Trustworthiness
  - Expert witness and advisors,
  - Research Integrity; Technology Transfer
  - Computer Ethics and Internet

Suggested Texts

- Ethics in Engineering *by* Mike W. Martin and Roland Schinzinger
- Engineering Ethics: Concepts and Cases *by* Charles E Harris Jr., Michael S Pritchard and Michael J. Rabins
- Ethics and Professionalism *by* John. H. Kultgen

Chapter-wise Contents

- Ch:1 Ethics and Professionalism
  - Ethics and various Ethical Theories ; Accepting and Sharing Responsibilities
- Ch:2 Moral Reasoning and Codes of Ethics
  - Ethical Dilemmas and making Moral Choices ; Importance, limitations, abuse and justifications of Code
- Ch:3 Moral Frameworks
  - Utilitarianism, Right, Duty and Virtue Ethics ; Ethical Frameworks
- Ch:4 Engineering as Social Experimentation
  - Socially conscious engineering; Engineering, Ecology and Economics
- Ch:5 Commitment to Safety
  - Safety and risk, assessing and reducing risk
- Ch:6 Workplace Responsibilities and Rights
  - Team work, Confidentiality and Conflict of Interest
- Ch:7 Trust and Trustfulness
  - Trustfulness and Trustworthiness ; Expert witness and advisors ; Research Integrity
- Ch:8 Computer Ethics
  - Computer Ethics and Internet
- Ch:10 Global Justice
  - Technology Transfer

Course CLOs and PLOs

CLO No.	CLO Description	PLO	Domain & Level
1	Know the theories in the case of professional ethics	8 (High)	C1
2	Analyze critically and select of different approaches to solving problems	8 (High)	C4
3	Recognize the limits of the knowledge and skill acquired	6 (Medium)	C1
4	Investigate problems using evidentiary and procedural based processes in predictable and new context that include devising and sustaining arguments	6 (Medium)	C4
5	Argue and criticize complex and unpredictable matters with presentations, explanations	12 (Medium)	C6
6	Demonstrate self-evaluation and responsibility for contributing to professional practices	6 (Medium)	C3
7	Demonstrate self-Assessment of personal development	8 (Medium)	C3
8	Show and observe ethical standards	8 (Medium)	C3

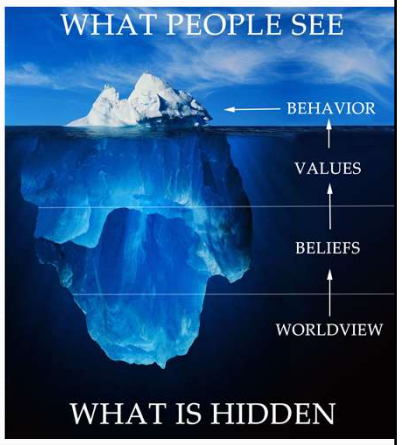
Grading Policy

- Quizzes: Quiz 1 = 10% (5th week) Quiz2 = 10% (13th week)
  - MCQs, TFs, Fill in the Blank (one word substitution), Diagram Labeling, Column Matching, Short Questions.
- Assignment: 10% (will be assigned in 9th week)
- Mid-Term Exams = 30%
- Final Term Exams = 40%

Introduction

Motivations

- Why this Course?



Ethics

- *Ethics* is synonymous with *Morality.*
- Engineering Ethics consists of the *responsibilities* and *rights* that ought to be endorsed by those engages in engineering, and also of desirable ideals and personal commitments in engineering.
- Engineering Ethics is the study of the *decisions*, *policies* and *values* that are morally desirable in engineering practice and research.

Senses of Ethics

- *Normative Sense* refer to justified values or norms, desirable choices and sound policies.
- *Descriptive Sense* refer to what individuals or groups believe and how they act without implying that their believes and actions are justifies. For example the study of a society through polls, surveys and documents to understand their effect on reshaping of engineering ethics.

