

Q.1 What is professionalism? Explain any four characteristics and four responsibilities of a professional?

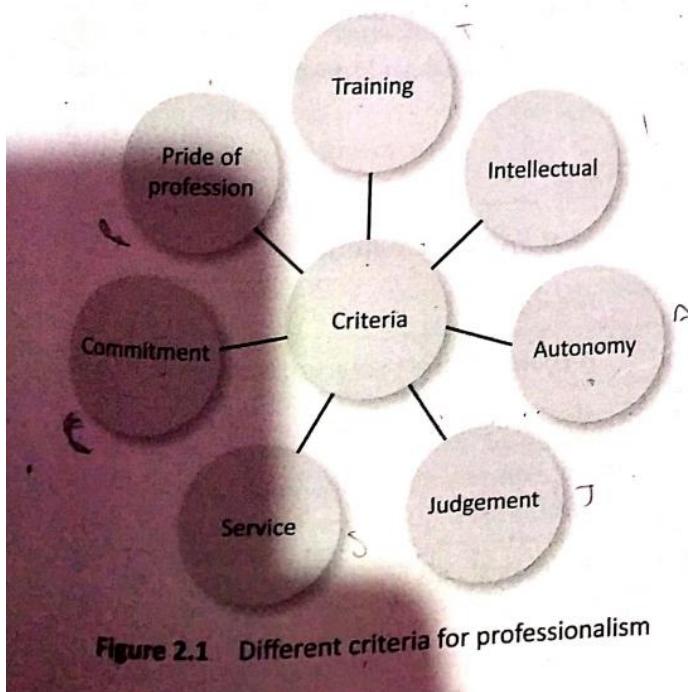
## PROFESSIONALISM

Professionalism is again a term used in different contexts with different meanings. The Oxford Dictionary defines professionalism as the high standard that you expect from a person who is well trained in a particular job requiring great skill or ability.

Professionalism is a trait of professionals. David Maister states that professionalism is 'believing passionately in what you do, never compromising your standards and values, and caring about your clients, your people and your own career'.

Is it necessary to believe passionately in what you do? Is it a necessary condition for a professional? These are questions still being debated.

Professionalism, in any case, includes all the characteristics that we have discussed for a professional. Some people believe that the following are the criteria for professionalism:



### Characteristics

ROICE

In addition to meeting the criteria that we just discussed, a professional must exhibit the following characteristics:

**Expertise in terms of knowledge and skills** Professionalism can only come from people having expertise in terms of both knowledge and skills in the profession. This is ensured through the high level of education and special training that a person gets before entering the profession.

**General orientation toward public or community interest** All professions have a common theme of public service

in their ambit. Medical profession, legal profession, and engineering profession in a variety of public services are examples of public utility of professions. The professional must get an orientation towards public service during his/her education and training. Community interest must be kept in mind in professional functions. This orientation is necessary for professionalism.

**Self-regulation in work** Professionalism calls for self-regulation by the person doing any job. He/She does not need supervision and control in doing his/her job professionally. Professionalism requires the professionals to regulate and control their work themselves without being supervised.

**High level of ethics** A professional can be left to do his/her job professionally because of the high level of ethics possessed by the person. Ethical functioning is a basic requirement of professionalism. As professional functions are performed with freedom and self-regulation, ethics becomes a regulatory factor in true professional functioning.

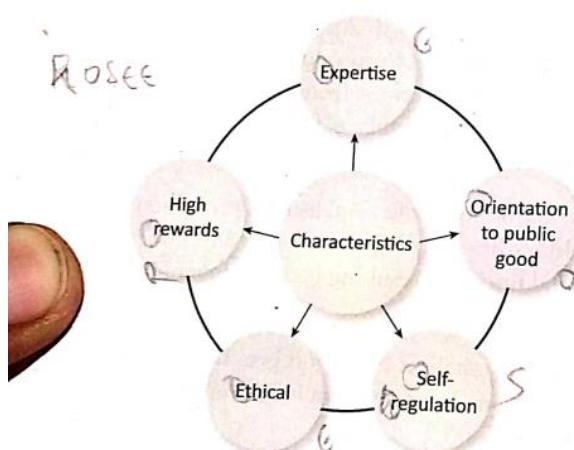


Figure 2.2 Characteristics of a professional

Exhibit 2.1

**High level of rewards** We have mentioned earlier that a professional commands a greater pay package and perks because of the high level of education and special training undergone. It is not only the remuneration that is high; he/she also has a high status in the society. More than this, professionalism requires that professional functions be performed with commitment and integrity irrespective of the monetary rewards. That is the spirit in which a true professional functions.

Figure 2.2 showcases all characteristics required in a professional.

## Responsibilities

The responsibilities of a professional can be explained as follows:

**Advancement of knowledge** A professional must be involved in the advancement of knowledge in the profession. Innovation must be a hallmark of a professional's functions. Whatever one may be doing, attempts for improvement must be made. One may not always be involved in research activities. A person working in the shop floor is far removed from research, but he/she has a role to improve whatever function is being done. Such innovations through action research are not uncommon and a professional is required to do them.

**Publication of information** One should not only attempt to advance one's knowledge domain in the profession but also publicize and inform others about such developments. This is also a responsibility of a professional.

**Maintenance of associations of professionals to advance the goals of the profession** We will be discussing professional associations in the next section. This is a basic requirement of professional activities. A professional should necessarily become a member of professional bodies and contribute to their objectives.

**Promotion of well-being of co-professionals** Professionals, individually or through their associations, must ensure the well-being of the members of their profession. It is essentially done

through the membership of the professional association. These associations are duty-bound to protect the interests of the members.

**Development and maintenance of standards** In a profession and its practice, one should abide by the code of conduct developed by professional bodies. In addition, professionalism requires that a professional sets his/her own standards for his/her functions and adheres to those standards. They may be ethical or other standards. Professionalism comes only through adherence to such codes and standards.

**Control of access to the profession** Controlling access to the profession is the responsibility of the professional bodies comprising professionals. This is done through registration and conducting examinations to evaluate the individuals seeking entry to the profession.

**Maintenance of a clean image of the profession** Again, individuals and professional bodies are responsible for this. The image of the profession is very important as it is mostly related to public service in some way. Professionals and professional bodies need to control professional practices by ensuring that ethical conduct and professional practice are beyond any kind of questions.

**Q.2 What is the importance of codes of ethics? Name few professional associations and codes prescribed by them.**

## **NEED FOR ETHICAL CODES**

Ethical codes have been present from the early days, in one form or the other. All professionals are members of professional bodies, either by mandatory registration or otherwise. In India, medical and legal professionals are compulsorily required to register themselves with a mandated professional body before they can practise the profession. In engineering, there is no such professional body with which engineers have to be registered before entering the profession.

What are the objectives or purposes of ethical codes? The following are some of the positive aspects that the codes provide to professional engineers and the profession itself.

**Codes act as guides for ethical functioning** The code of ethics of professional societies act as guides for an engineer to perform his/her professional duties. Most codes talk of public good, honesty and integrity, rules and regulations of the country, etc. The decisions and actions of engineers can be guided by these codes.

**Codes enhance the image of the profession** For a professional society, having a carefully drawn ethical code is not only necessary to regulate the members' conduct, but also to enhance the image of the profession and the group forming the society. Public image is important to claim more autonomy and self-regulatory powers and to prevent government regulations that may not be in their interest.

**Codes support professionals to fight against unethical acts** When an engineer enters the profession, it is very likely that he/she may face a moral dilemma, something he/she feels is not right. If the engineer has to raise his/her voice against such ethical aberrations, he/she needs some support to justify why he/she chooses to do so. Ethical codes can provide the engineer with the necessary support to fight against unethical acts.

**Codes help in grooming future professionals** Nowadays, most engineering curricula have a course on ethics. It may be a compulsory course, an elective course, or a non-credit course. There is now an increased realization to introduce a course on ethics. As part of this course, students learn about the code of ethics and their duties. This generally helps in grooming a group of professionals who are aware of their responsibilities and rights.

