Engineering Ethics - Social Experimentation

- Engineering is the application of science a math concerned with the design, building, and use of engines, machines, and structures.
- Engineers figure out how things work and find practical uses for scientific discoveries.
- **To solve real world problems that improve the world around us.**

Engineering & Experimentation

- Experimentation (Preliminary tests or Simulations) plays a vital role in the design of a product or process(Engineering).
- Engineering is inherently a risk activity.
- So Engineering should be viewed as a experimental process.
- Engineering involves people,Environment,Nature.

What is Engineering Process?

- When it is decided to change a new engineering concept into its first rough design, preliminary tests or simulation should be conducted.
- Using formal experimental methods, the materials and methods of designing are tried out. These tests may be based on more detailed designs.
- The test for designing should be evolved till the final product produced. With the help of feedback of several tests, further modification can be made if necessary.
- Beyond these tests and experiments, each engineering project has to be viewed as an experiment

ENGINEERS AS RESPONSIBLE EXPERIMENTERS

In the engineering project, the engineers are the main technical enablers(or) facilitators.

Their responsibility is shared with management, public, and others.

The engineers have so many responsibilities for serving the society.

Social Responsibilities of engineers in experimentation are…

1. ***Conscientiousness:*** *A* primary duty is to protect the safety of human beings and **respect their right of consent**. [A conscientious commitment to live by **moral values**].

2. ***Moral Autonomy:*** *Unrestricted* free **personal involvement** in all the steps of a project.

3. ***Relevant information:*** A **constant awareness** of the experimental nature of any project, **imaginative forecasting** of its possible side effects and a reasonable effort to monitor them. [comprehensive perspective or relative information].

4. **Accountability:** Being **accountable** for the results of a project.

CONSCIENTIOUSNESS

- Conscientiousness implies **consciousness** (sense of awareness). **Conscientiousness** implies a **desire** to do a **task well**. **Conscientious** people are **efficient and organized** as opposed to easy-going and disorderly.
- As holding the responsible profession with maintaining full range moral ethics and values which are relevant to the situation.
- In order to understand the given situation, its implications, know-how, person who is involved or affected, Engineers should have **open eyes, open ears and open mind**.
- One who thinks of oneself and one's benefits alone cannot be moral agents.

Example: [**Should not involve in**...]The small negative duties such as altering data by fraud, violating patent right and breaking confidentiality.

MORAL AUTONOMY

- This refers to the **personal involvement** in one's activities. People are morally autonomous only when their moral conduct and principles of actions are their own i.e., **genuine** in one's commitment to moral values.
- **Moral beliefs and attitudes** must be integrated into an individual's personality which leads to a committed action.

Relevant information

- Without relevant factual information, conscientious is not possible.
- Moral concern involves a commitment (dedication) to obtain and assess all available relevant information.
- Another dimension to factual information is the **consequences** of what one does.

Accountability(Answerability)

- An engineer is always **answerable** for what he had undertaken. He must observe care and caution at every stage of his experiment, monitor it by his best capacity and skills and ultimately produce the outcome in the expected manner. **If there be failures** or errors ,he must **accept** them with grace.
- The people those who feel their responsibility, always accept moral responsibilities for their actions. It is known as **accountable**.
- In short, 'accountable' means being **liable and hold responsible** for faults.
- In general and to be proper, it means the general tendency of being willing to consider one's actions to moral examinations and be **open and respond** to the assessment of others.

CODE OF ETHICS

CODE OF ETHICS/ ETHICAL CODES/ CODE OF CONDUCT

- Codes are the **set of laws and standards**.
- Codes defines the **roles and responsibilities** of professionals.
- Ethical codes are adopted by **organizations to assist members in understanding the difference between 'right' and 'wrong'** and in applying that understanding to their decisions.
- These codes exhibit the rights, duties, and obligations of the members of a profession.

CODE OF ETHICS(Cont..)

- A code of ethics provides a **framework for ethical judgment** for a professional. A code cannot be said as totally comprehensive and cover all ethical situations that an engineer has to face. It serves only as a starting point for **ethical decision-making**.

Roles of codes and its functions

1. Inspiration and Guidance
2. Support
3. Deterrence and Discipline
4. Education and Mutual Understanding
5. Contributing to the profession's public image
6. Protecting the Status Quo
7. Promoting Business Interests

1.INSPIRATION AND GUIDANCE

Inspiration and Guidance

- Codes give a **convinced motivation** for ethical conduct and provide a **helpful guidance** for **achieving the obligations** of engineers in their work. Codes contribute mostly general guidance as they have to be brief. **Specific directions** may also be given to apply the code in morally good ways.

1.Inspiration and Guidance(Cont..)

- The following **engineering societies** have published codes of ethics:
  - ✓ **AAES** - American Association of Engineering Societies
  - ✓ **ABET** - Accreditation Board for Engineering and Technology (USA)
  - ✓ **NSPE** - National Society of Professional Engineer (USA)
  - ✓ **IEEE** - Institute of Electrical and Electronics Engineering (USA)
  - ✓ **AICTE** - All India Council for Technical Education (India)
- Most of the technological companies have established their **own codes** such as pentagon (USA), Microsoft etc. These codes are very much helpful to **strengthen** the moral issues on the work of an engineer.

2.SUPPORT

Support

- Codes **always support** an engineer who follows the ethical principles.
- Codes give engineers a **positive, a possible good support** for standing on moral issues.
- Codes also serve as a **legal support** for engineers.

