PROFESSIONAL ETHICS: MODULE 2
ENGINEERING ETHICS AND PROFESSIONALISM

Engineering Ethics

Engineers make products and methods that satisfy basic needs, food and shelter. Scientists and engineers make discoveries and inventions. As a result, they construct projects and make products, which are used by the people in their day-to-day life. This improves the standard of living of the people. The products that are manufactured are to be given due attention in respect of safety, health, welfare of the people and environment. This is the basic concept of engineering ethics. This has to be take into account in understanding what is morally required and not morally required of engineers.

Definition of Engineering Ethics

"Engineering Ethics" is study of moral issues and decisions confronting the engineers' organisations.
"Engineering Ethics "is study of related questions above the moral ideals, character, policies and relationships between the people and corporations, involved in technical activities.

Sense of "Engineering Ethics"

1. Engineering ethics is an activity and discipline, aimed at understanding the moral values to guide the Engineering practice, to solve moral issues in Engineering and justifying moral judgements concerned in Engineering.
2. Engineering ethics also refers to the set of specific moral problems and issues related to Engineering. i.e. political, legal etc.
3. Engineering ethics are the accepted codes and standards of conduct endorsed by various groups of Engineering, Engineering societies, Professional bodies like IEEE, AICTE etc.
4.Engineering Ethics is a study of morality, the inquiry into moral issues and ideals dealt by engineers. Morality is concerned with
what ought or ought not to be done in a given situation.
What is right or wrong while handling a situation
what is good or bad about people, policies and ideals involved.

Variety of Moral Issues

A variety of moral issues are relevant in engineering disasters like
The " Challenger" Explosion , the accidents at Nuclear Power Plant at Russia, USA etc, Gas leak at chemical plant, Union Carbide Plant at Bhopal, India, The

Exxon Valdez Oil Spill, UAE , indiscriminate use of plastic etc. . All these disasters give a warming about safety beyond the level of acceptable risk.

Two Approaches:

There are two approaches in Ethics. They are:

1. Micro Ethics
2. Macro Ethics

Micro Ethics means the everyday problems faced by an Engineer in his life or in an engineering office.

An engineer may face problems from various bodies like family, clients/ customers, law, government or public agencies, industry or other firms, global environment, managers, engineers or colleagues, or engineering professional societies.

Macro Ethics means the problems arising on a regional or national level.

Moral problems arise when

1. The engineering activities like conception, design, manufacture, testing, sales or service will ultimately lead to a product unsafe or less useful.
2. A product may be designed intentionally for early obsolescence (to become outdated)
3. An inferior material may be used under pressure of time or budget
4. Product's ultimate harmful effects may not be foreseen
5. Engineers are tempted of bribes and corruption.

Few examples covered by engineering ethics:

1. An assistant engineer finds a faulty construction equipment and certified that the equipment violated construction code and prevented its continuous use in the construction. The junior engineer, in- charge of construction viewed this as a minor one, in respect of safety regulations and allowed the use of the equipment in the project because otherwise the project will be delayed. The junior engineer is threatened with disciplinary action by assistant engineer who objected to this.
2. A chemical plant dumped wastes on open land. Hazardous substances polluted the underground water table. The plant engineer was aware of the problem. But no action was taken to prevent ground water pollution because a nearby plant also adopted the same way of disposal which is cheaper. Plant supervisor told the Pollution Control Board that it is the responsibility of the local municipality to identify such problem.

The above examples show how ethical problems arise when there are differences of judgement or expectations as shown in the figure.

