

Chapter – 2

Engineering Ethics

2.0 OVERVIEW

Engineering Ethics is the activity and discipline aimed at

- (a) understanding the moral values that ought to guide engineering profession or practice,
- (b) resolving moral issues in engineering, and
- (c) justifying the moral judgments in engineering. It deals with set of moral problems and issues connected with engineering.

Engineering ethics is defined by the codes and standards of conduct endorsed by engineering (professional) societies with respect to the particular set of beliefs, attitudes and habits displayed by the individual or group.

Another important goal of engineering ethics is the discovery of the set of justified moral principles of obligation, rights and ideals that ought to be endorsed by the engineers and apply them to concrete situations. Engineering is the largest profession and the decisions and actions of engineers affect all of us in almost all areas of our lives, namely public safety, health, and welfare.

2.01 Scope

The scope of engineering ethics are twofold:

1. Ethics of the workplace which involves the co-workers and employees in an organization.
2. Ethics related to the product or work which involves the transportation, warehousing, and use, besides the safety of the end product and the environment outside the factory.

2.02 Approach

There are conventionally two approaches in the study of ethics:

1. Micro-ethics which deals with decisions and problems of individuals, professionals, and companies.
2. Macro-ethics which deals with the societal problems on a regional/national level. For example, global issues, collective responsibilities of groups such as professional societies and consumer groups.

2.1 SENSES OF ENGINEERING ETHICS

There are two different senses (meanings) of engineering ethics, namely the Normative and the Descriptive senses. The normative sense include:

- (a) Knowing moral values, finding accurate solutions to moral problems and justifying moral judgments in engineering practices,
 - (b) Study of decisions, policies, and values that are morally desirable in the engineering practice and research, and
 - (c) Using codes of ethics and standards and applying them in their transactions by engineers.
- The descriptive sense refers to what specific individual or group of engineers believe and act, without justifying their beliefs or actions.

2.2 VARIETY OF MORAL ISSUES

It would be relevant to know why and how do moral issues (problems) arise in a profession or why do people behave unethically? The reasons for people including the employer and employees, behaving unethically may be classified into three categories:

1. Resource Crunch

Due to pressure, through time limits, availability of money or budgetary constraints, and technology decay or obsolescence. Pressure from the government to complete the project in time (e.g., before the elections), reduction in the budget because of sudden war or natural calamity (e.g., Tsunami) and obsolescence due technology innovation by the competitor lead to manipulation and unsafe and unethical execution of projects.

Involving individuals in the development of goals and values and developing policies that allow for individual diversity, dissent, and input to decision-making will prevent unethical results.

2. Opportunity

- (a) Double standards or behavior of the employers towards the employees and the public. The unethical behaviors of World Com (in USA), Enron (in USA as well as India) executives in 2002 resulted in bankruptcy for those companies,
- (b) Management projecting their own interests more than that of their employees. Some organizations over-emphasize short-term gains and results at the expense of themselves and others,
- (c) Emphasis on results and gains at the expense of the employees, and
- (d) Management by objectives, without focus on empowerment and improvement of the infrastructure.

This is best encountered by developing policies that allow 'conscience keepers' and whistle blowers and appointing ombudsman, who can work confidentially with people to solve the unethical problems internally.

3. Attitude

Poor attitude of the employees set in due to

- (a) Low morale of the employees because of dissatisfaction and downsizing,

- (b) Absence of grievance redressal mechanism,
- (c) Lack of promotion or career development policies or denied promotions,
- (d) Lack of transparency,
- (e) Absence of recognition and reward system, and
- (f) Poor working environments.

Giving ethics training for all, recognizing ethical conduct in work place, including ethics in performance appraisal, and encouraging open discussion on ethical issues, are some of the directions to promote positive attitudes among the employees⁹.

To get firm and positive effect, ethical standards must be set and adopted by the senior management, with input from all personnel.

2.3 TYPES OF INQUIRIES

The three types of inquiries, in solving ethical problems are: normative inquiry, conceptual inquiry, and factual or descriptive inquiry.

The three types of inquiries are discussed below to illustrate the differences and preference.

1. Normative Inquiry

It seeks to identify and justify the morally-desirable norms or standards that should guide individuals and groups. It also has the theoretical goal of justifying particular moral judgments. Normative questions are about what ought to be and what is good, based on moral values. For example,

1. How far does the obligation of engineers to protect public safety extend in any given situation?
2. When, if ever, should engineers be expected to blow whistle on dangerous practices of their employers?
3. Whose values ought to be primary in making judgment about acceptable risks in design for a public transport system or a nuclear plant? Is it of management, senior engineers, government, voters or all of them?
4. When and why is the government justified in interfering with the organisations?
5. What are the reasons on which the engineers show their obligations to their employees or clients or the public?

2. Conceptual Inquiry

It is directed to clarify the meaning of concepts or ideas or principles that are expressed by words or by questions and statements. For example,

- (a) What is meant by safety?
- (b) How is it related to risk?
- (c) What is a bribe?
- (d) What is a profession?

When moral concepts are discussed, normative and conceptual issues are closely interconnected.

3. Factual or Descriptive Inquiry

It is aimed to obtain facts needed for understanding and resolving value issues. Researchers conduct factual inquiries using mathematical or statistical techniques. The inquiry provide important information on business realities, engineering practice, and the effectiveness of professional societies in fostering moral conduct, the procedures used in risk assessment, and psychological profiles of engineers. The facts provide not only the reasons for moral problems but also enable us to develop alternative ways of resolving moral problems. For example,

1. How were the benefits assessed?
2. What are procedures followed in risk assessment?
3. What are short-term and long-term effects of drinking water being polluted? and
4. Who conducted the tests on materials?

2.4 MORAL DILEMMA

2.4.1 Definition

Dilemmas are situations in which moral reasons come into conflict, or in which the application of moral values are problems, and one is not clear of the immediate choice or solution of the problems. Moral reasons could be rights, duties, goods or obligations. These situations do not mean that things had gone wrong, but they only indicate the presence of moral complexity. This makes the decision making complex. For example, a person promised to meet a friend and dine, but he has to help his uncle who is involved in an accident — one has to fix the priority.

