Unit I

1. Explain with the suitable examples the need of courage in maintaining honesty and character

Honesty:

- Honesty is telling the truth.
- Honesty is straightforward conduct.
- Honesty is being sincere, truthful, trustworthy, honorable, fair, genuine, and loyal with integrity.

Honest, trusting kids:

- ✓ Tell the truth despite consequences
- ✓ Voice their opinion in a kind, thoughtful way
- ✓ "Tell on" someone only when necessary
- ✓ Show and share their feelings
- ✓ Know their classmates and teachers care and want the best for them
- ✓ Feel and react without guilt
- ✓ Express themselves positively as well as critically
- ✓ Do your own homework
- ✓ Tell a friend the truth
- ✓ Explain the real reason you didn't turn in your homework
- ✓ Keep your eyes on your own paper
- ✓ Clean up your room after making a promise
- ✓ Give the cashier the extra money she gave you by mistake
- ✓ Write a report in your own words instead of copying
- ✓ Admit you made the mistake
- ✓ Keep a friend's secret
- ✓ Turn in a wallet full of money that you found

- **Be honest with yourself**
  - Accept responsibility for your own actions; don't blame others.
  - Be honest about your feelings.
  - Face issues as they arise.
  - If you are considering lying, try to think of the consequences.
  - When confronted with a situation, think of others.
- **Proverbs and maxims**
  - Truth exists; only falsehood has to be invented.
  - The truth is more important than the facts.
  - In the mountains of truth, you never climb in vain.
  - If you tell the truth, you have infinite power supporting you.
- Cochise was a Native American leader who was known for his honor and for keeping his word.
- Barbara Jordan was a remarkable Congresswoman who was a model for honesty in politics.
- Martin Luther was a religious leader who led the Reformation movement (against the existing church) with honesty and courage.

Put honesty into action

- Thank someone in your family for being honest.
- Tell your parents about a mistake you've made.
- Tell the truth when you've done something wrong.
- Compliment a friend for being honest.
- Express your real feelings without anger, without blaming others, without exaggerating, and without hurting the feelings of someone else.
- Turn in something that is lost and encourage others to do the same.
- When someone wants to copy your work, politely explain that it isn't right and that it's best to do your own work.

- Admit a mistake or error in judgment you have made and apologize to anyone it might have affected.
- Do your schoolwork honestly
- Be truthful with your friends and thank them for being truthful with you.
- When you ask someone to be honest with you, don't get angry with them if their honesty isn't what you wanted to hear.

Community service ideas

- Write a letter of thanks to a politician or community leader who has taken a stand on a controversial issue.
- Visit a senior citizen center to play board games with the residents. Make very honest moves as you play.
- Share the meaning of honesty with your family. Ask them to share their ideas with you.
- Remind members of your community to be honest. Decorate public areas with signs telling about the value of honesty.
- Create a classroom honor code. Write it down and hang it up in the classroom, so that everyone can see it all year long.
- Plan a class field trip to a daycare center to tell stories with themes of honesty to young children.

8 great reasons to tell the truth

- Telling the truth lets everyone know what really happened. There's less chances of misunderstandings, confusion, or conflict.
- Telling the truth protects innocent people from being blamed or punished.
- Telling the truth allows everyone to learn from what happened.
- You usually get into less trouble for telling the truth than for lying.
- Other people trust you more when you tell the truth.
- You don't have to tell more lies to keep your story straight.

- You gain a reputation for being truthful - a trait that most people value.
- Telling the truth helps you feel secure and peaceful inside.

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2. **Explain with the suitable examples how the respect for other religious beliefs enhances the peaceful living**

As we live in a society which is of increasingly diverse nature, it is more important to have tolerance for various customs and outlooks. Hence the concept of ethical pluralism emerges. It views that there may be alternative moral attitudes that are reasonable. But none of the moral perspectives can be accepted completely by all the rational and the morally concerned persons. Ethical pluralism allows the customs which plays an important role in deciding how we should act. Moral values are many, varied and flexible. So, these moral values allow considerable variation in how different individuals and groups understand and apply them in their day-today activities. In other words, to be precise, reasonable persons always have reasonable disagreement on moral issues, including issues in engineering ethics.

Ethical Relativism, an objectionable view, should not be confused with Ethical Pluralism. As per Ethical relativism says that actions are morally right when they are approved by law or custom and they are said to be wrong when they violate laws or customs. Ethical relativism tries to reduce moral values to laws, conventions and

Customs of Societies

What is the necessary for a person to accept ethical relativism? There are so many reasons for accepting ethical relativism –

I. The laws and customs seem to be definite, real and clear – cut. They help to reduce the endless disputes about right and wrong. Moreover, laws seem to be an objective way to approach values. The above argument is somewhat weak. This reason underestimates the extent to which ordinary moral reasons are sufficiently objective to make possible criticism of individual prejudice and bias. Moreover, moral reasons allow objective criticism of the given laws as morally inadequate. For example, the apartheid laws (racial segregation) in south Africa. This law violated the human rights are not given any legal protections to the majority of the blacks, but morally ought to be.

