

ENGINEERING ETHICS



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About the Tutorial

Engineering Ethics is the study of decisions, policies and values that are morally desirable in engineering practice and research. This tutorial covers all the major topics of professional and engineering ethics. It covers the ethics and morals an engineer should follow in his profession.

Audience

We have designed this brief tutorial for students of Engineering to help them understand the ethics they will need to follow in the profession that they might venture into.

Prerequisites

The tutorial will be helpful for students from all the branches of engineering, hence we assume no prior knowledge of any technical topic.

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1. Engineering Ethics – Introduction

Engineering is the process of developing an efficient mechanism which quickens and eases the work using limited resources, with the help of technology. **Ethics** are the principles accepted by the society, which also equate to the moral standards of human beings. An engineer with ethics, can help the society in a better way.

Hence the study of **Engineering ethics**, where such ethics are implemented in engineering by the engineers, is necessary for the good of the society. Engineering Ethics is the study of decisions, policies and values that are morally desirable in engineering practice and research.

Morals

The word "Morality" originates from the Latin word "mos" meaning "custom". Morals are the principles or habits with respect to right or wrong of one's own conduct. They are not imposed by anyone. Morals are what you think is good and bad personally.

Though morals are not imposed, they can be understood as the preaching of our inner self. Depending on a few factors, our mind filters things as good or bad. These are the ideas that help frame our personality so that we can distinguish between what is right and what is wrong.

A moral is the code of conduct that you develop over time and set for yourself to follow, just like

- Being good to everyone
- Speaking only the truth
- Going against what you know is wrong
- Having chastity
- Avoid cheating
- Being a nice human being etc.

Morals are always defined by one's own personality. Morals can be changed according to one's beliefs as they are completely dependent on one's perception towards the ethical values.

Ethics

The word "Ethics" originates from the Greek word "ethos" meaning "character". Ethics are a set of rules or principles that are generally considered as standards or good and bad or right and wrong, which are usually imposed by an external group or a society or a profession or so.

Ethics can be understood as the rules of conduct proposed by a society or recognized with respect to a particular class of human actions or a particular group or culture. Ethics are dependent on others definition. They may or may not vary from context to context.



A person who strictly follows a set of ethical principles, may not have any moral at all while a person who violates ethical principles at times, may maintain a high moral integrity. The ethical theories include duty ethics, right ethics, virtue ethics and so on. A best example that can explain ethics is utilitarianism.

Utilitarianism is the philosophy which explains that the happiness or pleasure of a greatest number of people in the society is considered as the greatest good. According to this philosophy, an action is morally right if its consequences leads to happiness of the people and wrong if the action leads to their unhappiness. This theory moves beyond the scope of one's own interests and takes into account the interests of others.

Ethics in Engineering

Ethics are principles followed depending upon the moral responsibility that a person feels. The study of related questions about moral ideals, character, policies and relationships of people and organizations involved in technological activity, can be termed as **Engineering ethics**.

An engineer whether he works individually or works for a company, has to go through some ethical issues, mostly under the conditions such as, conceptualization of a product, issues arising in design and testing departments, or may be on the issues involving the manufacturing, sales and services. Questions related to morality also arise during supervision and team works.

The ethical decisions and moral values of an engineer need to be considered because the decisions of an engineer have an impact the products and services - how safe they are to use, the company and its shareholders who believe in the goodwill of the company, the public and the society who trusts the company regarding the benefits of the people, the law which cares about how legislation affects the profession and industry, the job and his moral responsibilities and about how the environment gets affected, etc.



Not only an engineer, but everyone has to follow a set of morals in order to keep away from getting morally degraded. Our behavior should include the following:

- Respecting others and ourselves.
- Respecting the rights of others.
- Keeping promises.
- Avoiding unnecessary problems to others.
- Avoiding cheating and dishonesty.
- Showing gratitude towards others and encourage them to work.

Morality commands respect for persons, both others and ourselves. It involves being fair and just, meeting obligations and respecting rights and not causing unnecessary harm by dishonesty and cruelty or by hubris.