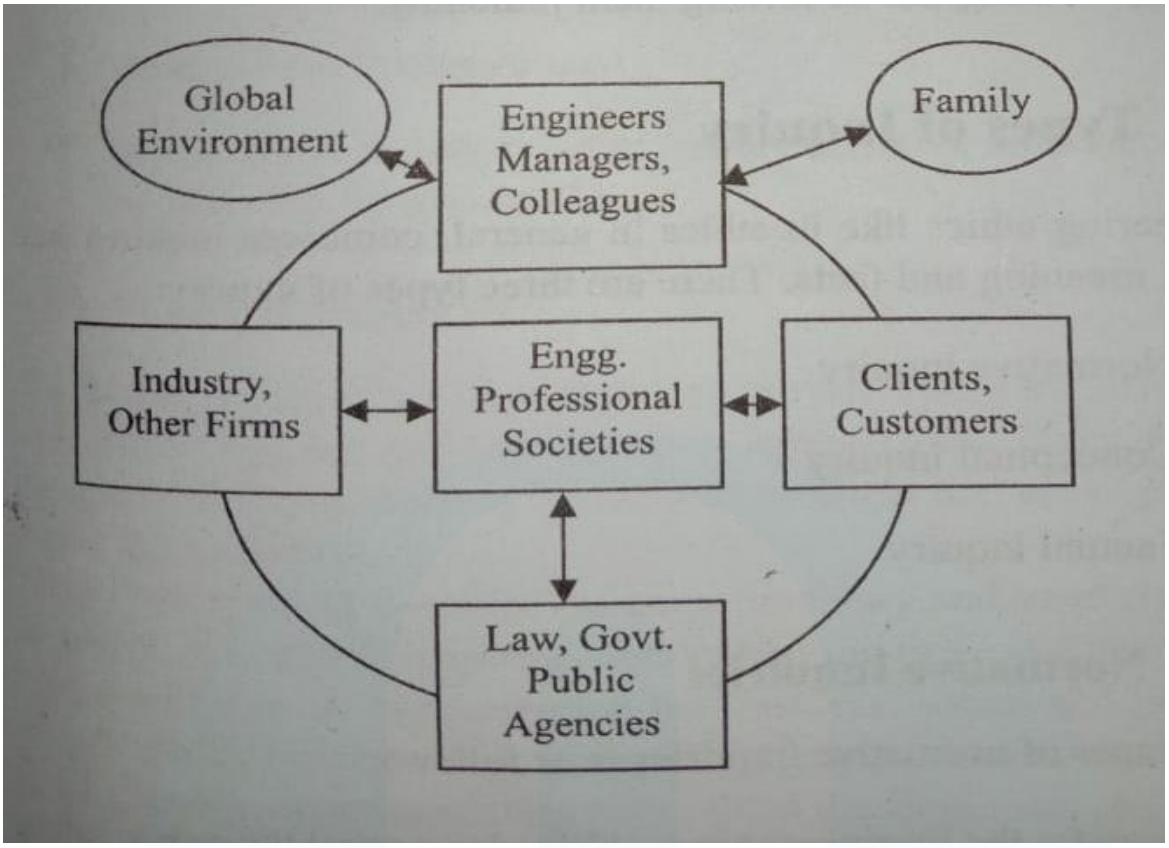

Fig: The various bodies with which engineers may face problems

Types of Inquiry

There are three types of inquiries to be conducted by an engineer.
1. Normative Inquiry
2. Conceptual Inquiry
3. Factual Inquiry

Normative Inquiries

Normative inquiries deal with the standards or norms to be followed by engineers in their activities. Examples:
In a given situation, how far the engineers protect the public safety?
In designing a public transport system, where government, engineers and citizens are involved, whose values are to be given importance?

Conceptual Inquiries

To clarify the meaning of concepts, principles and issues in engineering ethics,

conceptual Inquiries are needed.
For example
1. What does “safety” mean?
2. How safety is related to “risk “?
3. What does it mean when codes of ethics say engineers should do and should not do?
4. What is meant by protective safety, health and welfare of people?
5. What is a bribe?
6. What is a profession?
7. What defines a professional?

Factual Inquiries

The factual inquiries are descriptive in nature. These inquiries give all the information relevant to value issues. They also provide information about facts on business practices.
These three types of inquiries are interrelated and complementary. They help to understand the business, social and political facts which influence the operation of the company. Only with these ideas we can make a strong recommendation about what engineers should do and should not do.