**Codes generally promote ethical business** A professional who is aware of the code of ethics has a better chance of promoting ethics in business. Today, most companies have a code of ethics for their employees. An ethical climate should permeate all the business activities. Codes can help in promoting ethical businesses and also show that ethics in business is not a constraint, but rather promotes the business.

**Codes provide deterrence to unethical conduct** Many codes provide deterrent actions and punishment for unethical conduct. However, it is not very explicit in engineering codes. The code of the Indian Medical Association (IMA) has a separate chapter on deterrents. Deterrents are a necessary part of the codes. Even if registration and membership is not mandatory for practising the profession, as in engineering, the termination of membership and the subsequent publicity itself can act as deterrents.

**Codes can create an ethical climate** When a group is governed by the same code of conduct, it can promote cooperation and focus on common issues. This helps in the enhancement of an ethical climate in the profession as a whole.

Codes are developed by experienced professionals in the respective areas. Engineering codes are developed by experienced engineers and approved by the professional body. To that extent, an ethical code is only a sort of self-regulatory mechanism. A group of professionals decide on the rules of conduct based on ethical principles. All contingencies cannot be anticipated at any point in time. Codes are thus dynamic and undergo changes from time to time.

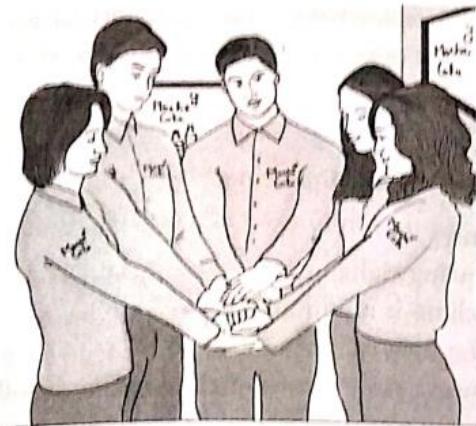
Most professional bodies also have committees, like the ethical review committees, to interpret the provisions of the code in case of any dispute. Before discussing the development of ethical codes, we will look at samples of codes from a variety of organizations to get an idea about how codes are developed and implemented.

..... codes are presented.

### **Institute of Electrical and Electronics Engineers\***

The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit

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'... I swear that I will never drink Gipsi or allow any of my family members to drink Gipsi...'

Mocha gipsy

lines of AIEE and had the objective of promoting innovations in radio and then electronics. In 1963, these two professional bodies merged to form the IEEE with a membership of 150,000.

The IEEE remains the largest professional body of engineers with 395,000 members. The society promotes advancement in the field of electrical engineering and electronics by its worldwide network of branches, publications, and conferences.

of humanity. The IEEE and its members inspire a global community through IEEE's highly cited publications, conferences, technology standards, and professional and educational activities.

The IEEE was formed by the merger of two professional bodies of electrical and electronic engineers. The American Institute of Electrical Engineers (AIEE) was formed in 1884 by a group of engineers. The main objective was to support professionals and to help them in their efforts to innovate and apply the innovations for the benefit of humanity. In 1912, with the advent of wireless and radio, the Institute of Radio Engineers (IRE) was formed. This professional body was formed essentially on the

### Code of Ethics

The code of ethics of the IEEE, as available today, is as follows:

'We, the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

- 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;
- to avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;
- to be honest and realistic in stating claims or estimates based on available data;
- to reject bribery in all its forms;
- to improve the understanding of technology, its appropriate application, and potential consequences;
- to maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;
- to seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;
- to treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;
- to avoid injuring others, their property, reputation, or employment by false or malicious actions;
- to assist colleagues and co-workers in their professional development and to support them in following this code of ethics.'

## **National Society for Professional Engineers (USA)\***

The National Society of Professional Engineers (NSPE) is the national society of engineering professionals from all disciplines that promotes the ethical and competent practice of engineering, promotes licensure, and enhances the image and well-being of its members. Founded in 1934, NSPE serves over 54,000 members and the public through 53 state and territorial societies and more than 500 chapters.

### ***Fundamental Canons***

Engineers, in the fulfilment of their professional duties, shall

- hold paramount the safety, health, and welfare of the public.
- perform services only in areas of their competence.
- issue public statements only in an objective and truthful manner.
- act for each employer or client as faithful agents or trustees.
- avoid deceptive acts.
- conduct themselves honourably, responsibly, ethically, and lawfully so as to enhance the honour, reputation, and usefulness of the profession.

### ***Rules of Practice***

- Engineers shall hold paramount the safety, health, and welfare of the public.
- Engineers shall perform services only in the areas of their competence.
- Engineers shall issue public statements only in an objective and truthful manner.
- Engineers shall avoid deceptive acts.

### ***Board of Ethical Review***

The Board of Ethical Review (BER) is a panel of engineering ethics experts that has served as the profession's guide through ethical dilemmas. The board consists of seven licensed members who are appointed by the NSPE president. The purpose of the BER is to render impartial opinions pertaining to the interpretation of the NSPE code of ethics, develop materials, and conduct studies relating to the ethics of the engineering profession.

### ***Observations***

After going through the code of the NSPE, you will observe the following:

- The code is in three sections: fundamental canons, rules of practice, and professional obligations. The code covers most of the aspects covered in other codes. The code also mentions whistle-blowing by professional engineers.
- The part on deterrents and punishments or any procedure to deal with violations is missing.
- There is a board of ethical review that helps in interpreting the provisions of the code.

## **American Society of Civil Engineers\***

Founded in 1852, the American Society of Civil Engineers (ASCE) represents more than 144,000 members of the civil engineering profession worldwide and is America's oldest national engineering society.

The ASCE's mission is to provide essential value to its members and partners, advance civil engineering, and serve the public good. In keeping with this mission, the ASCE performs the following functions:

- Advances technology
- Encourages life-long learning
- Promotes professionalism and the profession
- Develops civil engineer leaders
- Advocates infrastructure and environmental stewardship

### ***Code of Ethics***

Engineers uphold and advance the integrity, honour, and dignity of the engineering profession by

- using their knowledge and skill for the enhancement of human welfare and the environment;
- being honest and impartial and serving with fidelity the public, their employers and clients;
- striving to increase the competence and prestige of the engineering profession; and
- supporting the professional and technical societies of their disciplines.

## **American Society for Mechanical Engineers\***

The American Society of Mechanical Engineers (ASME) helps the global engineering community develop solutions to real world challenges. Founded in 1880, ASME is a non-profit professional

organization that enables collaboration, knowledge sharing, and skill development across all engineering disciplines, while promoting the vital role of the engineer in society. The ASME codes and standards, publications, conferences, continuing education, and professional development programmes provide a foundation for advancing technical knowledge and a safer world.

### ***Code of Ethics of Engineers***

ASME requires ethical practice by each of its members and has adopted the following Code of Ethics of Engineers as referenced in the ASME Constitution, Article C2.1.1.

The fundamental principles in the code of ethics of ASME are the same as that of the ASCE, **Fundamental Canons**

Q.3 What do you understand by risk-benefit analysis in engineering project? How far should ethical considerations become part of it?

### RISK-BENEFIT ANALYSIS

While designing an engineering product, the risks are to be estimated. The costing of risks is a difficult job but has to be done to compare it with the benefits of the product, especially in the case of big projects. The comparison of risks and benefits is done using risk-benefit analysis.

Many large projects are justified on the basis of risk-benefit analysis. Any person doing a risk analysis has to ask the following questions and search for the answers:

- What can go wrong?
- What is the probability that it will go wrong?
- What are the consequences if it indeed goes wrong?

An engineer entrusted with the management of risks associated with a product and risk avoidance has to ask himself/herself the following questions:

- What options are available to reduce risk?
- What is the organization's trade-off in terms of all costs, benefits, and risks?
- What is the highest acceptable risk and how can it be incorporated in the design?