There are some difficulties in arriving at the solution to the problems, in dilemma. The three complex situations leading to moral dilemmas are:

1. The problem of *vagueness*: One is unable to distinguish between good and bad (right or wrong) principle. Good means an action that is obligatory. For example, code of ethics specifies that one should obey the laws and follow standards. Refuse bribe or accept the gift, and maintain confidentiality
2. The problem of *conflicting reasons*: One is unable to choose between two good moral solutions. One has to fix priority, through knowledge or value system.
3. The problem of *disagreement*: There may be two or more solutions and none of them mandatory. These solutions may be better or worse in some respects but not in all aspects. One has to interpret, apply different morally reasons, and analyze and rank the decisions. Select the best suitable, under the existing and the most probable conditions.

2.4.2 Steps to Solve Dilemma

The logical steps in confronting moral dilemma are:

1. Identification of the moral factors and reasons. The clarity to identify the relevant moral values from among duties, rights, goods and obligations is obtained (conceptual inquiry). The most useful resource in identifying dilemmas in engineering is the professional codes of ethics, as interpreted by the professional experience. Another resource is talking with colleagues who can focus or narrow down the choice of values.

2. Collection of all information, data, and facts (factual inquiry) relevant to the situation.
3. Rank the moral options i.e., priority in application through value system, and also as obligatory, all right, acceptable, not acceptable, damaging, and most damaging etc. For example, in fulfilling responsibility, the codes give prime importance to public safety and protection of the environment, as compared to the individuals or the employers (conceptual inquiry).
4. Generate alternate courses of action to resolve the dilemma. Write down the main options and sub-options as a matrix or decision tree to ensure that all options are included.
5. Discuss with colleagues and obtain their perspectives, priorities, and suggestions on various alternatives.
6. Decide upon a final course of action, based on priority fixed or assumed. If there is no ideal solution, we arrive at a partially satisfactory or 'satisficing' solution.

2.5 MORAL AUTONOMY

Moral autonomy is defined as, decisions and actions exercised on the basis of moral concern for other people and recognition of good moral reasons. Alternatively, moral autonomy means 'self determinant or independent'. The autonomous people hold moral beliefs and attitudes based on their critical reflection rather than on passive adoption of the conventions of the society or profession. Moral autonomy may also be defined as a skill and habit of thinking rationally about the ethical issues, on the basis of moral concern.

Viewing engineering as social experimentation will promote autonomous participation and retain one's professional identity. Periodical performance appraisals, tight-time schedules and fear of foreign competition threatens this autonomy. The attitude of the management should allow latitude in the judgments of their engineers on moral issues. If management views *profitability* is more important than *consistent quality and retention of the customers* that discourage the moral autonomy, engineers are compelled to seek the support from their professional societies and outside organizations for moral support. It appears that the blue-collar workers with the support of the union can adopt better autonomy than the employed professionals. Only recently the legal support has been obtained by the professional societies in exhibiting moral autonomy by professionals in this country as well as in the West.

The engineering skills related to moral autonomy are listed as follows:

1. Proficiency in recognizing moral problems in engineering and ability to distinguish as well as relate them to problems in law, economics, and religion,
2. Skill in comprehending, clarifying, and critically-assessing arguments on different aspects of moral issues,
3. Ability to form consistent and comprehensive view points based on facts,
4. Awareness of alternate responses to the issues and creative solutions for practical difficulties,
5. Sensitivity to genuine difficulties and subtleties, including willingness to undergo and tolerate some uncertainty while making decisions,
6. Using rational dialogue in resolving moral conflicts and developing tolerance of different perspectives among morally reasonable people, and
7. Maintaining moral integrity.

Autonomy which is the independence in making decisions and actions, is different from authority. Authority provides freedom for action, specified within limits, depending on the situation. Moral autonomy and respect for authority can coexist. They are not against each other. If the authority of the engineer and the moral autonomy of the operator are in conflict, a consensus is obtained by the two, upon discussion and mutual understanding their limits.

2.6 MORAL DEVELOPMENT (THEORIES)

1. Kohlberg Theory

Moral development in human being occurs overage and experience. Kohlberg suggested there are three levels of moral development, namely pre-conventional, conventional, and post-conventional, based on the type of reasoning and motivation of the individuals in response to moral questions.

In the pre-conventional level, right conduct for an individual is regarded as whatever directly benefits oneself. At this level, individuals are motivated by obedience or the desire to avoid punishment or to satisfy their own needs or by the influence by power on them. All young children exhibit this tendency. At the conventional level, people respect the law and authority. Rules and norms of one's family or group or society is accepted, as the standard of morality. Individuals in this level want to please or satisfy, and get approval by others and to meet the expectations of the society, rather than their self interest (e.g., good boy, good girl). Loyalty is regarded as most important. Many adults do not go beyond this level.

At the post-conventional level, people are called *autonomous*. They think originally and want to live by universally good principles and welfare of others. They have no self-interest. They live by principled conscience. They follow the golden rule, 'Do unto others as you would have them do unto you'. They maintain moral integrity, self-respect and respect for others.

Kohlberg believed that individuals could only progress through these stages, one stage at a time. He believed that most of the moral development occurs through social interactions.

2. Gilligan's Theory

Carol Gilligan found that Kohlberg's theory had a strong male bias. According to Gilligan's studies, men had a tendency to solve problems by applying abstract moral principles. Men were found to resolve moral dilemma by choosing the most important moral rule, overriding other rules. In contrast, women gave importance to preserve personal relationships with all the people involved. The context oriented emphasis on maintaining personal relationships was called the *ethics of care*, in contrast with the *ethics of rules and rights* adopted by men.

Gilligan revised the three levels of moral development of Kohlberg, as stages of growth towards ethics of caring. The pre-conventional level, which is same as that of Kohlberg's first one, right conduct, is viewed in a selfish manner solely as what is good for oneself. The second level called *conventional level*, the importance is on not hurting others, and willing to sacrifice one's own interest and help others. This is the characteristic feature of women. At the post-conventional level, a reasoned balance is found between caring about others and pursuing the self-interest. The balance one's own need and the needs of others, is aimed while maintaining relationship based on mutual caring. This is achieved by context-oriented reasoning, rather than by hierarchy of rules.

The theories of moral development by Kohlberg and Gilligan differ in the following respects.