Moral Complexity: Explanation through an example (Product Development)

- Main Engineering Tasks
  - Initiation of Task
  - Design
  - Manufacture
  - Implementation
  - Finalization

Moral Complexity: Explanation through an example (Product Development)

- Main Engineering Tasks
  - Initiation of Task
    - Idea, Specific Request or Market Demand

Moral Complexity: Explanation through an example (Product Development)

- Main Engineering Tasks
  - Design
    - Concept, Goal, Preliminary Design
    - Performance Specifications
    - Preliminary Analysis
    - Detailed Analysis : Simulation / Prototyping
    - Specifications for Materials and Components
    - Detailed Shop Drawings

Moral Complexity: Explanation through an example (Product Development)

- Main Engineering Tasks
  - Manufacture
    - Scheduling of Tasks
    - Purchasing Components and Materials
    - Fabrication of Parts
    - Assembly / Construction
    - Quality Control / Testing

Moral Complexity: Explanation through an example (Product Development)

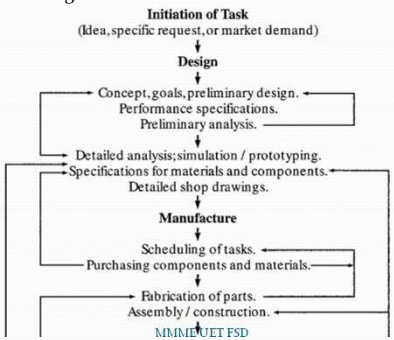
- Main Engineering Tasks
  - Implementation
    - Advertising, Sales and Financing
    - Operating and Parts Manuals
    - Shipping and Installation, Operator Training
    - Provisions for Safety Measures and Devices
    - Use of the Product
    - Field Service : Maintenance, Repairs, Spare Parts
    - Monitoring Social and Environmental Effects
    - Reporting findings to parties at possible risk

Moral Complexity: Explanation through an example (Product Development)

- Main Engineering Tasks
  - Finalization
    - Geriatric Service : Rebuilding, Recycling
    - Disposal of Materials and Wastes

Moral Complexity: Explanation through an example (Product Development)

- Main Engineering Tasks
  - Work Flow Diagram



Moral Complexity: Explanation through an example (Product Development)

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Moral Complexity: Explanation through an example (Product Development)

- Potential Moral Problems
  - Lack of Vision
  - Incompetence
  - Lack of Time/(Proper) Materials
  - Silo Mentality
  - Inattention to Safety
  - Improper Use or Disposal of the Product
  - Dishonesty
  - Inattention

Moral Complexity: Explanation through an example (Product Development)

- Task-wise Possible Problems

Tasks	A selection of possible problems
Conceptual design	Blind to new concepts. Violation of patents or trade secrets. Product to be used illegally.
Goals; performance specifications	Unrealistic assumptions. Design depends on unavailable or untested materials.
Preliminary analysis	Uneven: Overly detailed in designer's area of expertise, marginal elsewhere.
Detailed analysis	Uncritical use of handbook data and computer programs based on unidentified methodologies.
Simulation, prototyping	Testing of prototype done only under most favorable conditions or not completed.
Design specifications	Too tight for adjustments during manufacture and use. Design changes not carefully checked.
Scheduling of tasks	Promise of unrealistic completion date based on insufficient allowance for unexpected events.
Purchasing	Specifications written to favor one vendor. Bribes, kickbacks. Inadequate testing of purchased parts.
Fabrication of parts	Variable quality of materials and workmanship. Bogus materials and components not detected.

Moral Complexity: Explanation through an example (Product Development)

- Task-wise Possible Problems (. . .)

Fabrication of parts	Variable quality of materials and workmanship. Bogus materials and components not detected.
Assembly/ construction	Workplace safety. Disregard of repetitive-motion stress on workers. Poor control of toxic wastes.
Quality control/testing	Not independent, but controlled by production manager. Hence, tests rushed or results falsified.
Advertising and sales	False advertising (availability, quality). Product oversold beyond client's needs or means.
Shipping, installation, training	Product too large to ship by land. Installation and training subcontracted out, inadequately supervised.
Safety measures and devices	Reliance on overly complex, failure-prone safety devices. Lack of a simple "safety exit."
Use	Used inappropriately or for illegal applications. Overloaded. Operations manuals not ready.
Maintenance, parts, repairs	Inadequate supply of spare parts. Hesitation to recall the product when found to be faulty.
Monitoring effects of product	No formal procedure for following life cycle of product, its effects on society and environment.
Recycling/disposal	Lack of attention to ultimate dismantling, disposal of product, public notification of hazards.