3.Deterrence and discipline

Deterrence and discipline:

- Codes can be used as a basis for **conducting investigations on unethical conduct**.
- They also provide a **deterrent for engineers** to act immorally.
- Engineers who are **punished by professional societies** for proven unethical behavior by **revoking the rights to practice as engineers** are also subjected to **public ridicule and loss of respect** from colleagues and local community.
- This helps to produce ethical conduct even though this can be viewed as a negative way of motivation.

4. Education and mutual understanding

- Codes have to be **circulated and approved** officially by the professionals, the public and government organizations which concern with the moral responsibilities of engineers and organizations.

5. Contributing to the profession's Public Image

- Codes help to **create a good image to the public** of an ethically committed profession. It helps the engineers in an effective manner to serve the public. They also gives self-regulation for the profession itself.

6.Protecting the Status Quo

(Protecting private/Social Issues)

- Codes establish **ethical conventions(Principles),** which can **help promote** an agreed upon minimum level of ethical conduct.

7.Promoting Business Interests

- Codes help to **improve the business interests**. They help to moralize the business dealings to benefit those within the profession.

Limitations of Codes

1. Only a few practicing engineers are the members of Professional Societies and so they **can not be obliged to abide** by their codes.
2. Many engineers who are the members of Professional Societies are **not aware of the existence of the codes** of their societies and they never go through it.
3. Codes are said to be coercive i.e., implemented by **threat or force**.
4. Codes are restricted to **general and vague(Unclear) wordings**. Due to this limitation they **cannot be applicable to all situations** directly. It is also **impossible to analyze** fully and predict the full range of moral problems that arises in a complex profession.
5. Engineering codes often have **internal conflicts**. So they can't give a solution or method for resolving the conflict.

A BALANCED OUTLOOK ON LAW

[Role of Law in Engineering Ethics]

A BALANCED OUTLOOK ON LAW

- A balanced outlook on laws **stresses the necessity of laws and regulations** and their limitations in directing engineering practice.
- In order to live, work and play together in harmony as a society, there must be a balance between individual needs and desires against collective needs and desires.
- Only **ethical conduct** can provide such a balance.
- So the codes must be enforced with the **help of laws.**

ROLE OF LAW IN ENGINEERING

- **Precise rules and enforceable sanctions** are appropriate in cases of **ethical misconduct** that involve violations of well established and regularly reexamined procedures that have as their purpose the safety of public.
- It also provides a **self-interested motive** for most people and corporations to comply.
- Reasonable minimum standards are ensured of professional conduct.

ROLE OF LAW IN ENGINEERING[Cont..]

- They also serve as powerful support and defense for those who wish to act ethically in situations where ethical conduct might not be welcome.
- It is wrong to write off rule-making and rule following as ineffective. **Good laws, effectively enforced, clearly produce benefits**.
- In areas of experimentation, rules must not attempt to cover all possible outcomes of an experiment, nor must they force the engineer to adopt a rigidly specified course of action. Here the regulations should be **broad based guidelines** but should hold the engineer accountable for his or her decisions.

THE PROBLEMS OF LAW IN ENGINEERING

- The greatest problem of law in engineering is of '**minimal compliance(Fulfillment)**'. Engineers and employers can **search for loop holes in the law** to barely keep to its letter while violating its spirit. Engineers will tend to refer to standard readymade specifications rather than come up with innovative ideas. **Minimal compliance led to the tragedy of the 'Titanic'.**
- Continually updating laws and regulations may be counter-productive and will make law always lag behind technology. This also **overburdens the rules and regulators.**
- Many laws are '**non-laws**' i.e. laws **without enforceable(ineffective)** sanctions. These frequently gives a **false sense of security to the public.**

INDUSTRIAL STANDARDS

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- Industry standards are a **set of criteria** within an industry relating to the **standard functioning** and carrying out of operations in their respective fields of production.
- Industrial Standards are generally **accepted requirements** followed by the members of an industry.
- It provides an **orderly and systematic formulation, adoption, or application of standards** used in a particular industry or sector of the economy. Industry standards vary from one industry to another.

INDUSTRIAL STANDARDS(Cont..)

- Industry standards facilitate global as well as domestic competitiveness. It is a crucial tool for **developing and meeting industry goals**. For Example in the automotive industry, tire sizes and durability must fall within a standardized range..
- Standardization serves as a **quality check** for any industry.

Example Of Industrial Standards

- **Institute of Electrical and Electronics Engineers**: "To accept responsibility in making decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment"
- **Institution of Civil Engineers**: "Members of the ICE should always be aware of their overriding responsibility to the public good".
- **National Society of Professional Engineers**: "Engineers, in the fulfillment of their professional duties, shall: Hold paramount the safety, health, and welfare of the public."
- **American Society of Mechanical Engineers**: "Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties."
- **Institute of Industrial Engineers**: "Engineers uphold and advance the integrity, honor and dignity of the engineering profession by: 2. Being honest and impartial, and serving with fidelity the public, their employers and clients."

ROLE OF INDUSTRY STANDARD

- Standardization facilitates a healthy competition and designing of new concepts.
- Administration and the legislative bodies are benefited by the Industry standard. They govern the practical as well as the technological standards as per the legal requisites.
- Optimum standards facilitate the creation of political as well as business related advantages. The reason being that the industry standard is worked out in consonance with the expertise of the corporate houses and different segments of the society.
- In a nut shell, industry standard is a crucial tool in **acquiring industry goals related to managerial, technological as well as political**. Therefore, setting standards for the industry whether in the domestic market or international market provides assurance of transparency. The ultimate aim of setting industry standard is to provide a platform for giving shape to new creations.