Kohlberg’s Theory	Carol Gilligan’s Theory
A. Basic Aspects	
1. Is based on the study on men. 2. Men give importance to moral rule. 3. Ethics of rules and rights.	1. Is based on the study on men and women 2. Women always want to keep up the personal relationships with all the persons involved in the situations. 3. Women give attention to circumstances leading to critical situations rather than rules: (context-oriented and ethics of care)
B Characteristic Features	
1. Justice 2. Factual 3. Right or wrong 4. Logic only 5. Logic and rule-based 6. Less of caring 7. Matter of fact (practical) 8. Present focus 9. Strict rules 10. Independence 11. Rigid 12. Taking a commanding role 13. Transactional approach	1. Reason 2. Emotional 3. Impact on relationships 4. Compassion too 5. Caring and concern 6. More of caring 7. Abstract 8. Future focus 9. Making exceptions 10. Dependence 11. Human-oriented 12. Shying away from decision-making 13. Transformational approach

The difference in these two theories is explained through the well-known example, *Heinz’s dilemma*¹. Heinz being poor and a debtor could not buy the costly medicine for his sick wife, at ten times the normal cost. Initially he begged the Pharmacist to sell at half the price or allow him to pay for it later. Pharmacist refused to oblige him either way. Finally he forcibly entered the Pharmacy and stole the drug.

According to Kohlberg study, men observed that the theft was morally ‘wrong’ at the conventional level, because the property right was violated. But men at the post-conventional level, concluded that the theft was ‘right’, as the life of the human being was in danger. But women observed that Heinz was wrong. They observed that instead of stealing he could have tried other solutions (threatening or payment in installments?) to convince the Pharmacist. Gilligan however attributed the decision by women as context-oriented and not on the basis of rules ranked in the order of priority.

2.7 CONSENSUS AND CONTROVERSY

In the study of moral autonomy, consensus and controversy are relevant factors to discuss on. Consensus means agreement and controversy means conflict or disagreement.

In exercising moral autonomy, one is not likely to obtain the same results as by others. This situation is likely to end in a controversy. In this case, good amount of tolerance among the individuals who are autonomous, reasonable and responsible is necessary. This does not mean forcing the engineers to reach unique moral solutions. Many reasonable solutions are possible to a given ethical problem. The ethics make the engineers realize the importance of tolerance among them, in case of disagreement while applying moral autonomy.

2.8 PROFESSION

2.8.1 Definitions

- A. **PROFESSION** is defined as any occupation/job/vocation that requires advanced expertise (skills and knowledge), self-regulation, and concerted service to the public good. It brings a high status, socially and economically. The characteristics of a profession are:
1. *Advanced expertise*: Many professions require sophisticated skills (do-how) and theoretical knowledge (know-how and why). Formal education, training, continuing education, updating are needed.
 2. *Self regulation*: Professional societies play important role in setting standards for admission to profession, drafting codes of ethics, enforcing standards of conduct, and representing the profession before the public and the government.
 3. *Public good*: The occupation provides some important public good, by concerted efforts to maintain ethical standards. For example, a physician promotes health, a lawyer protects the legal rights, an engineer provides a product or a project for use by the public towards their health, welfare, and safety. Teaching is also claimed as a profession as it helps shaping and training the minds of the students, young as well as old.

Some argue that jobs such as carpenter, barbers, porters, and drivers are to be recognized as professions. It is open for discussion. Such things can not be decided by referring to dictionary alone. A thorough analysis of the activities expected of these jobs is to be made and checked with explanation of the requirements of a profession before deciding it as profession. For example, having been engaged for driving one's vehicle is not a profession. But an ace driver who is engaged by a travel agency to drive different types of cars for tourists extends courtesy to the customers, requires education, expertise (a valid driving license), and respect to the public. His job may be termed as a profession. A mercenary is not a professional as he acts against public good

- B. **PROFESSIONAL** relates to a person or any work that a person does on profession, and which requires expertise (skills and knowledge), self-regulation and results in public good. The term professional means a 'person' as well as a 'status'.
- C. **PROFESSIONALISM**: It is the status of a professional which implies certain attitudes or typical qualities that are expected of a professional. According to Macintyre, professionalism is defined as the *services related to achieving the public good, in addition to the practices of the knowledge of moral ideals*.

The *criteria* for achieving and sustaining professional status or professionalism are:

1. *Advanced expertise*: The expertise includes sophisticated skills and theoretical knowledge in exercising judgment. This means a professional should analyse the problem in specific known area, in an objective manner.
2. *Self-regulation*: One should analyse the problem independent of self-interest and direct to a decision towards the best interest of the clients/customers. An autonomous judgment (unbiased and on merits only) is expected. In such situations, the codes of conduct of professional societies are followed as guidance.
3. *Public good*: One should not be a mere paid employee of an individual or a teaching college or manufacturing organization, to execute whatever the employer wants one to do. The job should be recognised by the public. The concerted efforts in the job should be towards promotion of the welfare, safety, and health of the public.

2.8.2 Characteristics

The characteristics of the ‘profession’ as distinct from ‘non-professional occupation’ are listed as follows:

1. Extensive Training

Entry into the profession requires an extensive period of training of intellectual (competence) and moral (integrity) character. The theoretical base is obtained through formal education, usually in an academic institution. It may be a Bachelor degree from a college or university or an advanced degree conferred by professional schools.

2. Knowledge and Skills

Knowledge and skills (competence) are necessary for the well-being of the society. Knowledge of physicians protects us from disease and restores health. The lawyer’s knowledge is useful when we are sued of a crime, or if our business is to be merged or closed or when we buy a property. The Chartered Accountant’s knowledge is important for the success of recording financial transactions or when we file the income return. The knowledge, study, and research of the engineers are required for the safety of the air plane, for the technological advances and for national defense.

3. Monopoly

The monopoly control is achieved in two ways:

- (a) the profession convinces the community that only those who have graduated from the professional school should be allowed to hold the professional title. The profession also gains control over professional schools by establishing accreditation standards
- (b) By persuading the community to have a licensing system for those who want to enter the profession. If practicing without license, they are liable to pay penalties.

