An Introduction to Engineering Ethics

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An Introduction to Engineering Ethics

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Engineering is the process of developing an efficient mechanism which quickens and eases the work using limited resources, with the help of technology.

Engineering
vs
Ethics

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.

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Engineering Ethics

➔ 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.

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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.

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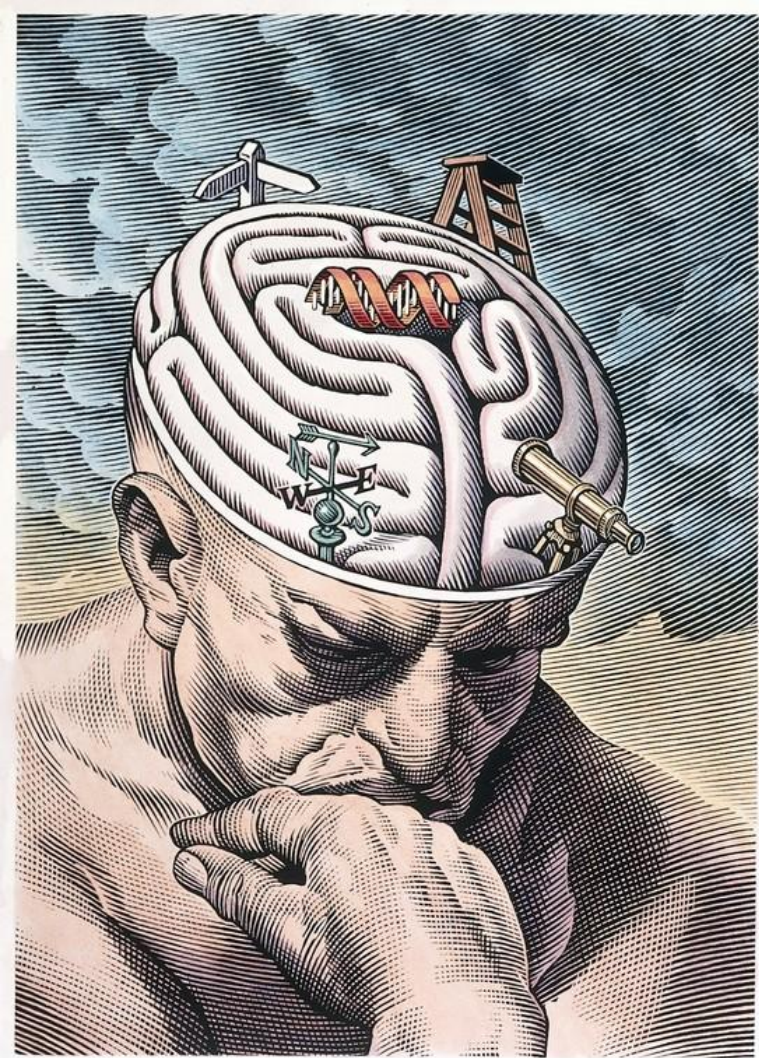
Morals

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.

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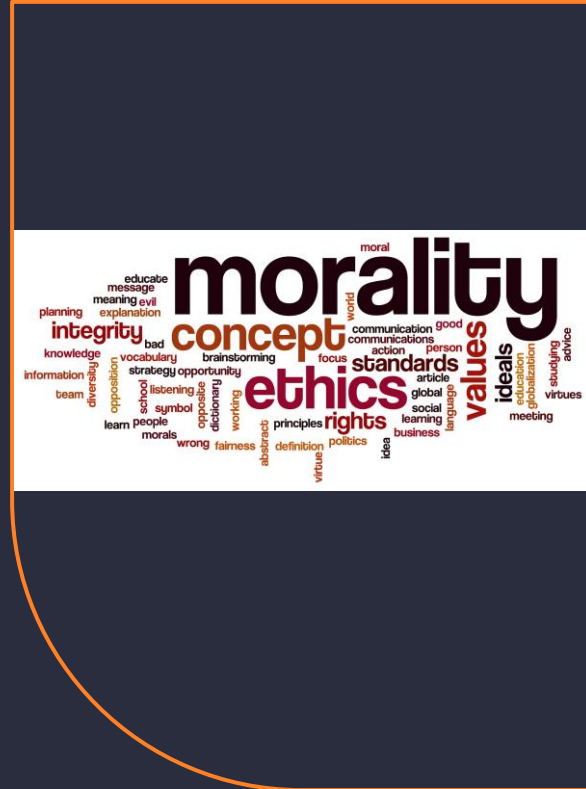
ETHICS

Rules of conduct or societal norms with respect to a group or culture.