Moral Dilemmas
Moral dilemmas are situations in which two or more moral obligations, duties, rights, goods or ideals come into conflict with one another.
Three types of complexities and murkiness are involved in moral dilemmas.
1. Problems of Vagueness
2. Problems of conflicting reasons
3. Problems of disagreement
Problems of vagueness
Sometimes, an engineer is confused when there is no clarity about moral issues. For example, an engineer may have doubts about, whether it is morally permissible to accept an expensive mobile phone as a gift from a sales person with whom their company does business. Will this be like accepting a bribe? The engineer is vague about whether the gift is an accepted article or an unacceptable bribe.

Problems of conflicting reasons
When it is perfectly clear about the moral principles to be applied under a given situation, there is no problem. But moral dilemmas occur when two or more clearly applicable moral principles come into conflict.

Problems of Disagreement
Reasonable and responsible engineers may disagree about how to interpret, apply and evaluate moral reasons under a particular situation. At times the disagreement will even become more complicated in an industry or corporation.

Steps in Confronting Moral Dilemmas

1. The relevant moral factors and the reasons are to be identified. What are the conflicting responsibilities, rights and ideals involved?
2. All the available facts relevant to the moral facts involved are to be gathered.
3. The moral considerations which are to be applied to a situation are to be ranked in order of importance.
4. Alternative courses of action to solve the dilemmas are to be considered.
5. Through discussions, opinions of colleagues may be sought.
6. A reasonable judgement by weighing all the relevant moral factors and reasons based on the facts, is to be arrived at carefully. This is the most difficult part of it.

Moral Autonomy

The study of engineering ethics will strengthen our commitments toward honesty, respect for colleagues, safety and concern for public good. To fulfill such commitments, one should have "moral autonomy". Autonomy means "self-determining" or "independent". Moral autonomy means the skill and habit of thinking rationally about ethical issues, based on moral binding.
The training we receive as children is the foundation of moral concern and moral binding. Children are sensitive to the needs and rights of others as well as themselves. Where such training is absent as in the case of abused or neglected children, the result is they turn into " sociopath" of murdering without any conscience, when they become adults; they lack a sense of moral harmony and guilt. They are never morally autonomous, though they are independent in their intellectual thinking.
Adult moral binding can be awakened in the young minds by the environment in which one is brought up. Environment is of friends, politics, social events, novels, cinemas and inspiring teachers.
Moral autonomy can be practised by improving various skills that will help independent thoughts about moral issues.
Such skills include the following:
1. Proficiency in recognising moral problems and issues in engineering.
2. Skills in comprehending, clarifying and critically assessing arguments for and against moral issues.
3. The ability to form consistent and comprehensive view based on relevant facts.
4. Creative solutions for practical difficulties
5. Sensitivity to genuine difficulties and delicate issues
6. Use of common ethical language
7. Reasonable dialogue in resolving moral conflicts.
8. One has to maintain moral uprightness.

Theories on Moral Autonomy

There are two main theories on moral autonomy; these psychological theories related to moral development are

1. Lawrence Kohlberg's Theory and
2. Carol Gilligan's Theory

Lawrence Kohlberg's Theory

According to Lawrence Kohlberg, there are three levels of moral development. They are
1. Pre - conventional level
2. Conventional level
3. Post - conventional level

Pre- conventional level

The concept of pre conventional level is to satisfy one's own needs.
At pre conventional level, the individual is interested in things which directly benefit oneself. Individuals are motivated by the desire to avoid punishment and by a desire to satisfy their own needs. This is the level of development of all young children. A few adults also fall under this category.

Conventional level

The concept of conventional level is to follow accepted norms and satisfy expectation of others.
At conventional level, the norms of one's family, group or society are accepted as the standards of morality. Individuals at this level are motivated by the desire to please others and they try to meet the expectations of others. While doing so, they are least concerned of immediate effects on their self interest.
Kohlberg studies reveal that most adults never mature beyond this stage.