4. Autonomy in Workplace

Professionals engaged in private practice have considerable freedom in choosing their clients or patients. Even the professionals working in large organizations exercise a large degree of impartiality, creativity and discretion (care with decision and communication) in carrying their responsibilities. Besides this, professionals are empowered with certain rights to establish their autonomy.

Accordingly physicians must determine the most appropriate medical treatments for their patients and lawyers must decide on the most successful defense for their clients. The possession of specialized knowledge is thus a powerful defense of professional autonomy.

5. Ethical Standards

Professional societies promulgate the codes of conduct to regulate the professionals against their abuse or any unethical decisions and actions (impartiality, responsibility) affecting the individuals or groups or the society.

2.9 MODELS OF PROFESSIONAL ROLES

Promotion of public good is the primary concern of the professional engineers. There are several role models to whom the engineers are attracted. These models provoke their thinking, attitudes and actions.

1. Savior

The engineer as a savior, save the society from poverty, illiteracy, wastage, inefficiency, ill health, human (labor) dignity and lead it to prosperity, through technological development and social planning. For example, R.L. Stevenson.

2. Guardian

He guards the interests of the poor and general public. As one who is conversant with technology development, is given the authority befitting his expertise to determine what is best suited to the society. For example, Lawrence of Arabia (an engineer).

3. Bureaucratic Servant

He serves the organization and the employers. The management of an enterprise fixes its goals and assigns the job of problem solving to the engineer, who accepts the challenge and shapes them into concrete achievements. For example, Jamshedji Tata.

4. Social Servant

It is one who exhibits social responsibility. The engineer translates the interest and aspirations of the society into a reality, remembering that his true master is the society at large. For example, Sir M.Viswesvarayya.

5. Social Enabler and Catalyst

One who changes the society through technology. The engineer must assist the management and the society to understand their needs and make informed decisions on the desirable technological development and minimize the negative effects of technology on people and their living environment. Thus, he shines as a social enabler and a catalyst for further growth. For example, Sri Sundarlal Bahuguna.

6. Game Player

He is neither a servant nor master. An engineer is an assertive player, not a passive player who may carry out his master's voice. He plays a unique role successfully within the organization, enjoying the excitement of the profession and having the satisfaction of surging ahead in a competitive world. For example, Narayanamurthy, Infosys and Dr. Kasthurirangan, ISRO.

2.10 RESPONSIBILITY

2.10.1 Senses

There are different senses of responsibility, such as:

1. *Characteristic Quality*

Primarily responsibility implies duty with care and efforts.

2. *Obligations*

These are one's moral responsibility i.e., duty to act right and in moral ways. The obligations such as honesty, fairness, and decency are incumbent on every one. In addition to this, we have role responsibilities assigned by taking up various roles, such as parents, inspectors, and employees. For example, a Safety Engineer has a responsibility to make regular inspections in a factory shops.

3. *General Moral Capacity*

One has the general capacity for moral agency, including the understanding and action on moral reasons.

4. *Liability and Accountability*

Liability and Accountability for actions. It means that one is liable (with a legal sense) to meet the obligations in better ways. The person is likely to respond legally, if necessary.

Accountable means that one is willing to justify or defend the decisions, actions or means and outcomes. It could include offering a reasonable excuse or accepting the shame for not having met the end results or accepting the guilt for harming others. One is also answerable to the assessment by others on one's actions (means) or outcomes.

5. *Praiseworthiness/Blameworthiness*

When accountability for wrong actions or results is at issue, responsibility means blameworthy. When the right conduct or successful result is at issue, responsible is synonymous with praiseworthy.

2.10.2 Types

Different types of responsibilities exhibited in human transactions are:

1. *Moral Responsibility*

Moral responsibility as applied to a professional: A professional must be responsible morally, in creating internal good or good outcomes, and eliminating /minimizing un- intended side-effects, from engineering and technology. It includes:

- (a) *Obligations*: A commitment to moral actions (primary obligation to protect the safety of the human beings and respect their rights),
- (b) *Conscientious*: A comprehensive perspective to accept the duties, and diligently do the right things by putting their heart, head and hands (awareness of the experimental nature of the product/project, anticipating possible and unexpected outcomes and putting efforts to monitor them),
- (c) Accountability (being accountable for the decisions, actions, and the results of product/project including safety), and
- (d) Praiseworthy/Blameworthy as applied to context of doing things right/doing things wrongly, respectively.

2. Causal Responsibility

It is being a cause of some event. For example, a child playing with matches cause a house to burn. The child is causally responsible, but the parent who left the child with matches, is morally responsible.

3. Job Responsibility

It consists of assigned tasks at the place of employment and achieving the objectives.

4. Legal Responsibility

It is the response required by law and includes legal obligations and accountability to meet them. Many of these responsibilities overlap with moral responsibility.

2.10.3 Responsible Professionalism

The most comprehensive virtue of engineers is responsible professionalism. It can also be called Professional Responsibility. This consists of five types of virtues, as follows:

1. Self-direction (Self-governance) virtues are fundamental and necessary in exercising moral responsibility. On the basis of ‘understanding and cognition’, it includes self-understanding, humility (proper assessment of one’s character), and good moral judgment (termed as ‘practical wisdom’ by Aristotle). On the basis of ‘commitment and action’, it covers courage, self-discipline, perseverance, self-respect, and integrity. Honesty a virtue common to both bases as it implies truthfulness in thoughts and words and trustworthiness in actions.
2. Public-spirited virtues focus on the good of the clients and the public. It includes the respect for rights (to make decisions and face the risk), non-maleficence (not harming others intentionally). Engineering codes go a step further and prescribe beneficence that includes preventing or removing harm to others and also promoting the public safety, health, and welfare, generosity (helping the community by voluntarily giving their time, talent, and money-voluntary service to the professional society and community), and justice (unbiased) in all decisions and actions.
3. Team-work virtues enable the professionals to work successfully with others. They include collegiality, cooperativeness, communicative ability, and respect for legitimate authority. Responsible exercise of authority and the ability to motivate other to achieve are also the relevant to team-work virtues.
4. Proficiency virtues, which mean the mastery of technical skills (called as Intellectual Virtue by Aristotle). It includes competence (having qualified, licensed, and prepared to execute the job that is undertaken), diligence (alert to dangers, careful attention, and avoidance of laziness or workaholic nature), creativity (learning to respond to the changing technological society), excellence (perform at the highest level), and self-renewal through continuing education.
5. Cardinal (chief) virtues: Wisdom (prudence), courage (fortitude), temperance and justice. Some of these may overlap other virtues. They are called ‘cardinal’ (Latin: cardo, hinge) because they are hinges on which all virtues depend. These are also called *moral* (Latin: mores, fixed values) because they govern our actions, regulate our passions, and guide our conduct according to faith and reason. Wisdom is perception of truth and ability to distinguish between the right and wrong. Courage means a firm and elevated mind. Temperance represents order in words and actions. Justice is preserving humanity and observing the faith of contracts. Although these virtues ring religious tones, they are very relevant to the engineering practice.