Steps to Deal with Issues

Whenever there occurs an issue, one should possess a few skills in order to sort out the problem. The issues that engineers face, have to be dealt with patience and few moral goals have to be kept in mind while dealing with such issues. They are as follows:

- **Moral Awareness** – One should be able to recognize the moral problems and issues that occur in Engineering. The analysis on the problem is necessary in order to differentiate and judge according to ethics or according to the rules to follow.

- **Cogent Moral Reasoning** – In order to come to a conclusion on an issue, the argument has to be assessed and comprehended. The argument on both sides has to be considered with all the probabilities and the nature of the argument should be logical and moral.
- **Moral Coherence** – After having gone through all the logical and moral facts, consistent and comprehensive view points are to be formed based upon a consideration of relevant facts.
- **Moral Imagination** – The moral issues and the practical issues have to be dealt separately. Alternative responses are to be found out for dealing with moral issues while creative solutions should be found out for practical difficulties.
- **Moral Communication** – The language to communicate about one's moral views should be so precise and clear, that the expression or words should not alter the original meaning.

Though one has all these moral goals, the ethical reasoning for achieving moral conduct with responsibility and commitment is obtained by a few skills that are described below.

Important Skills for Ethical Reasoning

Let us now discuss the important skills for ethical reasoning:

- **Moral Reasonableness** – The ability and willingness to be morally reasonable that one should have while dealing such issues. Unless one is willing and improve such ability, justice cannot be done.
- **Respect for Persons** – The persons involved in the issue, should be treated with genuine concern by one. Such concern should also be there with oneself along with being there for others.
- **Tolerance of diversity** – One should have a broader perspective towards ethnic and religious differences that the people have. Every person differs with another when compared on grounds of moral reasoning. The acceptance of those differences is really important.
- **Moral hope** – The moral conflicts can be resolved by using better communication and having rational dialogue which is evident-based and open-ended which is acceptable and appreciable by both the parties.
- **Integrity** – The moral integrity has to be maintained. Being honest and having strong moral principles helps one to resolve an issue in an efficient manner. An individual also needs to consider other's professional life and personal convictions while solving a problem.

2. Engineering Ethics – Moral Issues

A moral issue can be understood as an issue to be resolved not only by considering the technical stuff but also by keeping moral values in mind. To be more precise, let us consider the definition in general.

"Moral issue is a working definition of an issue of moral concern is presented as any issue with the potential to help or harm anyone, including oneself."

Types of Moral Issues

There are mainly two types of Moral issues that we mostly come across while keeping the ethical aspects in mind to respond. They are:

Micro-ethics

This approach stresses more on the problems that occur on a daily basis in the field of engineering and its practice by engineers.

Macro-ethics

This approach deals with social problems which are unknown. However, these problems may unexpectedly face the heat at both regional and national levels.

Examples

Let us now understand a few examples related to moral issues.

Example 1

After a recent collapse of a structure in which many people died, an Engineer came to know about a bridge which is marginally safe. He informed his superior who asked him to stay calm and not to discuss with anyone, while waiting for the next year budget sessions to get some financial help for the repair required. What should the engineer do?

Example 2

What should an Engineer who observes his colleague copying confidential information unauthorized, do immediately? If he chooses to stop his friend, what if this gets repeated without his notice? If he chooses to report the management, what if his friend loses the job? Which is morally correct?

Example 3

An engineer who develops a proto-type for the project, loses it due to a mishap exactly the day before the submission. Is it morally correct to outsource the prototype of the project and reduce the risks of job insecurity? What should he do?

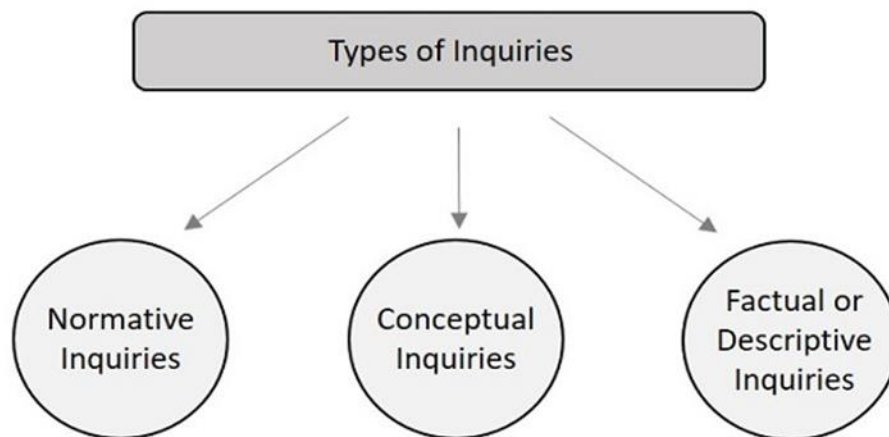
These are the few examples just to understand the kind of moral dilemmas. There might be one or more correct answers at times. There can be some other way around to deal with the issue, which one can't easily notice. However, the decisions have to be made by following a slow and clear process in order to avoid further problems and also to solve this in a manner that leads to no regrets.