Post- Conventional level

The concept of post conventional level is to follow the "golden rule" namely, "Do to others as you expect others to do to you ".
At post conventional level, an individual recognises the standards of right and wrong as a set of principles concerning rights. Kohlberg calls these individuals as morally autonomous because they think for themselves and they do not assume that customs are always right. They live by the general principles such as "golden rule ". The golden rule is applicable university to all people and all cultures. Also these people have a moral desire to maintain their moral integrity, self-respect and the respect for other autonomous individuals.
Kohlberg thinks that only a few people in society reach the post conventional level.

Carol Gilligan's Theory

Gilligan's Theory studies about the approaches made by male professionals and female professionals to attain moral autonomy. She criticises that Kohlberg's Theory on Moral autonomy is more male oriented.
Gilligan is pointing out that her studies suggest that men are interested in trying to solve moral problems by applying moral principles. Male professionals solve moral dilemmas by determining the most important moral rule. In contrast to this, women professionals try to preserve personal relationships with all people involved in a situation. They focus greater attention on the context in which dilemmas arises rather than calling for a help and try to solve by following general moral rules.
Gilligan viewed that maintaining personal relationships is "ethics of care " and it is in contrast to " ethics of rules and rights".
To understand Gilligan's criticism on Kohlberg, we can consider an example called
"Ram's Dilemma". Ram's wife suffering from cancer needed expensive medicines for treatment. Ram could not afford to purchase the medicine. He borrowed money from friends and relatives, but only half of the required amount could be collected. The pharmacist demanded 10 times the cost of the medicines. He even refused the request of Ram to accept half the payment and allow to pay the balance amount later or to reduce the price of the medicines. In his desperation, Ram broke into the pharmacy and stole the medicines.
Was the theft morally right or wrong?

Ram did a wrong thing as he broke the law. Obeying the laws is the right conduct. But according to Ram's wife, Ram did right thing because according to their religious belief, God commanded that human life is sacred and God should be obeyed. To Ram, his wife's life is more important than the pharmacist's right to his wealth. This is according to Kohlberg's reasoning, at the post conventional level. Women are hesitant to stealing the medicines. They search for alternative solutions. They recommend to find creative ways to raise the necessary money. Gilligan also observes value in the context oriented reasoning by women. After studying Kohlberg's experimental studies and combining them with her own studies about women, Gilligan gave a different scheme of moral development. She recast Kohlberg's three levels of moral development as three stages of growth towards an "Ethics of Caring ".
Gilligan's recasting is as follows:
1.Pre-Conventional Level
2.Conventional Level
3. Post Conventional Level

Pre- conventional level

This is roughly same as Kohlberg's first level. At this level, a person is preoccupied with self centred reasoning. Right conduct is viewed in a selfish manner, viewing what is good for oneself.

Conventional Level

At this level, the person does not want to hurt others. He is willing to sacrifice his own interests in order to help others. Women are always willing to give up their personal interests in order to serve the needs of others.

Post conventional level

At this level, an individual strikes a balance between caring about other people and pursuing one's own self interest , while exercising one's rights. The aim is to balance one's own needs and with the needs of others.

In Gilligan's Theory, moral autonomy cares for other people based on personal relationships. To Kohlberg, moral autonomy is sensitive to general principles and human rights .

Consensus and Controversy

When individuals exercise moral autonomy, there is no assurance that they will arrive at the same opinion as other people also exercise their moral autonomy. There will be some basic moral differences. This is inevitable. Tolerance is needed among people when there is disagreement.

The principle of tolerance suggests that aim of teaching engineering ethics is not to produce a unanimous conformity of outlook. Sometimes consensus would be achieved by resorting to intimidation,coercion or dogmatic teaching.

One major goal with the field of engineering ethics is to promote tolerance, while exercising moral autonomy by the engineers.

Employers have authority over engineers. Then the need for some consensus concerning the role of authority is to be clearly understood.

