GE8076
GE6705 - Professional Ethics in Engineering

Unit - III

1. what are codes of ethics? State and explain the functions of codes of ethics followed by an engineer. Also mention the objections to codes and their importance. How it provide discipline among the engineer?

Definition:

Code is a set of standards and laws.

The roles of codes are

- Inspiration and Guidance
- Support
- Deterrence and Discipline.
- Education And Mutual Understanding
- Contributing to the profession's public image.
- Protecting the Status Quo
- promoting Business Interests.

Purpose of codes of Ethics (importance)

a) It provides a frame work for ethical judgement for a professional.

b) It also express the commitment to ethical conducts by a professional.

c) It do not establish new ethical principles and Standards, but re-implement them.

d) It defines role, and responsibilities of professionals.

e) It serves as a guide, and Strengthen a professional by his correct behavior.

Features of Engineering Codes of Ethics.

• The highest ethical obligation of Engineer is to the "Safety, health and welfare of the public".

• Engineers must also act for clients or employers as "faithful agents or trustees"

• Engineers must practice only in their areas of competence.

• Engineers must act objectively, truthfully, and in a way that avoids deception and misrepresentation, especially to the public.

This include avoiding bribes or other actions that might compromise an engineer's professional integrity

• Engineers are encouraged to participate in civic affairs

• Engineers are encouraged to adhere to the principles of sustainable development in order to protect the environment

2 How can a engineer become a responsible experimenter? Explain the charactoristics of morally responsible engineers.

Although the engineers conduct experiments, they are not alone in the field. Their responsibility is shared with the organizations people, government, and others.

No doubt the engineer share a greater responsibility while monitoring the projects, identifying the risks, and informing the clients and the public with facts.

The engineer, as an experimentor, owe several responsibilities to the society, namely,

a) Conscientiousness
b) comprehensive Perspective
c) Moral Autonomy
d) Accountability.

- Consientious moral commitment means:

a) Being sensitive to full range of moral values and responsibilities relevant to the prevailing situation and
b) The willingness to develop the skill and put efforts needed to reach the best balance possible among those considerations.

In short, engineers must possess open eyes, open ears, and an open mind (i.e., moral vision, moral listening, moral reasoning).

- Comprehensive Perspective

The engineers should grasp the context of his work and ensure that work involved result in only moral ends.

One should not ignore his conscience if the product or project that he is involved will results in damaging the nervous system of the people.

A full scale environmental or social impact study of a product/project by individual engineers is useful, but not possible in practice.

- **Moral autonomy :**

It is the quality of
→ self-determining
→ Independent
→ personal Involvement
→ Exercised based on the moral concern for other people and recognition of good moral reasons

- **Accountability :**

Accountability refers to the act of being willing to be open and responsive to the appropriate situations.

An authority must be responsible and willing to take the actions regarding any employee's activity, he must be able to handle the problems situation ethically, with diligence.

3. Compare and contrast engineering experiments with standard experiments with suitable examples.

ENGINEERING PROJECTS Vs STANDARD EXPERIMENTS	SIMILARITIES	CONTRASTS
	• Partial ignorance • Uncertainty • Continuous monitoring • Learning from the past	• Experimental control • Humane touch • Informed consent • Knowledge gained.

SIMILARITIES:

1. Partial Ignorance:

* Any project is usually executed in partial ignorance. There may be uncertainties exist in the abstract model assumed.

* It can be said that, the behavior of materials purchased is uncertain and not constant. They may vary with the suppliers, time and the process used in shaping the materials.

* Eg: sheet or plate, rod or wire, forged or cast or welded.

2. Uncertainty:

* The final outcomes of project are generally uncertain same as in experiments.

* It is not even known what will be the possible, outcomes whether they are safe or may be even risky.

3. Continuous monitoring:

* It is a continuous process that helps in progress and gaining new knowledge that are needed before, during and after execution of project.

* The performance of a product is to be monitored even during the use of the product by the end user/ beneficiary. Hence it is not restricted inside the laboratory itself.

4. Learning from the past:

* Engineers normally learn from their own previous design and infer from the analysis of operation and results, and sometimes from the reports of other engineers. But this does not happen frequently.

Contrasts:

1. Experimental control:

It is not possible to make a random selection of participants from various groups.

In engineering, through random sampling, the survey is made from among the users, to assess the results on the product.

2. Humane touch:

Engineering experiments involve human souls, their needs, views, expectations, and creatives used as in case of social experimentation.

Example: Testing of drugs on human.

Initially this point of view is not agreed by many of the engineers. But now the quality engineers and managers have fully realized this humane aspect.

3. Informed Consent:

Consent refers to the agreement or the permission to conduct an engineering experiment.

Informed consent is said to have two basic elements:

1. Knowledge
2. Voluntariness.

4. Knowledge gained:

Engineering experiments most help us,

a) To verify the acceptability of the design.
b) To check the stability of the design parameters
c) To prepare for the unexpected outcome, in the actual field environments.

3. Explain the challenger space shuttle disaster. Discuss the violation of moral, ethical and professional codes of standards in it. Write a conclusion to avoid such disaster in future.

On 28 January, 1986 the challenger, seven astronauts were killed when the space shuttle they were piloting, the challenger, exploded at just over a minute into the flight.

The failure of the solid rocket booster O-ring to seal properly allowed hot combustion gases to leak from the side of the booster and burn through the external fuel tank.

