University of Technology
Department of Materials Engineering
Fourth Grade
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First Lecture- First Semester

Introduction of Engineering Ethics

Engineering ethics is the study of the decisions, policies, and values that are morally desirable in engineering practice and research. Engineering ethics refers to justified moral values in engineering, but what are moral values? What is morality? Dictionaries tell us that morality is about right and wrong, good and bad, values and what ought to be done. But such definitions are incomplete, for these words also have no moral meanings. In contrast, morality concerns moral right and wrong, moral good and bad, moral values, and what morally ought to be done. Saying this is not especially illuminating, however, for it is a circular definition that uses the word we are trying to define. As it turns out, morality is not easy to define in any comprehensive way. Of course, we can all give examples of moral values, such as honesty, courage, compassion, and justice. Yet, the moment we try to provide a comprehensive definition of morality we are drawn into at least rudimentary ethical theory. For example, if we say that morality consists in promoting the

most good, we are invoking an ethical theory called utilitarianism. If we say that morality is about human rights, we invoke rights ethics. And if we say that morality is essentially about good character, we might be invoking virtue ethics

Why Study Engineering Ethics?

Engineering ethics should be studied because it is important, both in contributing to safe and useful technological products and in giving meaning to engineers' endeavors. It is also complex, in ways that call for serious reflection throughout a career, beginning with earning a degree. But beyond these general observations, what specific aims should guide the study of engineering ethics?

The study of engineering ethics strengthens our ability to reason clearly and carefully about moral questions. To invoke terms widely used in ethics, the unifying goal is to increase moral autonomy.

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Improving the ability to reflect carefully on moral issues can be accomplished by improving various practical skills that will help produce autonomous thought about moral issues. As related to engineering ethics, these skills include the following:

1- Moral awareness: Proficiency in recognizing moral problems and issues in engineering.
2- Cogent moral reasoning: Comprehending, clarifying, and assessing arguments on opposing sides of moral issues.
3- Moral coherence: Forming consistent and comprehensive viewpoints based on consideration of relevant fac.
4- Moral imagination: Discerning alternative responses to moral issues and finding creative solutions for practical difficulties.
5- Moral communication: Precision in the use of a common ethical language, a skill needed to express and support one's moral views adequately to others.

6- Moral reasonableness: The willingness and ability to be morally reasonable.

7- Respect for persons: Genuine concern for the well-being of others as well as oneself.

8- Tolerance of diversity: Within a broad range, respect for ethnic and religious differences and acceptance of reasonable differences in moral perspectives.

9- Moral hope: Enriched appreciation of the possibilities of using rational dialogue in resolving moral conflicts.

10- Integrity: Maintaining moral integrity and integrating one's professional life and personal convictions.

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Dimensions of Engineering

Let us gain a more detailed understanding of moral complexity in engineering as a product develops from a mental concept to physical completion. Engineers encounter both moral and technical problems concerning variability in the materials available to them, the quality of work by coworkers at all levels, pressures imposed by time and the whims of the marketplace, and relationships of authority within corporations.

The idea of a new product is first captured in a conceptual design, which will lead to establishing performance specifications and conducting a preliminary analysis based on the functional relationships among design variables. These activities lead to a more detailed analysis, possibly assisted by computer simulations and physical models or prototypes. The end product of the design task will be detailed specifications and shop drawings for all components.

Manufacturing is the next major task. It involves scheduling and carrying out the tasks of purchasing materials and components, fabricating parts and subassemblies, and finally assembling and performance-testing the product.

Selling comes next, or delivery if the product is the result of a prior contract. Thereafter, either the manufacturer's or the customer's engineers perform installation, personnel training, maintenance, repair, and ultimately recycling or disposal.

Changes made during one stage will not only affect subsequent stages but might also require a reassessment of prior decisions. Dealing with this complexity requires close cooperation among the engineers of many different departments and disciplines such as chemical, civil, electrical, industrial, and mechanical engineering. It is not uncommon for engineering organizations to suffer from "silo mentality," which makes engineers disregard or denigrate the work carried out by groups other than their own.

It can be difficult to improve a design or even to rectify mistakes under such circumstances. Engineers do well to establish contact with colleagues across such artificial boundaries so that information can be exchanged more freely. Such contacts become especially important in tackling morally complex problems.

Here is the list of problems that can generate moral challenges for engineers :

1. Lack of vision, which in the form of tunnel vision biased toward traditional pursuits overlooks suitable alternatives, and in the form of groupthink promotes acceptance at the expense of critical thinking.

2. Incompetence among engineers carrying out technical tasks.

3. Lack of time or lack of proper materials, both ascribable to poor management.

4. A silo mentality that keeps information compartmentalized rather than shared across different departments.

5. The notion that there are safety engineers somewhere down the line to catch potential problems.

6. Improper use or disposal of the product by an unwary owner or user.

7. Dishonesty in any activity shown and pressure by management to take shortcuts.

8. Inattention to how the product is performing after it is sold and when in use.