Two general points about authority are that (1) moral autonomy and respect for authority are not incompatible, they go together. (2) sometimes tension may arise between individual's need for autonomy and the need for consensus about authority. Controversies and conflicts between autonomy and authority arise when authority is abused. When an opportunity is given to express feelings of employees, conflicts may subside and consensus will be arrived at.

Models of Professional Roles

Engineers are " Professional Models" . They have to play the role of professional models in promoting the public good, public safety and welfare. The various Models of Professional roles are

1. Saviour
2. Guardian
3. Bureaucratic servant
4. Social servant

5. Social enabler and catalyst
6. Game player

Saviour

Engineers are responsible in creating an ideal society, through technological developments. This will lead to material prosperity. Thus engineers save society from poverty, inefficiency, waste and overwork of manual labour.

Guardian

Even though engineers are not capable of creating an ideal society, they know the best direction in which technology should develop. Hence they should be given positions of higher authority based on their expertise.

Bureaucratic Servant

In corporations, companies, industries, engineers will have to play the role of a servant, who receives the directives of management. The engineer's special skill lies in solving problems assigned by the management.

Social Servant

'Society ' is the true master of an engineer. In co- operation with the management, engineers have to satisfy society's desires and needs.

Social Enabler and Catalyst

Though ultimate power and authority is with the management,engineers have to play a vital role beyond merely implementing management's decisions. At times, engineers need to help the management and society to understand their own needs and means of technological developments.

Game Player

Engineers have an economic game to play in their company. Since their organisation is functioning in a competitive world, engineers will have to play successfully within organisations.

Profession, Professional and Professionalism

Profession: means a " job" or an " occupation ".

Professional: is someone who is a member of a profession or who is practicing a profession.

Professionalism: Professionalism means employed engineers as professionals having obligations to both employers and the public.

Profession can be applied only to certain occupation,which meets special criteria,which are given below.

Knowledge

The work involves sophisticated skills, theoretical knowledge, judgements and discussions. It also requires extensive formal education, technical studies in more areas. Generally continuing education and updating knowledge are also required.

Organisation

Special societies and organisations set standards or codes of ethics for engineers in

their admissions, career and behaviour. Such professional societies represent the profession to the public and the government.

Public good

The occupation serves the public good as mentioned in the codes of ethics. Many jobs (sanitation works taxi driving etc) are not counted as profession as they lack advanced education.

Honours of Engineering Profession

Engineering as a profession has high esteem in society. They help in elevating the standards of life of people,by adding comforts of life.

Liabilities of engineering profession

Compared to other professionals, engineering professionals have liabilities like working in open areas, or in hard substances. They can not blame colleagues or politicians and avoid responsibility.

Professional ideals and virtues

To act ethically, high degree of courage is required.The spirit of professionalism is shown in moral ideals. The most basic professional virtue of an engineer is professional responsibility shown by self direction virtues,public spirited virtues,teamwork virtues and proficiency virtues.

Theories about Right Action

Right actions are virtues that provide a rough guidance about how to act.
There are four types of ethical theories about right action . An example is given to understand these theories about right action.
Mr. A was the head of an organisation. He was empowered to allot contract for public works projects to engineering firms. In exercising his authority,he was involved in a kickback scheme. After sometime he was charged with action of bribery and as a result, he resigned from the job.
B and C are two of the many engineers to participate in that scheme.
They belonged to a consulting firm. Since they made secret payment to Mr. A (5 % of fees collected from clients) , this consulting firm was given a special consideration in receiving contracts for public works projects.
The actions of engineers B and C are clearly unethical. The reasons for this conclusion can be analysed and the various answers to the question " was it wrong for the engineers A and B to make secret payment to Mr. A can be found out.
1. The first answer is in terms of "Virtue Ethics ". Right actions are those that build good character traits. Mr. A showed unfairness, dishonesty and greed. Mr B and C also showed moral weakness, dishonesty and lack of integrity. Morally better people have virtues like courage,honesty,fairness and conscientiousness.
2. The second answer can be given in terms of Bad consequences of the action. Other engineering firms were harmed by not having a chance to obtain the contract,though they are better qualified. The benefits of healthy competition among firms was removed. This scheme also resulted in loss of trust in public officials.