There are difficulties because of the very nature of the risks. Benefits may be immediate but risks, at least some of them, may be far off in the future. How should one account for this time difference while evaluating the risks and benefits in monetary terms? Both—risks and benefits are also probabilities. They have to be factored by the probability of their occurrence. Thus, risk-benefit analysis is not a simple task. It is only when the gains outweigh the risks that the product is considered fit for implementation.

There are many ethical questions arising here. While a project, such as the construction of a dam, may benefit many people, it can equally harm a number of others. Do we have the right to harm some for the benefit of others? Does it involve human rights violations?

An example in this regard is the Sardar Sarovar Dam. The project not only created a lot of apprehensions but also led to long-drawn agitations against the dam.

Q.4 Compare and explain in detail the major ethical theories (utilitarianism, deontology, virtue ethics)

### ✓ Utilitarianism

Utilitarianism, also known as consequentialism, is a theory credited to John Bentham and later to John Stuart Mill. Utilitarianism judges an action by the consequences of that action. Bentham stated the principle of *maximum good to maximum number of people*, which was later modified to *maximum good*. An action is good if it results in maximum good to people affected by that action. The many questions arising from this theory led to many people criticizing it. One such question was, What is meant by maximum good and how is it to be measured or verified? In addition, since the consequences come after the action has been performed, there is a predictive element in the theory—one has to predict and judge the consequences to classify the action as ethical or not. Jeremy Bentham considered the consequences of an action as either pain or pleasure. As pleasure is the more desirable state, the action is ethically correct if it results in great pleasure. John Stuart Mill, extending Bentham's idea of pleasure, stipulated that one should seek higher levels of pleasure. Mill was of the opinion that physical pleasures, such as eating and exercising, are lower levels of pleasure. According to him, we will be happier if we attain higher pleasures such as creativity, appreciation, and love.

Utilitarianism is a consequentialist theory as it judges actions by the results they produce. How to judge the result of an action is a matter of debate in itself. One school of thought recommends act-utilitarianism, which states that an act is good or desirable if it produces maximum good. Another school of thought talks about rule-utilitarianism, which states that one should act within the stipulated general rules and maximize the good. Act-utilitarians are of the view that rules can be broken, if doing so maximizes the good. Rules are only general guidelines and should be followed if, and only if, they maximize the goodness of the result.

Stuart J. Mill's act-utilitarianism is criticized as it can lead to many unfair practices. Rule utilitarianism proclaims that moral rules are to be followed to maximize the good. Mill supported act-utilitarianism because he felt that rules are only derived from past experiences. Richard Brandt is a staunch believer of rule utilitarianism. According to him, if moral codes or rules are framed to maximize the good resulting from following them, then such moral codes are justified.

### Virtue Theory

## ✓ **Virtue Theory**

Virtue theory is perhaps one of the oldest theories. It is credited to Aristotle, who propounded that **virtues are acquired habits** that help us lead a rational life. Of the many virtues, Aristotle

considered **wisdom** and **common sense** or **good judgement** as **important virtues**. He stated that many other virtues such as **truthfulness**, **courage**, **generosity**, and **comradeship** are also important. Aristotle considered each virtue to be governing some aspect of our lives.

Moral virtues can be thought of as **habits** acquired to exhibit a proper balance or behaviour that does away with extremes. This is called the **golden mean** between extremes. When one acquires desirable virtues, he/she exhibits a balanced behaviour while dealing with his/her emotions, attitude, and desires.

Virtue theory has also been dictated in many traditional religions, which extol human virtues as a means of leading a fruitful life.

According to this theory, an **action** is considered ethical if it is what a virtuous agent would have done in a similar situation. The judgement of an action is based upon the character of the person performing the action and not on the action itself. The difficulty with this theory is that moral characteristics or virtues of the person do not remain permanent and can change either way. A non-virtuous person may become virtuous later and a virtuous person may become non-virtuous. Hence, looking at the agent alone in judging his/her actions may not work in all cases.

## **Rights Theory**

## Deontology

Charlie Dunbar Broad defined the term as duty or obligatory actions. The theory of deontology is, however, credited to Immanuel Kant and this theory is also known as Kantian theory. Kant considered that an act is good if it is in accordance with some cardinal principles that govern our duties. An action that is performed according to the duties prescribed is considered to be ethical. Consequences of the action are not the most important thing. Kant stipulated the following three categorical imperatives for action.

- Act only according to that maxim by which you can also will that it would become a universal law.

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- Act in such a way that you always treat humanity, whether in your own person or in the person of any other, never simply as a means, but always at the same time as an end.
- Act as though you were, through your maxims, a law-making member of a kingdom of ends.

William David Ross, another proponent of duty ethics, stated our duties as the following.

**Duty of beneficence** A duty to help other people (increase pleasure, improve character)

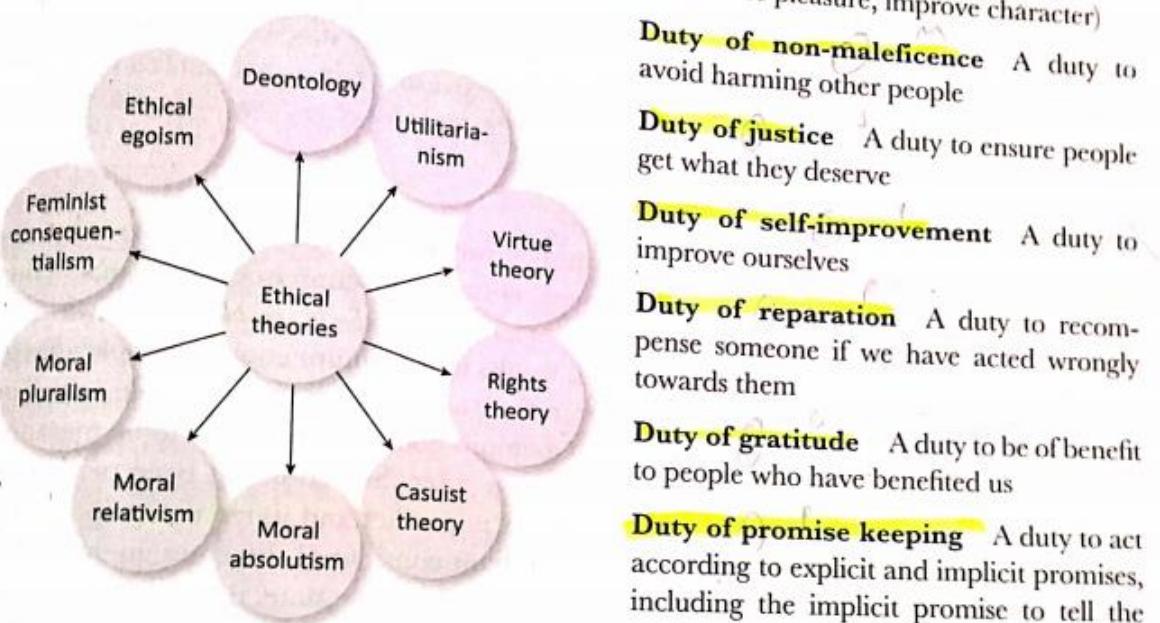


Figure 3.3 The basic theories

**Duty of non-maleficence** A duty to avoid harming other people

**Duty of justice** A duty to ensure people get what they deserve

**Duty of self-improvement** A duty to improve ourselves

**Duty of reparation** A duty to recompense someone if we have acted wrongly towards them

**Duty of gratitude** A duty to be of benefit to people who have benefited us

**Duty of promise keeping** A duty to act according to explicit and implicit promises, including the implicit promise to tell the truth

Figure 3.3 shows the basic ethical theories.

One should act according to the aforementioned sacred duties to ensure that an action is ethical. The consequence of the action, whether it leads to the good or bad, is immaterial. Exhibit 3.2 lists some common ethical problems in journalism.

Q.5 What are the major problems in Environmental ethics? What steps can be taken up to overcome ethical issues related to concerned field?

