1. Engineering societies should act as the forum for debating what should be in a professional code of ethics.
2. Engineering societies could promote ethics by establishing awards for engineers and employers who exhibit commendable ethical conduct.
3. Engineering societies could assist and protect engineers who have been discharged because they stick on to high ethical standards.
4. Engineering societies could establish 'ethics helplines' or other services whereby engineers could seek advice on difficult ethical issues.
5. Engineering societies could promote ethics by helping to educate the public about new technologies.
6. Engineering societies could investigate charges of wrongdoing by members because of malice or false information.
7. Engineering societies could also promote the discussion and understanding of engineering ethics by depicting on the application of their codes.

3.8. A BALANCED OUTLOOK ON LAW

(Interaction of rules with the engineering codes)

A balanced outlook on laws emphasizes the necessity of laws and regulations and their limitations in governing engineering practice. Now we shall examine the role of formal rules and their ethical implications.

3.8.1. A Regulated Society[9]

✓ ***What is a law?***

- Law is a body of rules of action prescribed by a controlling legal authority and having binding legal force.
- In general, law means all the rules established by authority or custom for regulating the behavior of members of a community or country.
- It is a solemn expression of the will of a supreme power the authority.

✓ ***Relationship between law and ethics***

- Ethics can be defined as 'knowing the difference between what one has a right to do and what is the right thing to do'.
- Law dictates the minimum standard of behavior required of an individual by a given society, whereas ethics go beyond what is required.
- It should be noted that many things that are legal need not to be ethical. In other words, legality does not imply morality. Conversely, illegality does not imply immorality. That is, something is illegal does not mean that it is unethical.

[9] Society means a system in which people live together in organized communities.

"Society cannot exist without law and order, and cannot advance except through vigorous innovators." – **Bertrand Russell**

✓ ***Laws with respect to social experimentation***

Laws are necessary because:

(i) people are not fully responsible; and

(ii) the corporations/companies are not encouraged to have moral initiative because of competitive nature in the society.

✓ Engineers are expected to play a vital role in framing, implementing, and propagating the rules of engineering. Also they have to strictly adhere to those rules.

✓ Moreover, it is inevitable that laws lag behind technological development. At the same time, one cannot expect lawmakers/rule-making agencies always to keep up with the technological development.

✓ In today's scenario, most of the industries feel that the laws are imposing excessive restrictions on engineering applications through regulatory agencies.

3.8.2. Industrial Standards

✓ ***What is meant by standardization?***

- Standardization primarily means setting up standards or measuring sticks by which extent, quality, quantity, value performance or service may be gauged or determined.
- In simple terms, it is the process of defining and applying conditions required to ensure that a given range of requirements can be easily met with minimum changes in an economical and reproducible manner by the latest technique.

✓ ***What are standards?***

(Why do the industries welcome the concept of standards?)

- Standards are framed by companies for their in-house use i.e., internal use, and by professional associations and trade associations for industry-wide use. Sometimes standards are also prescribed as parts of laws and official regulations.
- ***Standards facilitate:***

(i) Interchangeability;

(ii) Accuracy in measurement;

(iii) Ease of handling;

(iv) Prevention of harms;

(v) Decreased production costs;

(vi) Quality products etc.

"Laws can discover sin, but not remove it." - Milton

✓ ***Types of standards***

The various types of standards and their purposes with some examples, by Mike Martin and Ronald Schinzinger, are presented in Table 3.1.

Table 3.1. Types of standards and their purposes

Criterion	*Purpose*	*Selected examples*
Uniformity of physical properties and functions	Accuracy in measurement, interchangeability, ease of handling	Standards of weights, screw thread dimensions, standard time, film size
Safety and reliability	Prevention of injury, death, and loss of income or property	National electric code, boiler code, methods of handling toxic wastes
Quality of product	Fair value for price	Plywood grades, lamp life
Quality of personnel and service	Competence in carrying out tasks	Accreditation of schools, professional licenses
Use of accepted procedures	Sound design, ease of communications	Drawing symbols, test procedures
Separability	Freedom for interference	Highway lane markings, radio frequency bands

✓ ***Benefits of standards***

From Table 3.1, the following three central benefits of standards can be realized.