3.The third theory is "What is wrong with B and C in engaging in a "kickback scheme"? What are the intentions and motives of B and C , other than consequences? Thor actions violated two basic principles of duty namely
1. Avoid deceiving others
2. Be fair
Based on " Duty Ethics " the third answer is the engineers should have shown respect for persons and for their autonomy.
4. The fourth answer is " Why it was wrong to participate in the kickback scheme,when it violated the rights of other people " ? There should be equality of opportunity in seeking public contracts. The officials in charge will grant contract based on merits and not on bribes. Qualified firms have every right to take part in the contract proposals. These rights were violated by the kickback scheme.

Self Interest, Customs and Religion

Self interest means one's personal good. Major ethical theories also insist on the importance of self interest.
A duty ethicist emphasises duties to ourselves, for our own well-being.
Rights ethicist insists right to pursue our own good.
Virtue ethicist emphasises the importance of self respect,which means looking after one's own need.
At the same time,each of these theories insist that the self interest must be balanced by moral responsibilities to other people.
There is another view to challenge all these theories.The view called "Ethical Egoism " says that the main duty of each individual is to maximise his or her own good. This view attempts to reduce morality to the pursuit of self interest.
But one who is selfishly preoccupied with one's own good and neglect the good of others, will generally lose friendship and love, thus the paradox of happiness occurs.

Customs

We live in a diverged society in which tolerance for different customs and outlooks are very important. Customs have great moral significance in guiding us how we should act. Moral values are many and flexible. Moral difference between cultures are to be respected.

Religion

Moral commitments and religious beliefs are related in several ways.
First, they are related historically. For example, there are countries influenced by Christianity or Islam or Hinduism or Buddhism or Confucianism.
Second,for many people, there are psychological connections between their moral beliefs and religious beliefs. Trust in religion brings an inspiration to be moral.
Religion influences a person in performing social function or personal function. Social function is to motivate right action. Personal function is to promote

tolerance and moral concern for others.
Moral reasons are not reducible to religious matters but religious belief may provide an inspiration to avoid immoral things.

Use of Ethical Theories

Ethical Theories have three important uses:
1. Understanding moral dilemmas
2. Justify professional obligations and ideals
3. Relating ordinary and professional morality

Understanding and resolving moral dilemmas

Ethical theories are useful in understanding moral dilemmas. The uses of ethical theories are as follows.
1. Ethical theories help the professionals in identifying the reasons that constitute a dilemma. Moral considerations give guidance to professionals. Thus
i. Virtue Ethics emphasises loyalty to employer and colleagues and to the public.
ii. Duty ethics emphasises that professionals have duties to protect the . Also they have to respect the employer's.
3. Ethical theories offer ways to rank the relevant moral considerations in order of importance and thereby provide a rough guidance in solving moral problems.
4. Ethical theories help to find alternative courses of action in solving moral dilemmas.
5. Ethical theories strengthen our ability to reach balanced judgments.

Justifying Moral Obligations and Ideals

Engineering ethics focuses on the safety of the public while bringing useful technological products to the public. One of the obligations of engineers is to act in any situation so as to maximise the good consequences for everyone affected by engineering projects and products.

Relating Professional and Ordinary Morality

The special obligation of engineers regarding safety is connected with ordinary or everyday morality. There are four views concerning the safety obligations of engineers.
(a) The first view is that engineers have to consider safety measures as they are subject to laws.
(b) Engineers when they join Professional society, they agree to live by the code of ethics. This is the second view regarding obligations of engineers.
(c) The third view is that engineers acquire safety obligations through the contractual agreement by which they are employed in a company.
(d) The fourth view is that engineers have safety obligations when they enter into their careers, to protect and safeguard the public interests while performing their tasks.