### Challenge of Environmental Ethics

Environmental ethics developed as a discipline in the 1970s. Attention was drawn to the global effect of environmental damage and it was felt that the root cause of this disaster is ethical.

Rachel Carson was the first to draw attention to this. She highlighted the damage caused to other life forms and also to public health by commercial farming practices aimed at producing high yield and profits. She also warned that the use of high level of pesticides would make its way into the food chain, causing health hazards. Lynn White in his writings on the historical cause of our ecological crisis has pointed out that the way we deal with the environment is unethical and faulty, and we will have to finally pay for such extravagance in using the natural resources. Garret Hardin in his essay *Tragedy of the Commons* highlighted the same view.

Aldo Leopold claimed that the roots of the ecological crisis were philosophical. In the western developed world, the philosophy was to exploit natural resources for the benefit of the human society at the expense of other life forms. This view holds that humans are the only life forms having intrinsic value, that is, value as an end in itself. Other elements of the biosphere, living and non-living, have only instrumental value, as a means to an end. According to environmental ethicists, this philosophy is at the root of the environmental crisis that we face today. Environmental ethics tries to look at development from a new perspective of coexistence of all life forms and development of the human society in a sustainable manner.

### Anthropocentrism

Anthropocentrism is a word that has been coined to indicate the human-centredness in development. This philosophy puts human beings at the centre of the universe. Their well-being is the priority. All other living and non-living things have value only to the extent that they are of use to human beings. The apparent prosperity in the western world is said to be due to this philosophy. Human-centred development considers that humans are living beings with all the rights and that all other resources, including other living elements, are exclusively for use by them. This does not recognize the right of animals and plants to live. Anthropocentrism is an extended form of egoism. Typical expressions of this ideology can be seen in the western world. A herbal plant has instrumental value as it can be used as a medicine. It may not have any intrinsic value. As the human population increases, we look for space to live and encroach upon the habitat of animals by clearing forests. Unless we recognize that other life forms also have intrinsic value and recognize their right to live and multiply, we will have development that would finally lead to catastrophe for the human beings themselves. The philosophical view that gives equal importance to all living forms and recognizes their right can be called biocentrism.

Biocentrism puts all living elements in one basket recognizing their right to live, prosper, and coexist, and also share equally the resources available in the planet.

It may be noted that some ethicists working in the area feel that there is no need to have a non-anthropocentric philosophy to overcome the environmental crisis. A change in outlook, called prudential or benign anthropocentrism, is sufficient for overcoming the environmental crisis. This would be an outlook between highly human-centred development and biocentrism.

## Sustainable Development

Sustainable development is a term credited to the Brundtland Commission, which defined it as 'development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs.' Sustainable development is thus a pattern of resource utilization that meets the needs of the present but at the same time takes care of the needs of posterity. The three competing requirements of this model, as can be seen in Fig. 7.1, are the environment, society, and economy. Sustainable development is at the confluence of the three major elements of this diagram. Sustainable development can be seen as economic development of the society in equilibrium with the supporting ecosystems.

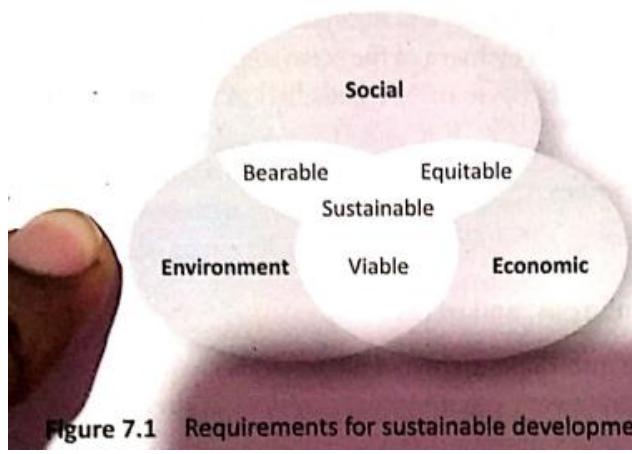


Figure 7.1 Requirements for sustainable development

Sustainability has to satisfy the three competing requirements of economic prosperity, environmental quality, and social equity. As the human society pursues the goal of economic prosperity, it has to take care of environmental stability and social equity. Heavy and speedy use of natural resources results in development that cannot be sustained. Table 7.1 shows the relationship between resource utilization and sustainability.

Use of resources: Developed countries use a major part of natural resources. The developing countries like China and India, also overuse their natural resources for their large population. Minerals are formed over a period of millions of years in the earth crust.

Urban issues- Horizontal expansion of urban areas creates many problems to environment. Urbanisation has influenced the atmosphere in different ways, such as growth of vehicles, sanitation, multiplying industrialization, power consumption etc. By this type of expansion of agriculture land, forests, grasslands reduce and on it the pressure on agriculture land increases. Solid waste and sewage waste management is also another problem of big cities.

Vegetations- The number of plant species are declining. The number of threatened plant species is 5611.

Animals and birds- Biodiversity is essential for survival of life on earth. India is rich in biological heritage of world. But deforestation and mining activities, threat to this priceless biodiversity.

Pollution- Pollution is undesirable change in the physical, chemical or biological characteristic of air, water and soil that may harmful affect the life. Air pollution means the presence of pollutants such as dust, smoke, fog and foul smell which are unimportant and even harmful for plants and other living being.

Noise pollution means the unwanted sound dumped in the atmosphere leading to health hazards. Rapid industrial growth, heavy traffic, urban crowed and electric equipments like loud speaker, DJ, religious and social functions increase noise pollution.

Water pollution- Water pollution simply means contamination of water due to any external material , or in other words introduction of something to natural water which make it unsuitable for human consumption.

Soil pollution- Soil pollution refers to any physical or chemical change in soil conditions that may adversely affect the growth of plants and other organisms.

Solid Waste- Solid waste is most of visible form of pollution. Solid waste includes glass containers as bottles , crockeries , plastic containers ,polythene and packing material that are used and then thrown as garbage . Most of methods disposing of solid waste pose serious damage to environment . More urbanization and industrialization the problem of waste disposal increased.

Population- Rapid growth of population has led to a number of environmental issues. Population growth and industrial development determine the total impact on environment. The major issue is population growth in India. Population of India is 17.8% of the world total population and 2.4 % of world"s total area. India with 1,220,200,000 people is second largest country in the world. It has greatly increased the pressure on natural resources.

Conservation of natural resources : Environmental goods are distributed in such a way that wealthy and otherwise privileged people enjoy the benefits of these environmental goods, but poor or otherwise disadvantaged people bore their burden.

Forestation : Forests play an important role in carbon cycle .Main greenhouse gas CO<sub>2</sub> , is absorbed by the forests .Forests can absorb many toxic gases and can help in keeping air cool. There is a need to grow more trees .The natural forests must be protected as national parks and wildlife sanctuaries where all the plants and animals can be protected.

Conservation of biodiversity : It is matter of prime concern that biodiversity should be conserved. Once a species is lost , it is gone forever and it will not come into existence again .There is a moral justification for conservation of existing of biodiversity . Every species has a right to exist and human being should not temper the nature"s creation . There are 668 protected areas including 102 national parks , 515 wild life sanctuaries , 47 conservation reserve and 4 community reserve in India . In addition there are 47 tiger reserves , 18 biospheres reserves ,125 elephant reserves and wetland sites in India .

Pollution control- Forests cover should be protected .Trees are best controller of air pollution ,noise pollution and soil pollution and soil erosion. Keeping the ill effects of noise pollution in mind it should be checked . and rules should be follow.

Population control- Increasing population should be checked. It is our duty. One child concept should be adopted.

Value leadership- Leader can play an important role in establishing a climate regarding ethics. Leader can convey the importance of ethical values to public easily. They can become a role model in youth by using eco friendly goods and mode of transportation . In this context our Honourable prime Minister Sh.Narendra Modi ,s efforts are praising .