The failure of the O-ring was attributed to several factors, including faulty design of the solid rocket boosters, insufficient low-temperature testing of the O-ring material and of the joints that the o-ring sealed, and lack of proper communication b/w different levels of NASA management.

Organizations / peopole involved.

① Marshall Space flight center: in charge of booster rocket development.

② Larry Mulloy: challenged the engineers' decision not to launch

③ Morton Thiokol: Contracted by NASA to build the solid rocket booster.

④ Alan McDonald:- Director of the solid Rocket Motors project.

⑤ Bob Lund: Engineering vice president.

⑥ Robert Ebeling : Engineer who worked under McDonald.

⑦ Roger Boisjoly : Engineer who worked under McDonald.

⑧ Joe Kilminster : Engineer in a management position.

⑨ Jerald Mason : Senior executive who encouraged Lund to reassess his decision not to launch.

Key Dates :

1974 – Morton-Thiokol awarded contract to build solid rocket booster

1976 – NASA accepts Morton-Thiokol's booster design.

1977 – Morton-Thiokol discovers joint rotation problem.

Nov. 1981 – O-ring erosion discovered after second shuttle flight.

Jan. 24, 1985 – Shuttle flight that exhibited the worst O-ring blow by.

July 1985 – Thiokol orders new steel billets for new field joint design.

Aug. 19, 1985 – NASA level I management briefed on booster problem.

Jan 27, 1986 – night teleconference to discuss effects of cold temperature on booster performance.

Jan 28, 1986, Challenger exploded 72 seconds after lift off.

Background of the disaster:

a) Pressure to launch:

There was a pressure to launch Challenger that it could be in space when President Reagan gave his State of the Union address.

Reagan's main topic was to be education, and he was expected to mention the shuttle and the first teacher in space, Christa McAuliffe.

b) Solid rocket booster

It is a key element in the operation of the shuttle. An SRB in attached to each side of the external fuel tank. Each booster is 149 feet long and 12 feet in diameter. Before ignition, each booster weighs 2 million pounds.

NASA accepted the design in 1976.

c) O-Rings:

Each SRB joint is sealed by two O-Rings: the bottom ring known as primary O-ring and the top known as the secondary O-ring.

d) Launch delays:

The first delay of the challenger mission was due to a weather front expected to move into the area, bringing rain and cold temperatures.

The second launch delay was caused by a defective micro-switch in the hatch locking mechanism and by problems in removing the hatch handle.

Almost half of the shuttle flights has experienced O-ring erosion in the booster field joints. The management was not supporting the redesign task force.

e) The night before launch:

The temperature for the next launch date were predicted to be in low 20°F. They had only a short time to prepare their data for the presentation.

The lowest temp. experienced by the O-rings in any previous mission was 53°F, on the Jan 24, 1985 flight.

The boosters had experienced O-ring erosion at this temp. They could not prove that it was unsafe to launch at lower temp.

f) The launch.

During the night, the temp. dropped to as low as 8°F, much lower than had been anticipated.

The primary O-ring was too cold to seal properly.

Conclusion: NASA was very anxious to proceed with the launch for a variety of reasons including, economic consideration and political pressure.

The European space Agency was providing added competition and here was political pressure for the challenger to be in space when the president of the US gave the State of the Union address.

The cold weather, some of the coldest in Florida history, provided un charted waters for the operation of the SRBs

5. What is research ethics? Discuss the models of research ethics with suitable examples.

Research ethics the application of moral rules and professional codes of conduct to the collection, analysis, reporting and publication of information about research subjects, in particular active acceptance of subjects right to privacy confidentiality and informed constant

principles of Research ethics:

1. minimizing the risk of harm.
2. obtaining informed consent.
3. Protecting anonymity and confidentiality.
4. Avoiding deceptive practices.
5. providing the right to withdraw.

1. Informed consent
2. No pressure on individuals to participate
3. Respecting individuals autonomy
4. Taking particular care in research with Vulnerable Groups.
5. Maintaing Anonymity and confidentiality
6. Avoid causing harm.
7. Objective Vs subjectivity
8. Not taking advantage of easy-access groups.
9. openness

Reasons for having research ethics.

1. To respect and cause no harm to the participants.
2. To ensure that research is conducted in a way that serves interests of individuals, groups and/or society as a whole.
3. It promotes the aims of the research such as knowledge.
4. It promotes ethical consideration.
5. Research ethics also help to build public support for research.
6. It promotes a variety of other important moral and social values.
7. It ensures that researchers can be held accountable to the public.

13

6 Discuss the problems associated with laws in engineering and enumerate the proper Role of law engineer.

Need for law:

- Laws are necessary because, people are not fully responsible by themselves and because of the competitive nature of the free enterprise which does not encourage moral initiatives.
- Laws are needed to provide a minimum level of compliance.
- The following codes are typical examples of how they were enforced in the past.
  - Code for Builders by Hammurabi
  - Steam Boat code in USA.

Proper Role of Laws:

Good laws when enforced effectively produce benefits. They establish minimal standards of professional conduct and provide a motivation to people.

Further they serve as moral support and defense for the people who are willing to act ethically.

Thus it is concluded that:

- The rules which govern engineering practice should be construed as of responsible experimentation rather than rules of a game.

Precise rules and sanctions are suitable in case of ethical misconduct that involves the violation of established engineering procedures.

In situations where the experimentation is large and time consuming

The regulation should be broad but make engineers accountable for their decisions,

Through their professional societies and the engineers can facilitate the rules, amend whenever necessary, and enforce them, but without giving in for conflict of interest.