2.10.4 Social Responsibility

Corporate organizations have social responsibility to all of their ‘stakeholders’. This includes the well-being of the employees and their unions, socially responsible investors, customers, dealers, suppliers, local communities, governments, non-governmental organizations, and the business owners and managers. Besides showing concern with employee relations and other internal organizational matters, the organization is concerned with

- (a) how the product/project is marketed, used or misused, how it fails, and how it is disposed or discarded. The ways in which the used battery cells and computers are discarded have been debated in the engineers’ forums.
- (b) protecting the work environment during manufacture as well as the external environment during transport or use
- (c) training the disadvantaged or physically-challenged workers
- (d) subcontracting and hiring practices, and
- (e) contribution to local communities to enrich their cultural, social, and civic life. It may be even compensatory against the harm to environment (e.g., planting trees).

Various types of responsibilities such as causal, moral, and legal are distinguished through appropriate examples, as shown below:

Events	Responsibility
1. A stray cattle on the rail track caused the derailment of goods train	(a) Although cattle is the cause, the owner of the cattle is morally responsible (b) For letting the cattle go astray on the railway track, that is trespassing the owner is legally responsible
2. A child playing with (safety?) matches causes fire	Although the child is the cause, the parents who who have left the match box within the reach of the child, are morally responsible
3. (a) Seth was driving a car. He failed to stop at the red signal, which caused an accident (b) Suppose he applied brakes, but they failed	(a) Seth is causally responsible (b) Seth has been negligent of maintenance of brakes
4. There was a forest fire. It was traced to camp fire at specific site and Raj was the last to use the campsite.	Raj is causally responsible for the forest fire he failed to put out the camp fire. Although the temperature was high, and the dry leaves helped the fire to spread, Raj allowed the fire to spread. Hence, he is the cause

(Contd...)

5. The products sold have caused harm while being used	The engineer or the engineering firm is legally responsible for the harmful effects of defects in their products. But they are not morally responsible for the harm or defects
6. A fitter lost one his eyes while inserting a chip by using a hammer	The hammer manufacturer was legally responsible on the basis of the doctrine of strict liability, which does not require any proof of effect in the design of the hammer. Morally the manufacturer was not responsible
7. In a contract, it is not implied that the engineer to be held for not observing the possibility of danger. But an accident occurs	The engineer is free from legal responsibility, but he has moral responsibility to observe the work done
8. A pandal erected by the contractor, in a marriage hall catches fire, due to a leakage of electric current	No legal responsibility for pandal contractor. Owner of the hall is morally responsible for the leakage
9. Question papers were leaked out by some persons, during transport	Controller of Examinations can not be held legally responsible, although he is morally responsible

2.10.5 Accountability

Accountability means:

1. The capacity to understand and act on moral reasons
2. Willingness to submit one’s actions to moral scrutiny and be responsive to the assessment of others. It includes being answerable for meeting specific obligations, i.e., liable to justify (or give reasonable excuses) the decisions, actions or means, and outcomes (sometimes unexpected), when required by the stakeholders or by law.
3. Conscientiousness: It means:
 - (a) Being sensitive to full range of moral values and responsibilities and
 - (b) The willingness to upgrade their skills, put efforts, and reach the best balance possible among those considerations, and
4. Blameworthy/Praiseworthy: Own the responsibility for the good or wrong outcomes. Courage to accept the mistakes will ensure success in the efforts in future.

The terms ‘corporate responsibility’ and ‘corporate accountability’ have different meanings. Corporate responsibility emphasizes the voluntary compliance of a particular organization to particular codes of conduct. The groups of individuals in the organization are assigned responsibilities through policy manuals and flow charts. The corporate accountability means holding all the corporate organizations accountable to the public, employees, customers, and stock holders, as empowered by rules and laws.

2.10.6 Obligation

The safety and other obligations of professional engineers are justifiable based on the following aspects.

1. Moral obligations through laws and enforced codes of conduct
2. Through membership of professional society
3. Contractual agreement with the employers
4. By entry into career as engineer upon graduation from Engineering institutions and
5. By special employment agreements or agreement with professional societies.

The *paramount obligation* means, giving importance to the safety, health, and welfare of the public in performing the professional duties.

2.11 THEORIES ABOUT RIGHT ACTION (ETHICAL THEORIES)

2.11.1 Uses and Criteria

The ethical theories are useful in many respects.

1. In understanding moral dilemma. They provide clarity, consistency, systematic and comprehensive understanding.
2. It provides helpful practical guidance in moral issues towards the solution.
3. Justifying professional obligations and decisions, and
3. In relating ordinary and professional morality.

Different *criteria* may be applied for evaluating various ethical theories and deciding upon the best.

1. The theory must be clear and (coherent) formulated with concepts that are logically connected.
2. It must be internally consistent, i.e., none of its principles conflicts with any other
3. The theory and its defense must depend, only upon facts.
4. It must organize basic moral values in systematic and comprehensive manner. It is to fix priority of values and provide guidance in all situations
5. It must provide guidance compatible with our moral convictions (judgments) about concrete situations. For example, if an ethical theory says that it is all right for engineers to make explosive devices without the informed consent of the public, we can conclude that the theory is inadequate.

Theories and judgments are continually adjusted to each other until we reach a reflective equilibrium. Most of the theories converge towards the welfare of the humanity. The duty ethics and right ethics differ in great extent on their emphasis. But they remain complementary always.