Types of Inquiries

The issues can be resolved by following an investigation procedure, step by step in order to have a clear understanding towards the issue. Here we have three different types of inquiries.

Judging the issues has to be followed by a systematic procedure to avoid any flaws. Engineering ethics involves investigations into values, meanings and facts. Following are the different types of inquiries made for this.

- Normative inquiries
- Conceptual inquiries
- Factual or descriptive inquiries



Normative Inquiries

Normative Inquiry refers to the description that describes **what one ought to do** under a specific circumstance. This is the expected ideal response, which might differ from what one believes to be right or wrong.

This list identifies and justifies the morally desirable nature for guiding individuals or groups. This includes the responsibility of engineers to protect the public safety and how they should respond under such dangerous practices. Normative inquiries also quote the laws and procedures that affect the engineering practice on moral grounds. They refer to the thought process where the moral rights are to be implemented in order to fulfill their professional obligations.

Conceptual Inquiries

Conceptual Inquiry refers to the description of the meaning of concepts, principles and issues related to engineering ethics. The ethics that an engineer should possess to protect the safety, health and welfare of the public, etc. are described under conceptual inquiries.

It describes what safety is and mentions the marginal issues of safety along with the precautions an engineer should take to avoid risk. Conceptual inquiries mention the moral aspects of bribery and how its effects, along with the professional ethics and professionalism.

Factual and Descriptive Inquiries

Factual Inquiry or the descriptive inquiry help to provide the facts for understanding and finding solutions to the value based issues. The engineer has to conduct factual enquiries by using scientific techniques.

This helps in providing the information regarding the business realities such as engineering practice, history of engineering profession, the effectiveness of professional societies, the procedures to be adopted when assessing risks and psychological profiles of engineers.

Let us now go through the concept of Moral dilemma that a person faces when confronted with a situation.

3. Engineering Ethics – Moral Dilemmas

At times, the situations occur where one cannot make immediate decisions as the moral reasons come into conflict. The moral reasons can be rights, duties, goods or obligations, which make the decision making complex.



Types of Complexities

The difficulties in arriving to a solution, when segregated, can be divided into the following three sections.

Vagueness

This refers to the condition where the doubt lies in whether the action refers to good or bad. This is just like having a thought that following the rules is mandatory. This sometimes includes the unwritten rules like being loyal, having respect, maintaining confidentiality, etc.

Conflicting reasons

When you know about the solutions you have, the making of better choice among the ones you have, will be the internal conflict. Fixing the priorities depends upon the knowledge and the moral values one has. The reason why the particular choice is being made, makes sense.

Disagreement

When there are two or more solutions and none among them is mandatory, the final solution selected should be best suitable under existing and the most probable conditions. The interpretation regarding the moral reasons behind the choice and analysis should be made keeping in mind whether this is the better or the worse solution in the probable aspects.

Steps in Facing Moral Dilemmas

Whenever a person is faced with a moral dilemma, the issue is to be solved with a stepwise approach as this will generate a better output. The steps include the following:

Identification

The step of identification involves the following:

- The issue has to be thoroughly understood.
-
- The duties and the responsibilities of the persons involved are to be clearly known.
-
- The moral factors related to the issue are to be understood.
-
- The conflicting responsibilities, the competing rights and the clashing ideas involved are to be identified.

Ranking

The considerations in the issue are to be listed down. Then they have to be ranked according to the priorities. The moral aspect has to be considered to rank the issues. The advantages of a single person should never be given any importance unless any moral reason is there behind it. No partiality is allowed.