Social and Ethical Skills in Engineering

- *Moral Awareness*
- *Cogent Moral Reasoning*
- *Moral Coherence*
- *Moral Imagination*
- *Moral Communication*
- *Moral Reasonableness*
- *Respect for Persons*
- *Tolerance of Diversity*
- *Moral Hope*
- *Integrity*

Discussion Questions

- DQ1:

Identify the moral values, issues, and dilemmas, if any, involved in the following cases, and explain why you consider them moral values and dilemmas.

a. An engineer notified his firm that for a relatively minor cost a flashlight could be made to last several years longer by using a more reliable bulb. The firm decides that it would be in its interests not to use the new bulb, both to keep costs lower and to have the added advantage of "built-in obsolescence" so that consumers would need to purchase new flashlights more often.

Discussion Questions

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b. A linear electron accelerator for therapeutic use was built as a dual-mode system that could either produce X-rays or electron beams. It had been in successful use for some time, but every now and then some patients received high overdoses, resulting in painful after-effects and several deaths. One patient on a repeat visit experienced great pain, but the remotely located operator was unaware of any problem because of lack of communication between them: The intercom was broken, and the video monitor had been unplugged. There also was no way for the patient to exit the examination chamber without help from the outside, and hence the hospital was partly at fault. On cursory examination of the machine, the manufacturer insisted that the computerized and automatic control system could not possibly have malfunctioned and that no one should spread unproven and potentially libelous information about the design. It was the painstaking, day-and-night effort of the hospital's physicist that finally traced the problem to a software error introduced by the manufacturer's efforts to make the machine more user-friendly.[8]

Discussion Questions

- DQ2:

Regarding the following example, comment on why you think simple human contact made such a large difference. What does it say about what motivated the engineers, both before and after the encounter? Is the case too unique to permit generalizations to other engineering products?

Discussion Questions

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A team of engineers are redesigning an artificial lung marketed by their company. They are working in a highly competitive market, with long hours and high stress. The engineers have little or no contact with the firm's customers, and they are focused on technical problems, not people. It occurs to the project engineer to invite recipients of artificial lungs and their families to the plant to talk about how their lives were affected by the artificial lung. The change is immediate and striking: "When families began to bring in their children who for the first time could breathe freely, relax, learn, and enjoy life because of the firm's product, it came as a revelation. The workers were energized by concrete evidence that their efforts really did improve people's lives, and the morale of the workplace was given a great lift."

- DQ3: It is not easy to define morality in a simple way, but it does not follow that morality is a hopelessly vague notion. For a long time, philosophers thought that an adequate definition of any idea would specify a set of logically necessary and sufficient conditions for applying the idea. For example, each of the following features is logically necessary for a triangle, and together they are sufficient: a plane figure, having three straight lines, closed to form three angles. The philosopher Ludwig Wittgenstein (1889–1951), however, argued that most ordinary (nontechnical) ideas cannot be neatly defined in this way. Instead, there are often only "family resemblances" among the things to which words are applied, analogous to the partly overlapping similarities among members of a family—similar eye color, shape of nose, body build, temperament, and so forth.[10] Thus, a book might be hardback, paperback, or electronic; printed or handwritten; in English or German; and so forth. Can you specify necessary and sufficient conditions for the following ideas: chairs, buildings, energy, safety, engineers, morality?

Discussion Questions

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Should SUV problems at the macro level be of concern to engineers as a group and their professional societies? Should individual automotive engineers, in their daily work, be concerned about the general social and environmental impacts of SUVs?

Q & A