2.11.2 Ethical Theories/Approaches

Several ethical theories have been developed over different times, each of them stressing certain ethical principles or features. Each stresses a view and many a times, we find that these theories converge and reinforce the ethics, in deciding upon the actions and justifying the results.

1. Utilitarian Theory

The term Utilitarianism was conceived in the 19th century by **Jeremy Bentham** and **John Stuart Mill** to help legislators determine which laws were morally best. They suggested that the standard of right conduct is maximization of good consequences. Good consequences mean either ‘utilities’ or the ‘balance of good over evil’. This approach weighs the costs and benefits. Right actions are the ones that produce the greatest satisfaction of the preferences of the affected persons. In analyzing an issue in this approach, we have to:

- (a) Identify the various courses of action available to us.
- (b) Ask who will be affected by each action and what benefits or harms will be derived from each.
- (c) Choose the action that will produce the greatest benefits and the least harm. The ethical action is the one that provides the greatest good for the greatest number.

The ACT UTILITARIAN theory proposed by **J.S. Mill** (1806-73) focuses on actions, rather than on general rules. An action is right, if it generates the most overall good for the most people involved.

The RULE UTILITARIAN theory, developed by **Richard Brandt** (1910-97), stressed on the rules, such as ‘do not steal’, ‘do no harm others’, ‘do not bribe’, as of primary importance. He suggested that individual actions are right when they are required by set of rules which maximizes the public good.

The act utilitarian theory permitted a few immoral actions. Hence, there was need to develop rule *utilitarian theory* to establish morality and justice, in the transactions. For example, stealing an old computer from the employer will benefit the employee more than the loss to the employer. As per Act, utilitarian this action is right. But rule utilitarian observes this as wrong, because the employee should act as ‘faithful agent or trustee of the employees’. In another example, some undisciplined engineers are terminated with the blame for the mistakes they have not committed.

The process is unfair although this results in promotion of overall good.

2. Duty Ethics

- A. The duty ethics theory, proposed by **Immanuel Kant** (1724-1804) states, that actions are consequences of performance of one’s duties such as, ‘being honest’, ‘not cause suffering of others’, ‘being fair to others including the meek and weak’, ‘being grateful’, ‘keeping promises’ etc. The stress is on the universal principle of respect for autonomy i.e., respect and rationality of persons. As per Kant we have duties to ourselves, as we are rational and autonomous beings. We have a duty not to commit suicide; a duty to develop our talents and a duty to avoid harmful drugs. Kant insisted that moral duties are categorical imperatives. They are commands that we impose on ourselves as well as other rational beings. For example, we should be honest because honesty is required by duty. A businessman is to be honest because honesty pays — in terms of profits from customers and from avoiding jail for dishonesty.
- B. On the other hand, the DUTY ethics theory, as enunciated by **John Rawl**, gave importance to the actions that would be voluntarily agreed upon by all persons concerned, assuming impartiality. His view emphasized the autonomy each person exercises in forming agreements

with other rational people. Rawls proposed two basic moral principles; (1) each person is entitled to the most extensive amount of liberty compatible with an equal amount for others, and (2) differences in social power and economic benefits are justified only when they are likely to benefit every one, including members of the most disadvantaged groups. The first principle is of prime importance and should be satisfied first. Without basic liberties other economic or social benefits can not be sustained for long. The second principle insists that to allow some people with great wealth and power is justified only when all other groups are benefited. In the business scenario, for example, the free enterprise is permissible so far it provides the capital needed to invest and prosper, thereby making job opportunities to the public and taxes to fund the government spending on the welfare schemes on the poor people.

C.W.D. Ross, the British philosopher introduced the term *prima facie duties*, which means duties might have justified exceptions. In fact, most duties are *prima facie* ones; some may have obligatory or permissible exceptions. Ross assumed that the *prima facie* duties are intuitively obvious (self-evident), while fixing priorities among duties. He noted that the principles such as ‘Do not kill’ and ‘protect innocent life’ involve high respect for persons than other principles such as, ‘Do not lie’ (less harmful). This theory is criticized on the fact, that the intuitions do not provide sufficient guideline for moral duty. He has listed various aspects of Duty Ethics that reflect our moral convictions, namely:

- | | |
|---------------------|---|
| 1. Fidelity | : duty to keep promises. |
| 2. Reparation | : duty to compensate others when we harm them. |
| 3. Gratitude | : duty to thank those who help us. |
| 4. Justice | : duty to recognize merit. |
| 5. Beneficence | : duty to recognize inequality and improve the condition of others. |
| 6. Self-improvement | : duty to improve virtue and intelligence. |
| 7. Non-maleficence | : duty not to injure others. |

3. Rights Theory

Rights are entitlement to act or to have another individual act in a certain way. Minimally, rights serve as a protective barrier, shielding individuals from unjustified infringement of their moral agency by others. For every right, we have a corresponding duty of noninterference.

A. The RIGHTS approach to ethics has its roots in the 18th century philosopher **Immanuel Kant**, who focused on the individual’s right to choose for oneself. According him, what makes human beings different from mere things is, that people have dignity based on their ability to choose freely what they will do with their lives, and they have a fundamental moral right to have these choices respected. People are not objects to be manipulated; it is a violation of human dignity to use people in ways they do not freely choose. Other rights he advocated are:

1. *The right to access the truth*: We have a right to be told the truth and to be informed about matters that significantly affect our choices.
2. *The right of privacy*: We have the right to do, believe, and say whatever we choose in our personal lives so long as we do not violate the rights of others.

3. *The right not to be injured*: We have the right not to be harmed or injured unless we freely and knowingly do something to deserve punishment or we freely and knowingly choose to risk such injuries.
 4. *The right to what is agreed*: We have a right to what has been promised by those with whom we have freely entered into a contract or agreement.
- B. In deciding whether an action is moral or immoral, we must ask, does the action respect the moral rights of everyone? Actions are wrong to the extent that they violate the rights of individuals; the more serious is the violation, the more wrongful is the action. The RIGHTS theory as promoted by **John Locke** states that the actions are right, if they respect human rights of every one affected. He proposed the three basic human rights, namely *life, liberty, and property*. His views were reflected in the modern American society, when Jefferson declared the basic rights as life, liberty, and pursuit of happiness.
- C. As per **A.I. Melden's** theory based on rights, nature mandates that we should not harm others' life, health, liberty or property. Melden allowed welfare rights also for living a decent human life. He highlighted that the rights should be based on the social welfare system.
- D. *Human rights*: Human rights are explained in two forms, namely liberty rights and welfare rights. Liberty rights are rights to exercise one's liberty and stresses duties on other people not to interfere with one's freedom. The four features of liberty rights (also called *moral rights*), which lay the base for Government Administration, are:
1. Rights are natural in so far as they are not invented or created by government.
 2. They are universal, as they do not change from country to country.
 3. They are equal since the rights are the same for all people, irrespective of caste, race, creed or sex.
 4. They are inalienable i.e., one cannot hand over his rights to another person such as selling oneself to slavery.