Say No to Plastic- Now a days we are using plastic in much amount. Use of plastic is dangerous for environment. Many cows are being killed by eating plastic bags. Parties and Functions we use plastic plates and glasses. It does not decompose easily and pollutes our environment .We must say No to plastic items and start to use earthern pots like Kullars , and leaves plates like Pattals instead of using plastic products.

Solid waste management- 3Rs Principle:

Reduce- We can reduce our necessities by changing our life style . Reduction in use of raw material will correspondingly decrease the production of waste . .We can use public transport , make pools in car , and also use cycles and save precious fuel and environment.

Reuse- Some resources can be used reused. Water is more important in them. Refillable containers can be reused .Other things like paper, clothes , bottles ,boxes and other waste material etc. also can be reused.

Recycle- Recycling is more important now a days . Recycle is the processing of a use item or any waste in to usable form .All metallic goods can be recycled.

The conservation ethic and traditional value system of India – People in ancient India give regard and respect to mountains, rivers, forests, animals and birds. Nature was very important for them . Mother nature is worshipped in Hindu religion. Hindus have sacred rivers and lakes, mountains, worship of snakes, and other plants and animals. Peepal tree (long pepper tree) was considered holy tree and it is not to be cut down. Banyan tree , tulsi plant (basil ) are also considered holy plants. Tribal people worship forests. Some species of animals ,birds and trees are venerated as being the „Vahan“ or vehicle of gods and goddesses, mouse of Ganesh, eagle of Vishnu, bullock of Shiv, lion of Durga, swan of Saraswati, peacock of Kartik etc. And some are associated with gods and goddesses elephant with Ganesh, cow with Krishna, monkey with Rama and Hanuman. With each one of them ,some particular characters like power ,grace ,peace ,prosperity , sharpness ,stability ,force etc. are attached. The Vedas and Upanishads contain the earliest message for preservation of environment and ecological balance. This was a simple way of making the common people love nature and care for it . Buddhism and Jainism believe in Ahimsa ,tolerance ,love ,compassion , forgiveness .

Guru Jambheshwar Ji, the founder of Bishnoi sect laid great stress on having compassion toward all living beings and protection of innocent animals . He also advocated to preserve and protect wild life and plants. Our religions teach us to conserve and protect our environment in a simple and natural way.

**Q.6 What is computer ethics? What are the ethical problems related to computer ethics and what steps can be taken to minimize the problems associated to it?**

## **COMPUTER ETHICS**

Computers are ubiquitous tools that have affected our lives immensely. They are digital machines with the capacity to store an enormous amount of data, retrieve and process them at great speed, and display the results instantly. They have affected our lives for various reasons, good and bad.

The early development of computers saw a few huge machines placed at government offices and universities. Two fears felt at that time were that the information stored in these monsters could concentrate power in a few hands and that computers will have the effect of eliminating jobs as they could do the job of many, with great speed and accuracy. These fears were proved baseless with the advent of microcomputers and the computer technology itself being the provider of millions of jobs the world over.

During the last half-century, the developments in computer technology have been phenomenal. The personal computers (PCs), laptops, and palmtops have revolutionized both the spread and power of computer technology. For those who want it big, supercomputers do a variety of jobs in all spheres of life with their power to perform trillions of operations per second.

Computers today have become akin to media. They carry news and views, entertain, communicate, educate, and interact. The interactive nature of the computer medium is a great advantage as you can instantly react to news and views.

The Internet, essentially a network of computers, has become a source of all the things that a medium can offer. It enables us to interact with one another in a variety of ways—e-mail, chat, and socializing sites. This power in the hands of people is not without associated problems.

Computer technology utilizes the services of many professionals such as hardware engineers, software professionals, system analysts, and networking specialists. Information technology (IT) and information technology enabled services (ITES) form the backbone technology of all developments today in all the three sectors of economy: primary sector of agriculture, secondary sector of industry, and the tertiary sector of services. At the root of this development sits the computer.

## **Manufacturing and Marketing of Computers**

There is a tendency to exploit the innate craze and fancy of buyers for state-of-the-art systems. With so many manufacturers in place, one has to work hard to sell computers with cutting-edge features. With this, many consumers end up owning systems that are way beyond their requirements.

## **Software**

Software development and marketing face similar problems. Developers tend to bundle the software and market them as a package and you are forced to buy the same, whether you need the whole package or not. These unethical marketing practices have landed companies like Microsoft in trouble. While the company feels that it has done nothing wrong in supplying an integrated Windows and Web browser software (many people like it that way), competitors felt it was an unethical practice and comes under anti-trust laws. There has been a ruling against Microsoft as well.

There have been many cases of half-baked software being supplied, which do not work properly, causing immense trouble to customers. Wrongly prepared bills are common in departmental stores. Human error can also cause trouble if discounts and other benefits are not reflected in the bills. Only alert consumers notice this. Quite often, the consumer is unaware that he/she has been cheated because the proper amount is not reflected due to the non-updating of databases of the software by the store.

## **Cybercrimes**

Many nuisance activities and criminal acts are performed with computer systems. These unethical acts can cause loss of property and harassment.

### ***Unsolicited Mails and Promotional Materials***

This is the simplest of cybercrimes but has immense nuisance value. Many people are flooded with unsolicited e-mails and business promotional materials. This is done by obtaining the e-mail IDs of people and bombarding them with such mails. This is also an unethical marketing practice as it is cheaper to do than advertising on the Internet. Such mails can also be used for introducing malicious software into someone's computer.

### **Data Stealing**

Computer systems used by organizations are well-protected by using specialized software. An equally dynamic system of hacking into such computers thrives. This requires great expertise and knowledge. As information is power, such efforts are intended to steal sensitive data and information from many sources. It has been reported that there is an organized effort from some countries to hack computer systems of many governments and steal data and information. This is a criminal act.

## **Embezzlement**

Money being stolen from bank accounts by unscrupulous elements has become very common. There have been many cases of stealing from someone's bank account by employees of business process outsourcing (BPO) companies or other unscrupulous elements. It is estimated that millions of dollars are lost this way every year. Many gullible customers are coaxed to reveal their protected details, such as IDs and security numbers, enabling crooks to embezzle money from their bank accounts.

This is only a sample of the types of crimes related to computer technology and its use. While manufacturers try to develop more secure computer systems, this has fallen short of cyber criminals' efforts to breach any form of security.

## **Hacking**

Hacking into computer systems is a common crime. It needs some expertise, which many computer users have acquired. It may start as a fun game but often leads to criminal acts involving stealing somebody's e-mail ID and sending mails on that ID to others. This comes into the realm of invading someone's privacy and creating a misunderstanding.

Hacking is the process of entering the computer systems of other people with the intention of either collecting information or crashing the system. Hacking is classified into two types—ethical hacking and illegal hacking. People who perform ethical hacking are known by the fancy name 'white hats' and those who do illegal hacking are known as 'black hats'.

### **Ethical Hacking**

The objective of ethical hacking is to check the security of computer systems. Ethical hacking is done by experts who are engaged by companies for that purpose. Ethical hackers check computer systems to assess the vulnerability and improve security.

Ethical hacking is a course conducted by many organizations. It requires expertise and intimate knowledge of computer systems. While illegal hacking is done with the intent of mischief or personal gains, ethical hacking is done with the permission of the owners of the system to evaluate security aspects, check for vulnerabilities, and suggest improvements. The objective of ethical hacking is to see how to break into the system to create mischief, but on the request and permission from the owners, and to put in place mechanisms so that others are not able to attack the system.

With most of the managements in government and private sectors going for e-governance, data security has become a big challenge. Most organizations engage ethical hackers or outsource the job of assessing the data security to experts. Many people who were illegal hackers earlier have now been engaged by organizations as white hats to check the security of their computer systems.

### **Illegal Hacking**

Illegal hacking is done by those who have the capability to penetrate into others' computer systems without the owners' knowledge. The essential objective is to create mischief or to collect

data with the intent of getting some personal gains. Hacking with any kind of intent requires intimate knowledge of computer systems and their functioning.