1. Standards help the manufacturers, the clients, and the public.
2. Standards maintain a steady and balanced competition among industries by reducing down the demands for certain popular name brands.
3. Standards ensure a measure of quality and hence facilitate more realistic trade-off decisions.

✓ ***Negative aspects of standards***

- Standards may reduce choice for customers because of reduced variety.
- Excessive standardization of operations and procedure may reduce the initiative and interests of workers.

"The success of any great moral enterprise does not depend upon numbers." - William Lloyd Garrison

- Sometimes manufacturers, trade unions, exporters and importers impose unnecessarily changes in the provisions on standards for achieving their self-centered goals.

3.8.3. Problems With The Law In Engineering

There are more complaints about the laws that can cause problems in engineering with regard to ethical conduct. Some of the problems with the law in engineering are given below.

1. The existence of minutely detailed rules/laws may result in minimal compliance i.e., small level of obedience. The minimal compliance has become one of the greatest moral problems in engineering nowadays. Because the minimal compliance encourages the companies and individuals to search for loopholes in the law so that they can violate the spirit of laws for achieving their goals. For example, the Titanic tragedy was exclusively caused by this minimal compliance. Though the shipping authority fulfilled the minimum compliance by having minimum number of lifeboats, the numbers were not adequate enough to rescue all passengers.
2. It is inevitable that the law lags behind the technological development. Even updating the laws and regulations continually with further specifications may also be not effective and not productive. Also there is a danger of over burdening the rules and the regulators.
3. Practically speaking, many laws are 'nonlaws', that is, laws without enforceable sanctions. All these 'nonlaws' are useless; they merely act as window dressing, a false display of caring. So the public in general has lost their sense of security with these kinds of new laws.
4. Another situation for frustration with the laws is the apparent immunity. That is, the most influential, powerful persons/societies including the government, politicians, corporations, etc can violate laws when they can get away with it. Because they think that adherence to laws may lead to lengthy and costly court proceedings.

3.8.4. The Proper Role of Law in Engineering

From the perspective of engineering as social experimentation, the laws can play the following roles.

- ✓ The laws can authoritatively establish reasonable minimal standards of professional conduct.
- ✓ The laws can provide a self-interested motive for most of the people and corporations to comply.
- ✓ The laws act as a protector of ethical engineers. That is, they serve as a powerful support and defense to those who wish to involve in ethical activities.

"Laws should be like death, which spares no one." - Montesquieu

Also the laws can be little considerate with some exceptional engineering situations. For example, in cases where strong experimentation is involved. In these situations, the rules should not try to cover all possible outcomes of the experiment. Also the rules should not force the engineers to adopt a rigidly specified course of action.

3.8.5. Engineering Responsibility Regarding The Law

- ✓ As a social experimenter, engineers shall not treat the laws/rules governing practice merely as rules of a game; instead they should respect it as rules of responsible experimentation.
- ✓ Thus the moral responsibility of engineers is not merely following the laws and their emphasis should go beyond that, especially during the technological development activities.

REVIEW QUESTIONS

Engineering as *Experimentation*

1. Do you agree with the view of 'engineering as experimentation'? Justify your view.
2. 'Engineering as experimentation plays a vital role in the design process'- Discuss.
3. What are the aspects of engineering that make it appropriate to view engineering projects as experiments? ***[A.U., Nov' 2004]***
4. What are the similarities between engineering experiments and standard experiments? ***[A.U. Apr' 2005]***
5. "The final outcomes of engineering projects, like those of experiments, are generally uncertain"- Discuss.
6. Illustrate why it is not sufficient for engineers to rely on handbooks alone?
7. What do you understand by (i) experimental control, and (ii) informed consent, in the context of engineering as experimentation?
8. What are the elements of informed consent? What are the conditions that are essential for a valid informed consent?
9. Explain with the help of examples of that engineers would learn not only from their earlier design and operating results, but also from those of other engineers. ***[A.U. Apr' 2005]***
10. "Engineering projects are experiments that are not necessarily designed to produce very much knowledge"- Discuss.

Engineers as *Responsible Experimenters*

11. What are the general responsibilities of engineers to society?
12. What are the general features of morally responsible engineers?
13. What is meant by conscientiousness?
14. "Conscientiousness is blind without relevant factual information"- Justify.