The Welfare Rights are the rights to benefit the needy for a decent human life, when one can not earn those benefits and when those benefits are available in the society.

- E. *Economic rights*: In the free-market economy, the very purpose of the existence of the manufacturer, the sellers and the service providers is to serve the consumer. The consumer is eligible to exercise some rights⁹. The consumers' six basic rights are: Right to Information, Right to Safety, Right to Choice, Right to be Heard, Right to Redressal, and Right to Consumer Education.

A few rights are absolute, i.e., unlimited and have no justifiable exceptions. For example, rights ethicists view that the rights have not been violated if the people purchase a (technological product) hang glider and they get injured by flying them carelessly or under bad weather conditions. But human rights imply that one not to be poisoned or killed by technological products, whose dangers are not obvious or wantonly hidden. They imply a right to be informed, when the purchase was made, of the possible dangers during use or service (obtaining informed consent).

Rights ethics is distinctive in that it makes human rights the ultimate appeal — the moral bottom line. Human rights constitute a moral authority to make legitimate moral demands on others to respect

our choices, recognizing that others can make similar claims on us. Thus, we see that the rights ethics provides a powerful foundation for the special ethical requirements in engineering and other professions.

4. The Virtue Theory

This emphasizes on the character rather than the rights or duties. The character is the pattern of virtues (morally-desirable features). The theory advocated by Aristotle, stressed on the tendency to act at proper balance between extremes of conduct, emotion, desire, attitudes to find the golden mean between the extremes of ‘excess’ or ‘deficiency’. The examples shown below illustrate the theory:

Virtue	Excess	Golden mean	Deficient
Truthfulness (governs communication)	Revealing all in violation of tact and confidentiality	Necessary and sufficient, to proper person	Secretive
Courage (face danger, risk)	Roguishness, bold	Firm and humble	Cowardice
Generosity (giving)	Wasting resources	Give, in appropriate measure	Miserly
Friendliness (governs relationship)	Without anger, effusive	Within decent limits	Bad-tempered
Green environment	Exploitation	Protection	Neglect
Work and earn	Tiresome work (strained)	Balance of work and leisure	Lazy (no work) and more pay

On the other hand, the Virtue Theory proposed by **Mac Intyre**, highlighted on the actions aimed at achieving common good and social (internal) good such as social justice, promotion of health, creation of useful and safe technological products and services. Five types of virtues that constitute responsible professionalism, namely public-spirited virtues, proficiency virtues, team-work virtues, self-governance virtues, and cardinal virtues are discussed in # 2.10.3.

5. Self-realisation Ethics

Right action consists in seeking self-fulfillment. In one version of this theory, the self to be realized is defined by caring relationships with other individuals and society. In another version called *ethical egoism*, the right action consists in always promoting what is good for oneself. No caring and society relationships are assumed.

6. Justice (Fairness) Theory

The justice or fairness approach to ethics has its roots in the teachings of the ancient Greek philosopher Aristotle, who said that “equals should be treated equally and unequals unequally.” The basic moral question in this approach is: How fair is an action? Does it treat everyone in the same way, or does it show favoritism and discrimination?

Issues create controversies simply because we do not bother to check the fairness or justice. Favoritism gives benefits to some people without a justifiable reason for singling them out; discrimination imposes burdens on people who are no different from those on whom burdens are not imposed. Both favoritism and discrimination are unjust and wrong.

2.12 SELF-CONTROL

It is a virtue of maintaining personal discipline. It means a strong will and motivation and avoidance of fear, hatred, lack of efforts, temptation, self-deception, and emotional response. It encompasses courage and good judgment also. Self-respect promotes self-control.

2.13 SELF-INTEREST

Self-interest is being good and acceptable to oneself. It is pursuing what is good for oneself. It is very ethical to possess self-interest. As per utilitarian theory, this interest should provide for the respect of others also. Duty ethics recognizes this aspect as duties to ourselves. Then only one can help others. Right ethicist stresses our rights to pursue our own good. Virtue ethics also accepts the importance of self-respect as link to social practices.

In Ethical Egoism, the self is conceived in a highly individualistic manner. It says that every one of us should always and only promote one's own interest. The ethical egoists do not accept the well being of the community or caring for others. However this self interest should not degenerate into egoism or selfishness, i.e., maximizing only own good in the pursuit of self-interest. The ethical egoists hold that the society benefits to maximum when (a) the individuals pursue their personal good and (b) the individual organizations pursue maximum profit in a competitive enterprise. This is claimed to improve the economy of the country as a whole, besides the individuals. In such pursuits, both individuals and organizations should realize that independence is not the only important value. We are also interdependent, as much as independent. Each of us is vulnerable in the society. Self-respect includes recognition of our vulnerabilities and interdependencies. Hence, it is compatible with caring for ourselves as well as others. Self-interest is necessary initially to begin with. But it should be one of the prime motives for action; the other motive is to show concern for others, in the family as well as society. One's self-interest should not harm others. The principles of 'Live and let (others) live', and 'reasonably fair competition' are recommended to professionals by the ethicists.

2.14 CUSTOMS

Ethical Pluralism: Various cultures in our pluralistic society lead to tolerance for various customs, beliefs, and outlooks. Accordingly ethical pluralism also exists. Although many moral attitudes appear to be reasonable, the rational and morally concerned people can not fully accept any one of the moral perspectives. There are many varied moral values, which allow variation in the understanding and application of values by the individuals or groups in their everyday transactions. It means that even reasonable people will not agree on all moral issues and professional ethics.