Illegal hacking is done with the following objectives:

- One does it for fun, just to see the data or private communications of other people with no intention of using them for any personal gains.
- One does it for testing their own expertise to see whether they are capable of entering other computer systems, again with no bad intentions.
- One does it as a business—for someone else who would use the data as he/she may wish—for a fee.
- One does it with the intention of personal gains, by collecting data and personal or professional information for his/her personal gains.

**Q.7 What are the rights of professionals? Explain the concept of 'whistle blowing' and IPR (intellectual property right).**

Rights of true professionals

- 1: Put customer satisfaction first**
- 2: Make expertise your specialty**
- 3: Do more than expected**
- 4: Do what you say and say what you can do**
- 5: Communicate effectively**
- 6: Follow exceptional guiding principles**
- 7: Praise your peers not yourself**
- 8: Share your knowledge**
- 9: Say thank you**
- 10: Keep a smile on your face and the right attitude in your heart**

### **Rights of an Employee**

- You have a right to get a **compensation package** commensurate with your qualifications, experience, and skills, as per industry norms or standards. Many times people are underpaid or underemployed. You have a right to seek a job that matches your qualifications and get a remuneration package that corresponds to that. We must recognize that very often an employee works for a lesser pay because the job is challenging and provides better opportunities.
- You have a right **not to be discriminated** against in the course of your career, starting from recruitment to promotions and other employee benefits. There should be no discrimination based on caste, religion, race, colour of skin, etc.
- You also have rights conferred on you by the **employment contract**. You have the right to salaries and perks as mentioned earlier. In addition, there are many other benefits that you may demand such as paid leave and travel allowances.
- You have the right to pursue some outside activities that do not interfere with your work such as a **hobby or other interests**.
- You have a right to be a member of an **organization of employees** for collective bargaining for getting their just rights.

### **Rights of a Professional**

- You have the right to pursue **your profession** in a free and fair manner by freely expressing your professional judgement.
- You have the right to perform **your professional duties** according to **your best professional judgement**, without being coerced into decisions.
- You have the **right of refusal**, that is, the right to refuse to do anything that is unprofessional or unethical.
- Within the bounds of confidentiality, you have the right to **talk freely about professional matters**.
- You have the right to pursue **your professional interests**, such as higher studies or research, without hampering your contractual obligations.
- You have the right to be a member of **professional organizations** that **promote the profession** and take active part in activities related to the profession.
- You have the **right to engage in activities** that **uphold your professional responsibility** of public safety and welfare despite your loyalty to your employers.
- You have the **right for recognition** of your professional services, including adequate remuneration and other rewards.
- You have the **right to go public** with **unethical acts** (whistle-blowing).

The term whistle-blowing comes from the field of sports where a whistle is blown when a player commits a foul. In ethics, a whistle is blown (information is disclosed) when something bad or unethical has happened. Whistle-blowing, thus, refers to the phenomenon when someone comes out with the information that something unethical has happened or is happening. Whistle-blowing in general has the following five attributes (Fig. 6.2):

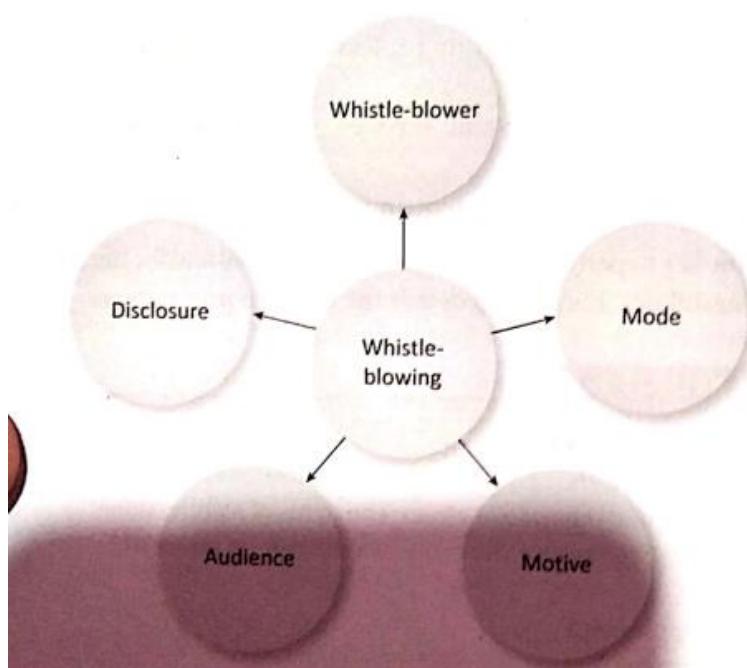


Figure 6.2 Attributes of whistle-blowing

approved or regular channels to convey the information. There can be many reasons for this: (a) the person is under pressure from the organization not to disclose such information; or (b) the person finds that the immediate superiors who form the normal channels of communication do not listen to what he/she considers legitimate complaints.

**Disclosure** A person discloses information about an unethical happening. The unethical act is serious enough to warrant such disclosure and concerns public safety.

**Whistle-blower** The whistle-blower is the person disclosing the information. In a narrow sense of the term, the person disclosing the information is an employee or former employee. In a wider sense, it can be anyone who has the knowledge and proof of the unethical acts.

**Mode** When a person discloses information of some unethical acts, he/she does not follow the

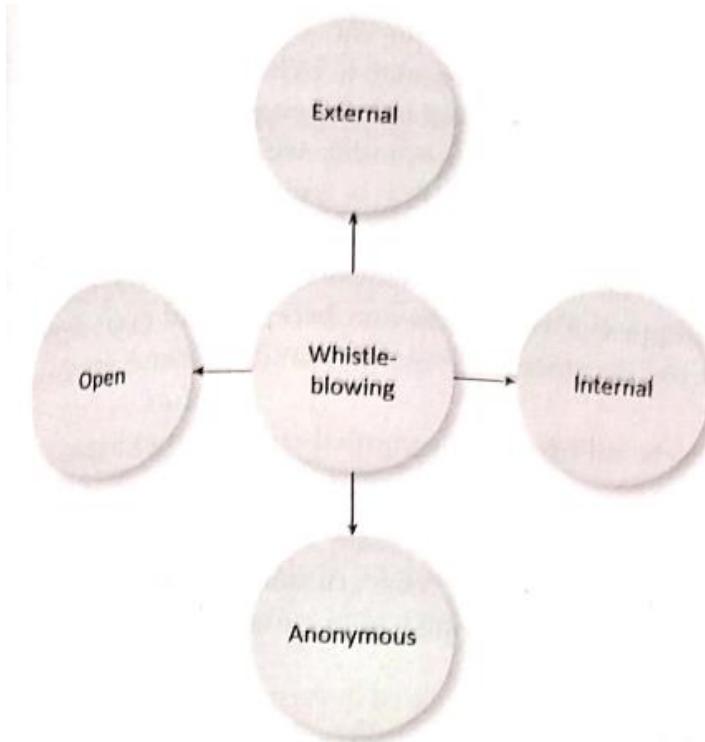


Figure 6.3 Types of whistle-blowing

organization to a superior entity bypassing the normal channels of communication.

**Open whistle-blowing** This is when the person disclosing the information does not hide his/her identity.

**Anonymous whistle-blowing** This is when the person disclosing the information does not disclose his/her identity. Anonymous whistle-blowing is generally not taken seriously.

In general, the term whistle-blowing is restricted to employees who disclose information about corruption or unethical acts in the organization to an authority within or bring it out to the public domain.

Whistle-blowing can thus be defined as 'disclosure of information about unethical acts in an organization to an authority within or outside the organization that is capable of taking steps to prevent such actions or punish those doing such acts with the motive of ensuring public safety or upholding morality.'