MORALS

Habits or behaviors with respect to what an individual believes is right or wrong.

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→ 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.

Ethics

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Ethics

→ 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.

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What Ethics Is NOT

Ethics ≠ Law

Legal doesn't always mean ethical (example: discriminatory laws have existed legally)

Ethical doesn't always mean legal (example: whistleblowing may violate employment contracts)

Laws set minimum standards; ethics often demands more

Ethics ≠ Personal Opinion

•"I feel this is wrong" isn't the same as ethical reasoning

•Ethics requires justification, consistency, and rational argument

Ethics ≠ Cultural Norms

•"Everyone does it this way" doesn't make something ethical

•Cultural practices must still be examined through ethical frameworks

Ethics ≠ Religion

•While religious traditions offer moral guidance, professional ethics must work across diverse beliefs

•Engineers serve a pluralistic society

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Ethics in Engineering[1]

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.

Ethics in Engineering and What it Means for You

Be efficient

Contribute to society

Be sustainable

We strive to grow from partnerships with our clients to ensure the prosperity of both by providing quality services and solutions. In doing this we will:

Enhance the well-being of our people

Be able to change

Operate ethically

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Ethics in Engineering[2]

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.

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Ethics in Engineering[3]

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.

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Engineers hold a special place in society because:

- **Public Safety Dependence -** People trust buildings won't collapse, bridges won't fail, medical devices will work correctly, and software will protect their data.

- **Specialized Knowledge -** The public cannot independently verify engineering work. They must trust professional judgment.

- **Scale of Impact -** A single engineering decision can affect thousands or millions of people, sometimes for generations.

- **Irreversible Consequences -** Unlike many professions, engineering mistakes can result in loss of life, environmental damage, or catastrophic failures that cannot be undone.

Why Engineering Ethics Matters?...

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Steps to Deal with Issues

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.

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Important Skills for Ethical Reasoning

Moral Reasonableness

Respect for Persons

Skills → **Tolerance of diversity**

Moral hope

Integrity

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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.

Important Skills for Ethical Reasoning

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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."*

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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.

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
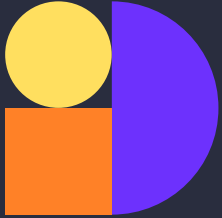
What should an Engineer who observes his colleague copying confidential information unauthorized, do immediately?

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?
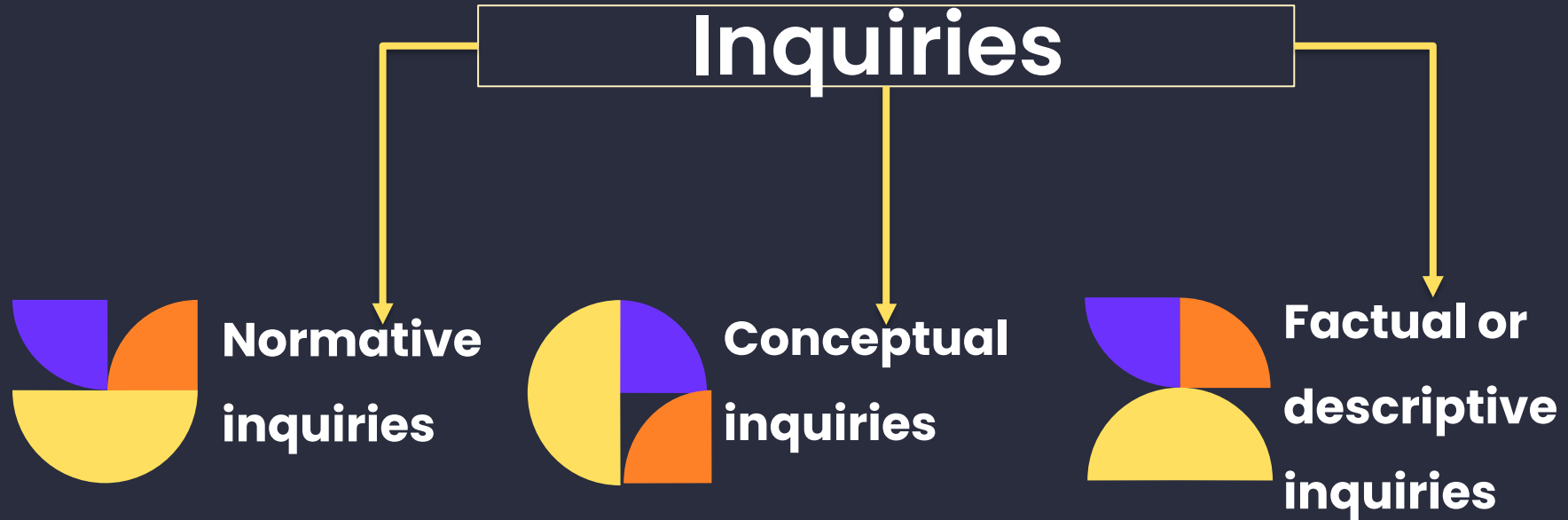
Which is morally correct?