Ethical Relativism: According to this principle, actions are considered morally right when approved by law or custom, and wrong when they violate the laws or customs. The deciding factor is the law or the customs of the society. Should we accept the principle of relativism or not? A few reasons to accept this are explained in the following paragraphs:

1. Laws appear to be objective ways for judging values. The laws and customs tend to be definite, clear and real, but not always. Further moral reasons allow objective criticism of laws, as being morally lacking. For example, the Apartheid laws of South Africa violated the human rights of the native Africans. No legal protection was available for native citizens for a long time. Now, of course, these laws have been repealed.
2. Ethical relativism assumes that the values are subjective at the cultural level. Moral standards also vary from culture to culture. The objectivity is supported by the existing laws of that society. The relative morality accepted, supports the virtue of tolerance of differences among societies. This argument is also not fully acceptable. As per ethical relativism, the actions and laws of the Nazis and Hitler who vowed on Anti-Semitism and killed several million Jews would be accepted as right.
3. Moral relationalism or moral contextualism: According to this, the moral judgments must be made in relation to certain factors, which may vary from case to case. The morally important factors for making judgments include the customs and laws. The virtue ethicists hold that the practical wisdom should prevail upon assessing the facts and in the judgment.

This principle was accepted by the early anthropologists because they had a specific tendency to over-stress the scope of moral difference between cultures. The human sacrifices and cannibalism were accepted. But the modern anthropologists insist that all cultures shall exhibit the virtue of social welfare and safety against needless death or physical or mental harm. Moral differences were based on the circumstances and facts and not on the difference in moral attitudes. For example, the pharaohs buried the live attendants along with their dead king with the belief that they would continue to serve the king in his after life.

2.15. RELIGION

Religions have played major roles in shaping moral views and moral values, over geographical regions. Christianity has influenced the Western countries, Islam in the Middle-East countries, Buddhism and Hinduism in Asia, and Confucianism in China. Further, there is a strong psychological link between the moral and religious beliefs of people following various religions and faiths. Religions support moral responsibility. They have set high moral standards. Faith in the religions provides trust and this trust inspires people to be moral. The religions insist on tolerance and moral concern for others. Many professionals who possess religious beliefs are motivated to be morally responsible.

Each religion lays stress on certain high moral standards. For example, Hinduism holds polytheistic (many gods) view, and virtues of devotion and surrender to high order. Christianity believes in one deity and emphasizes on virtues of Love, Faith, and Hope. Buddhism is non-theistic and focuses on compassion and Islam on one deity and adherence of *ishan* (piety or pursuit of excellence) and prayer. Judaism stresses the virtue of 'tsedakah' (righteousness). But many religious sects have adopted poor moral standards, e.g., many religious sects do not recognize equal rights for women. The right to worship is denied for some people. People are killed in the name of or to promote religion. Thus, conflicts exist between the 'secular' and religious people and between one religion and another. Hence, religious views have to be morally scrutinized.

2.15.1 Divine Command Ethics

As per this principle, the right action is defined by the commands by God. It implies that to be moral, a person should believe in God and an action is right only if it is commanded by God. There are some difficulties in this approach, namely, (a) whether God exists or not is not clear. (b) How to know what are the God’s commands? and (c) How to verify the genuineness of the commands? Further, religions such as Hinduism, Islam, and Christianity accept the existence of God. But Buddhism, Taoism, and Confucianism adopt only faith in a right path and do not believe in God.

Socrates was said to have argued that God, an entity which is responsible, morally good, and beyond fear or favor, would not command murder, rape, torture, immoral activities, and even mass suicide. Many such crimes were committed in the name of God then and continue even now in different parts of the world. Some Western leaders had claimed that God had commanded them to invade against the Middle-East countries. If anyone claims to have obtained commands from God to kill people merciless, then we have to conclude that the person is not religious but insane.

2.16 SELF-RESPECT

It is defined as valuing oneself in morally suitable ways. Self-respect includes (a) recognition, which means respect to others, their ideas, decisions, ability, and rights and (b) appraisal, which means properly valuing ourselves as to how well we face moral standards and our personal commitments (aims). An intensive but balanced feeling of self-respect is sense of honor. This includes intense agony and guilt for wrong doings. Self-control is a virtue of maintaining personal discipline (self-regulation). Courage is a bye-product of self-respect, which makes a person face the hardship in rational way

Self-respect is different from self-esteem in the following manner:

Self-respect	Self-esteem
1. A moral concept	1. A psychological concept
2. Valuing oneself in morally-suitable ways	2. Having a positive attitude towards oneself. It may be excessive or unwarranted or normal
3. It includes virtues of recognition and appraisal. It promotes virtues of sense of honor, self-control and courage	

2.17 CASE STUDY: CHOICE OF THE THEORY

The choice of the ethical theory to study a problem is illustrated herein with an example. In tackling ethical problems, we can apply all the theories and analyze the actions and results from different angles and see what result each theory gives rise to. This enables us to examine the problem in different perspectives. Many a time, the result will be the same though we have applied various theories.

Case: A chemical plant near a small town is discharging hazardous wastes into the fields nearby. The ground water gets contaminated and significant health problems surface in the community.

Since harm is caused to the residents, the action is unethical as per rights ethics. The agriculturists who have the agrarian right of water supply have been over looked. The pollutants may endanger their profession and welfare. Hence, *rights* ethics also concludes that the action is unethical.

The effects of polluted water and the cost to purify the water by the municipality may out weigh the economic benefits of the plant. Hence, the *utilitarian* analysis leads to the same conclusion.

The groundwater harms the people and caused health problems. Hence, discharging the pollutants is unethical as per *duty* ethics.

Generally, because the rights of the individuals should weigh strongly than the needs of the society as a whole, rights and duty ethics take precedence over utilitarian considerations.

Caution is necessary in applying theory of virtue ethics. When we use the word ‘honor’, we mean it to be a measure of dignity and integrity. It is a positive virtue. When it points to ‘pride’ it is not a virtue and has a negative connotation. History abounds with examples of war, which have been fought and atrocities were committed on innocent people in order to preserve the honor (pride) of an individual or a nation. In using virtue ethics, we have to ensure that the traits of virtue are actually virtuous and will not lead to negative consequences.