In a much wider sense, the person disclosing the information need not be an employee. Anyone with the knowledge of any unethical or fraudulent acts can disclose the information. The sting operation conducted by a media group or newspaper can come equally within the ambit of whistle-blowing. This is so because the final objective is to disclose unethical acts and bring it to public domain for the authorities to take note of and take action.

An employee as a whistle-blower is more critical because of the ramifications involved. The following are some critical issues connected with whistle-blowing:

**Audience** When a whistle-blower passes information about something unethical happening, he/she has to report the same to someone or some entity with the authority to take appropriate action to prevent or punish those who have done that act.

Whistle-blowing can be of many types (Fig. 6.3). These are discussed here:

**External whistle-blowing** This occurs when an employee gives out information about unethical acts to agencies outside the organization he/she works for.

**Internal whistle-blowing** This is when the employee discloses the information within the

## **INTELLECTUAL PROPERTY RIGHTS**

Intellectual property rights (IPR) is a global issue. We will take a brief look at the concept of IPR and its various dimensions and the laws that govern these dimensions.

Intellectual property right can be defined as the right to the creation of one's mind or intellect. The creations can be in many forms in terms of artistic or literary works, scientific inventions, designs, etc. IPR, once established, enables the individual to claim exclusive right to exploit his/her creation commercially. Essentially, IPR ensures that others cannot exploit somebody's creation without his/her consent or by making some financial or other arrangements with him/her to use that invention.

Many forms of intellectual property have been identified. Most common ones are patents, trademarks, copyrights, industrial design, and geographical indications.

### **Why Intellectual Property Rights?**

Intellectual property rights are granted to the innovator as an incentive for creativity. Consider the case of a medical formulation. The stages gone through in getting a marketable formulation include research, testing on animals and humans, getting approvals, and finally production and marketing. The process is very expensive and the pharmaceutical company investing money in such a venture would like to be compensated by getting the right to produce and market that product. Such a right granted is the IPR.

The right so granted is for a limited period only, say 20 years. During this period, other companies are prevented from manufacturing and marketing the same formulation. This gives the company exclusive right to produce and sell the product.

### **Purpose and Advantages of IPR**

The granting of IPR can be considered to have the following purposes:

- It is basically an incentive for the innovators. It promotes innovation because IPR makes it possible for the innovator to commercially and exclusively exploit the innovation, even if for a limited period of time.
- IPR helps many companies invest in research and innovation because once IPR is granted, the company finds it possible to recover the investment and make profits. It makes investment in research a commercially viable proposition.
- Many IPR categories protect the long traditions and rich heritage associated with famous products and geographical territories such as *Kancheepuram silk* or *Darjeeling tea*.

Q.8 What is engineering ethics? What are the ethical issues(product specific) and ethical obligations in engineering ethics?

the failure has occurred. The failure may not be traceable to a single individual. The ethical issue is not the failure per se, but what efforts were put in the design and implementation to ensure that the failure does not happen. Whether compromises were made and corners cut for earning profits are the questions. Had there been a lapse knowing fully well the compromise being made and had the dangers due to such a lapse been underestimated?

### Issues in Engineering Ethics

What are the ethical issues that engineers face as they perform their functions? It may not be possible to generalize all the issues that may arise, as many of the issues may be product-specific. However, we look at some of the issues considering many kinds of engineering products.

**Conceptualization** This is the stage when a product is conceived for realization. The outcome may be a dam, a roadway, or a manufactured product. The conceptualization stage involves developing an idea into a conceivable product. A dam is conceived to be built for power generation or irrigation. It is a creative stage and the full ramifications of the project may not be known. However, the idea can be abandoned even at this stage if there are very obvious obstacles or cost-benefit factors that make it unviable. The following ethical questions may arise at this stage:

- Is the product useful?
- Does it satisfy a felt need?

At this stage, one essentially looks at and satisfies oneself of the utility considerations of the product.

**Investigation** Having satisfied oneself that there is nothing that is evident to abandon the idea, one gets into the details of the project. For this, investigation is required to collect data. For a dam project, one has to study the topography, geology, best location, social and environmental impact, etc. For a road project, traffic studies, topography, bridges to be built, drainage considerations, route analysis, etc., will be required. For a manufactured product, one conducts a market survey and analysis to optimally locate the product in terms of utility and cost. The following are the major ethical questions arising here:

- Has a thorough and unbiased study been conducted?
- Have all data and observations been reported fully?
- Is there any attempt to falsify or enhance the utility by hiding or falsely interpreting the data?
- If it is a manufactured product, has the market survey been thorough and the utility and safety of the product fully covered in the study?

**Product specification and costing** Once the investigation data is favourable, one goes into more details of the project. The concept takes shape here in terms of its size, materials, organization, and specifications. A rough cost estimate can be prepared at this stage for the purpose of approvals and sanctions. Time frames can be established for realization based on investigative reports and past experiences. At this stage, the following questions may arise:

- Have the specifications been drawn as per established norms and standards currently in vogue?

- Has the material selection been done without compromising safety norms?
- Is the product with the specifications realizable in the stipulated time frame?

**Analysis and design** Analysis and design are iterative processes. In small projects, this may not be a long-drawn affair; but there may be many mega projects where elaborate analysis and design processes are involved. Many designs may also involve model analysis to study the effect on the design. Designs are based on many assumptions, which can be verified using various methods including computer simulations. The ethical questions arising here may be as follows:

- Has the design been made based on the latest technological tools available?
- Have the assumptions made for the design been clearly stated?
- Have appropriate procedures been followed for the verification of the designs?
- Have all contingent factors been taken into account in the design?

**Bidding and contracting** Bidding and contracting are processes that have come under the scanner in many cases. Both the bidding process and the awarding of the contract are areas where a lot of unethical practices have been reported. The 2010 Commonwealth Games held in New Delhi had many alleged instances of violation in the bidding processes. The contracting may be for the procurement of materials and components, which is common in the manufacturing industry. The contracting may also be for the implementation of the project as a whole, as in the case of infrastructural projects. There are generally two types of bids—technical bid and financial bid. In all such cases, one should ask the following questions to find the ethicality of the process:

- Has the bidding process been fair and the principle of equity (equal opportunity) maintained?
- Have the contract documents been drawn up fairly for both the clients and the provider of the services?
- Have the analysis and award of bids been fair?
- In rejecting any bid, particularly the lowest bid, has appropriate reasons been given for rejection?

**Implementation of design** This refers to the realization of the product in the physical form. Implementation requires complete adherence to the specifications and design data. It involves ensuring complete reliability of the processes used by verifying them frequently. It also involves good supervision of work, communication with the designers in case of difficulties, and sticking to time frames. It also involves safety at the work place. All these factors result in the following ethical questions:

- Has the quality of materials been checked before use? In case of site-manufactured materials such as concrete, has adequate care been taken in testing the quality of component materials and the process of making the product?
- Is the time frame for realization adequate, without making the implementers to hurry through compromising the quality?
- Are appropriate quality tests and quality processes in place and strictly adhered to?
- Has work place safety been taken care of for workers? Are they provided with adequate safety gadgets?

- Have the test results been reported faithfully and interpreted fairly?
- Has the implementation been done on the basis of minimal compliance?
- In case of an unforeseen accident at the workplace, are there minimal health care kits available, such as a first aid box? Is adequate compensation given to the workers for any damage to their limbs or life? Are attempts made to hush up accidents and not report them?

**Installation and use** In the case of many engineered products, while the implementation is done in the factory, the product has to be installed, commissioned, and made fit for use at the customer's premises. The customer has to be informed of the complete details of the product. Appropriate documentation must be carried out for its use, indicating the likely pitfalls and most probable misuse. The following questions arise here:

- Is the advertising for the sale of the product fair, mentioning all facts of the product and without making false claims?
- Is the documentation of the product exhaustive and complete?
- Has the user been provided adequate training for use?
- Has the user been told of precautions to avoid any harm during use?