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Example 3
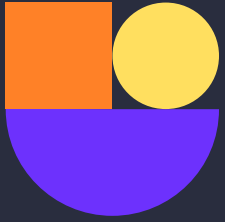
An engineer who develops a proto-type for the project, loses it due to a mishap exactly the day before the submission. Is it morally correct to outsource the prototype of the project and reduce the risks of job insecurity? What should he do?

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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.

Inquiries

Normative inquiries

Conceptual inquiries

Factual or descriptive inquiries

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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.

Examples of normative inquiry include claims about right and wrong, such as "Murder is wrong" or "We ought to keep our promises," and judgments about moral values, like "My grandfather was a good man"

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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.

Conceptual inquiry questions prompt students to explore the "why" and "how" behind concepts, rather than just memorizing facts. Examples include:
"How does energy transform and apply in the real world?"

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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.

Factual and descriptive inquiries are questions that seek to gather objective facts to understand a situation, problem, or topic.

Examples include "What are the short-term and long-term effects of drinking polluted water?"

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Personal vs. Professional Ethics

Personal Ethics: How you conduct yourself in your private life - honesty with friends, keeping promises, treating family well.

Professional Ethics: Additional obligations that come with being an engineer:

- Duty to public safety (even over employer interests)
- Maintaining competence in your field
- Honest representation of qualifications and work
- Protection of confidential information
- Fair treatment of colleagues and subordinates

DUTY TO PUBLIC SAFETY

PERSONAL ETHICS

PROFESSIONAL ETHICS

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Principles of ethics

- **Paramount Duty to Public Safety** - The foundational principle
- **Professional Competence** - Working within your expertise
- **Honesty and Integrity** - Truthfulness in all matters
- **Fairness and Non-Discrimination** - Equal treatment and inclusive design
- **Avoidance of Conflicts of Interest** - Maintaining independent judgment
- **Confidentiality** - Protecting proprietary information (with limits)
- **Credit and Recognition** - Proper attribution of work
- **Environmental Responsibility** - Sustainable practice
- **Professional Development of Others** - Mentoring and knowledge sharing within ethical bounds

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Application: A Complex Case

Scenario

You're a senior engineer at a chemical company. You discover that a manufacturing process releases slightly more emissions than permitted, but well within levels considered safe by scientific studies.

Fixing it would cost $2 million and potentially lay off 50 workers. Your supervisor knows about it and says "it's not really dangerous, and we can't afford the fix right now."

Which Principles Apply?

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Application: A Complex Case

Solution

- Document the issue thoroughly
- Recommend immediate compliance plan to supervisor
- If rebuffed, escalate to higher management
- Consult company ethics hotline or legal department
- If internal channels fail, report to regulators
- Throughout, maintain confidentiality about proprietary processes while addressing the violation

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Final Thought

"Engineering is not just about making things work. It's about making things that work for people, safely, responsibly, and justly. The 'E' in 'Engineer' could stand for 'Ethics' - it's that central to what we do."

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Next steps

01.

Ethical expectation
Employers and
Employees
Relationship

02.

Professional
Organization: ACM
Standards and
Codes
Institutionalization
of Ethical Conduct

03.

NSPE codes
IEEE codes of
conduct

04.

Ethical Problem-
Solving Techniques

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Any questions?
Ask away!

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Thank you

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