Inquiries

The inquiry of details involved in the issue is to be completely made. All the facts related to the issue are brought into light. Considering the alternative courses of action for resolving and tracing, full implications are also needed.

Discussions

Discussions are to be made with other members, as different minds look at the issue in different views to give different solutions. The complete analysis of a problem gives chances to different viewpoints, perspectives and opinions from which a better solution can be drawn.

Final Solution

After analyzing different perspectives and considering the facts and reasons on the basis of truths and understanding the flaws which lead to the issue, a final solution has to be drawn out. This solution will add value to the whole analysis, in all aspects.

4. Engineering Ethics – Moral Autonomy

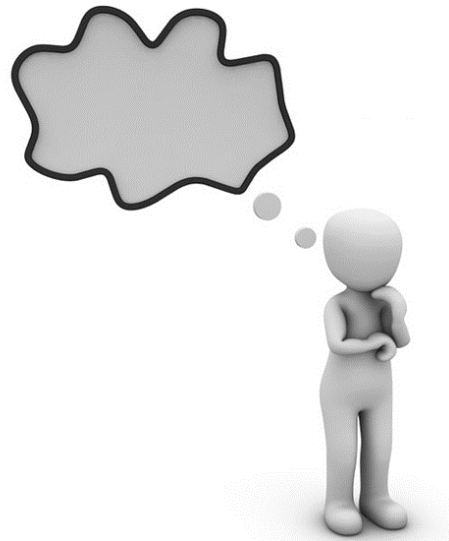
Moral Autonomy is the philosophy which is self-governing or self-determining, i.e., **acting independently** without the influence or distortion of others. The moral autonomy relates to the individual ideas whether right or wrong conduct which is independent of ethical issues. The concept of moral autonomy helps in improving self-determination.

Moral Autonomy is concerned with independent attitude of a person related to moral/ethical issues. This concept is found in moral, ethical and even in political philosophy.

Moral Autonomy – Skills Needed

In this section, let us discuss the skills needed for moral autonomy.

- **Ability to relate the problems with the problems of law, economics and religious principles** – It is essential to have the ability to analyze a problem and finding the relation with the existing law or the topic of issue with the existing principles on that topic. The ability to distinguish between both of them and finding the moral reasons.
- **Skill to process, clarify and understand the arguments against the moral issues** – If the issue is against some moral values or the ethical values to be followed in the society, then clarity should be maintained about the differences and similarities. Both of these differences and similarities are to be judged based on why they are a matter of concern and in what aspect.
- **Ability to suggest the solutions to moral issues on the basis of facts** – If the moral issues are not fulfilling and needs to be, then the solutions are to be suggested according to the moral issues based on the facts and truths of the issue. These suggestions must be consistent and must include all the aspects of the problem. No partiality is to be allowed in any such aspect.
- **Must have the imaginative skill to view the problems from all the viewpoints** – After having known about the facts and illusions of the issue, a clear understanding is attained in viewing the problem in all kinds of viewpoints. This enables one to be able to suggest a proper alternative solution.
- **Tolerance while giving moral judgements, which may cause trouble** – When the whole analysis is made considering all the viewpoints of the issue, the final output might be or might not be pleasing to the persons involved. Hence while declaring the judgements or the decisions taken, a detailed description of the actions done should



be given, while the actions ought to be done should be presented in a better way, to ensure others that the decisions have been taken without any partialities towards any party.

Skills for Improving Moral Autonomy

Moral autonomy reflects the concept of individuality. This relates to the idea of building one's self with the moral values one has while developing psychologically.

To have moral autonomy in all the aspects, one should have a lot of **patience** and interest. One should adhere to the basic principles of humanity and should be strict with the Don'ts he has in mind and liberal with his Do's. The kindness towards his fellow beings is also an important concept to be kept in mind. Inculcation of all these important qualities, enhances the skills of Moral autonomy in a person.

A Person must have adequate knowledge and understanding about the use of ethical language so as to defend or support his views with others. He must have better **knowledge** in understanding the importance of suggestions and better solutions while resolving moral problems and also about the importance of tolerance on some critical situations.

Above all, one must understand the importance of maintaining **moral honesty** and should be liberal to understand the human behavior under certain circumstances.

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