**Maintenance** The responsibility of the engineer (through his/her employer) does not end with the supply of the product. It has to be maintained in good condition during its lifetime. Sometimes, annual maintenance contracts are available and sometimes only warranty period maintenance is done free. This leads to the following questions:

- Is there adequate cover for the consumer for maintenance and repair?
- Is the maintenance contract fairly drawn or is it made vague for gullible customers who cannot read the fine print?
- Are there mechanisms kept ready for timely maintenance and repair?
- Is there a safe exit in case of emergency? (The concept of safe exit is given in a later section in this chapter.)

**Product recall and decommissioning** In many engineered products, the concept of product recall has become important. This is more so because all the component parts are not made by the same company. The main producer subcontracts the production of some components to another party after ensuring that the quality and safety of the products are satisfying their requirements. When this procedure is adopted, the company cannot ensure that the component parts maintain the same standards of quality all the time. The recalling of thousands of cars by car manufacturers or mobile phones by international mobile companies can be taken as examples.

Decommissioning is another important aspect, particularly while dealing with processes involving toxic and dangerous wastes such as nuclear material or chemical factories.

The following questions may arise here:

- In addition to effective maintenance, does the company have a policy of product recall in case common defects are noticed in the products?
- Is there a provision to safely discard toxic materials periodically or at the end of the life cycle of the product?
- Is there any provision for recycling and capturing valuable products?

These are sample questions one should ask oneself for ensuring that ethical practices are followed. Once the product or project is specified, one can ask more specific and pertinent questions related to that product.

As an example, let us consider some specific cases and frame sample ethical questions based on our discussion in this section.

Consider the case of building a dam for irrigating hectares of land and for generating thousands of watts of power. Let us see the ethical questions that arise as this project goes through the stages of conceptualization to realization.

#### **Conceptualization**

- Is the project useful? Even if apparently useful, have the downsides of the project, such as disturbance to ecosystem and displacement of communities considered before going ahead?
- Do the benefits of the project outweigh the damages?

#### **Investigation**

- Is the investigation exhaustive and complete?
- Does the report of the investigation fully cover the details of the land submerged and people displaced, and estimate the damage to the ecosystem?
- Has a mandatory environmental impact study been done thoroughly?
- Has the interpretation of the study been done fairly without hiding facts or embellishing the benefits by reducing risks?

#### **Specifications and costing**

- Have optimal specifications been used to detail out the dam configuration?
- Does the cost include the expenses involved in rehabilitating people and restricting environmental damage?
- Have all material and equipment specifications been drawn up exhaustively as per current availability and practice?

#### **Analysis and design**

- Has the design been done as per the best practices currently in use?
- Does the design take into account the unlikely, but possible, natural disasters such as earthquakes?

#### **Bidding and contracting**

- Has the bidding process been fair and equitable, without showing favours to anyone?
- If the lowest bid has been rejected, have adequate technical reasons been given?
- Have the terms and conditions of the contract been fairly drawn up?
- Is the time frame for the contract achievable?

#### **Implementation**

- Have the raw materials procured been tested as per standard practice?
- Has availability of safety gears such as helmets and other gadgets been ensured?
- Have the test results on materials and concrete been obtained as per standard practice and interpreted properly?
- Is there a quality control mechanism in place?

### Maintenance and use

- Is there sufficient instrumentation to check the health of the dam during use?
- Is there frequent inspection and maintenance of any defects that are noticed?

### Safe exit

- Is a safe exit planned in case of any unexpected happening to save lives and property?

## Ethical Obligations of Engineering Professionals

The discussions in earlier sections will require professionals to seriously consider their obligations to morally correct decisions and actions. Is it any different from ordinary morality as applied to all individuals? Do the professionals have any special obligations? If yes, then what are the reasons? Consider the following arguments for this question:

- An engineer is subjected to, and has to work within, the civil and criminal laws and the codes of conduct, so he/she has obligations with regard to safety, work quality, public good, etc.
- Moral obligations of the engineer arise because he/she is a member of a professional body and the body requires him/her to work as per the code of conduct and fulfil his/her ethical obligations.
- Ethical obligations of engineers arise out of contractual agreements with employers.
- When someone selects engineering as a career, he/she is bound by the principle of public good and the obligations of being a professional.

The first one is a legalistic view. Engineers acquire moral obligations either because they have a fear of laws or the codes of conduct go against the view that ethicality is a character trait of professionals, and is not because of fear of punitive action.

The second argument of the code of conduct being imposed on him/her by the professional body is again subject to the same consideration. In fact, professional societies are formed by professional engineers and the code of conduct is also framed by them. It is nothing more than self-regulation, a topic we had come across while discussing media ethics. Further, in engineering, unlike in medicine or law where joining a professional body is mandatory to practice the profession, there is no such mandatory requirement. So, if an engineer is not a member of a professional body, is he/she absolved of professional obligations?

The argument that employer loyalty is the reason for moral obligations again is not valid. Since engineering is very intimately concerned with business and making profits, loyalty towards their employer makes engineers walk on thin ice as far as moral obligations are concerned. One's professional interests and loyalty to his/her employer should not come into conflict. However, one cardinal principle is that engineers must act according to their conscience and not according to employer diktats. Moral obligations come not because of contractual obligations but in spite of that.

The fourth point of view is more appealing because when you take up the engineering profession, you become obliged to work for the public good and uphold the highest level of integrity of the profession. This argument comes from the tacit understanding or agreements one has with the public, who have played a role in subsidizing his/her education to become an engineer. The argument was very valid some years ago. When some years back, the IITs

made a study of the cost of educating an undergraduate student, they found that the cost was more than one lakh while the fees charged by IITs were very low compared to that. In most government institutions, the education is subsidized with low fee structure. Hence, the obligation to the public was more evident then. Today, with education having become a business with the entry of many private trusts, the question of subsidized education may not be as valid as it was before.

We may therefore conclude that an engineering professional acquires moral obligations towards the public because of the inherent nature of the profession and a tacit contract for working towards and ensuring public good based on ethical principles.

### Concept of Safe Exit

With so many failures reported in engineering products or projects, we may intuitively assume that no product can be made 100 per cent safe. We can only make efforts to reduce risks by taking care of various safety issues at every stage of the project, from conceptualization to realization. This can definitely reduce the risk of failure and make us ethically correct in our efforts. However, what happens if a failure still occurs? It may be due to natural causes or something unexpected coming up. Efforts to minimize the impact of such a failure lead to the concept of safe exit.

Engineering failures can cause fatalities, injuries, disablement, and damage to property. These will be specific to each project and must be provided for to reduce the risks involved. For example, the luxury ship *Titanic*, which sank in 1914, reportedly did not have enough life boats for every passenger. While everything else might have been provided, the eventuality of a failure was neither anticipated nor provided for. In this case, there was no provision for a safe exit. A nuclear power plant failure can cause immense damage to life for years to come. Safe exit must be provided for in such cases.

The concept of safe exit is to provide for three aspects in case of failure—the product fails safely; it can be abandoned safely; and the consumer can escape damage from the failure. We have to ensure that in the case of unanticipated failure, the damage is minimized.

Who will provide for this? It has to be done at the design stage, as has been illustrated in the *Titanic* accident. The engineering fraternity is the right agent to do this. However, cooperation from the consumers and the local community is required in many instances. This is essentially the concept of risk management.

Risk management involves communication with all stakeholders who have to react instantly in the case of failure. To manage fire in a building, the designer should provide for safe fire exits, fire extinguishers, and water supply for the safety of the residents. In the event of the mishap, the fire brigade must be informed immediately and should reach the spot as soon as possible to evacuate people. There must be provision for fire alarms for the detection and maintenance of fire extinguishing gadgets. All of these are efforts to provide for safe exit.

In the case of the 'Uphaar Cinema' fire tragedy in New Delhi, a safe exit was not available. The packed cinema hall did not have exit signs lighted by alternative power supply. People inside could not see the exit signs in the dark hall and could not escape in time, thus choking many to death. Such instances can be avoided by proper planning.