II. The second reason for accepting ethical relativism is because it believes the values are subjective at the cultural level. They also state that the moral standards are varied from one culture to another. The only kind of objectivity is relative to a given set of laws in a given society. This relativity of morality encourages the virtue of tolerance of difference among societies. The above said argument is also confusing one. It assumes that ethical relativism is implied by descriptive relativism. i.e., values and beliefs differ from culture to culture. There is nothing self-certifying about the laws and beliefs. This can be explained by the following

illustration. Ethical relativism would allow that Hitler and his followers (Nazis) acted correctly when they killed 6 million Jews, for their laws, customs, and beliefs which were based on anti – Semitism (hostile to Jews). So, ethical relativism refers anything but for the tolerant doctrine it pretends to be. But there is nothing tolerant in accepting Nazi beliefs about morality Admitting intolerant anti-semitic beliefs is not an act of tolerance. The supporters of ethical relativism, generally say that an action is right "for cultures" when believe it as the right one.i.e., it is right "for them" though not "for us". So, beliefs, however customary or widely shared, are not self-certifying whether we are talking about moral beliefs or scientific beliefs.

III. The third reason is based on the moral relationalism or moral contextulaism. This states that moral judgments must be made in relation to some factors which varies from case to case. Making simple and absolute rules are impossible in this way. In most of the cases, customs and laws are considered as morally important factors for making judgments.

All philosophers accepted this moral relationalism. But contemporary duty and right ethicists like 'Kant' do not accept. As per their views, respecting people require some sensitiveness to special circumstances. The virtue ethicists stress the role ofpractical wisdom in identifying the facts which are relevant to assessment of conduct based on virtual manner.

The ethical relativism was accepted by early cultural anthropologists because they had a specified tendency to overstress the scope of moral difference between cultures. Absorbed with unusual practices such as head – hunting, human sacrifices and cannibolism (cannibal is a person who eats human flesh); these persons who shifted their idea quickly form moral views differ greatly to "Morality is a simply a culture as such".

But modern anthropologists state that all cultures by virtual show some commitment to promote social co-operation and protect their members against needless death and suffering. Moral differences are based only on the circumstances and facts, not on the difference in moral attitudes. For example, we can consider the practice of human sacrifice in the Aztecs. [Members of a former Indian people who ruled Mexico before the 16th century]. This practice seems to be a sign of cruelty an lack of concern for life. But a full examination of their beliefs reveal that they believed their gods are pleased by such sacrifice to ensure the survival of their people and also it was considered an honour for the victims. Refer to the sacrifice or placing chicken and goal to god.

Religion and Divine Command Ethics

Moral responsibilities and religious belief are intertwined in many positive ways.

First, they are related historically. Our moral views have been shaped by the most known central moral values within the major world religions. For example, the Judeo- Christian tradition has been influential in Western countries like England, USA etc. Islam has been having a great influence in middle east countries such as Saudi Arabia, Kuwait, Pakistan etc. Confucianism has been influential in China and Buddhism, Hinduism and Taoism have been famous in Asian countries.

Second, most of the people still having beliefs and show some important and inevitable psychological connections between their moral and religious beliefs. Religious views frequently support moral responsibility by providing additional motivation for being moral. Faith in Religions or religious hopes imply trust. This trust gives an inspiration to be moral. The main social functions of religion is motivating right action based on ethical principles. Religion supports many people to follow their beliefs and promote tolerance and moral concern for others. Many of the engineers are motivated by the religious beliefs.

Thirdly, religions form a set of higher moral standards. For example, Christianity suggests for loving neighbors. Many religions include virtue ethics that stresses about particular virtues. For example, the ethics if Christianity focuses in the virtue of hope, faith and love. Buddhism emphasizes a feeling of pity (compassion). Islam pressures "insane" (being religious and pursuit of excellence).

Sometimes, religious set standards below the level of acceptable moral standards. Some religions do not give equal rights to women, as in Islam (particularly in Iran, Iraq). In this situation the conflict is not only between secular morality and religion but also among other religions.

By giving stress on the positive connections between secular morality and religion, we go for defining Divine Command ethics. It views that right action is defined by the commands of God, and without a belief in God there could be no moral values and if an action is said to be wrong, it means that it is forbidden by God. The Major difficulties in Divine Command ethics are: how to know what God's commands are and whether God exists or not. Judaism, Christianity, Islam and

Hinduism are mostly God-centered i.e., they believe in God. But some other religions such as Buddhism, Taoism and Confucianism calls for only faith in a right path from which code of ethics can be derived. For example in Buddhism the right path included eight steps such as right understanding, right intention, right intention, right action, right livelihood, right effort, right mindfulness and right concentration.

Questions on the belief in God were rejected by most of the theologians,[Theology – study of God] based on the question asked by Socrates. Socrates asked why does god make certain commands and not others. Are these commands made on the basis of sudden fancy? The answer is surely no. Because God is supposed to be morally good and He never commands bad acts such as irresponsible killing, rapes, tortures and other immoralities. Suppose a man claimed that God commands him to kill people randomly without making any religious inquiry, we can say that the main is mistaken. Divine Command ethics has things backwards. A morally divine being commands on the basis of moral reasons which determines the wrongness of actions and rightness of other actions. Moral reasons are presupposed as the foundation for making certain commands. Moral reasons cannot force hard to religious matters. Religious beliefs provides an added inspiration for responding to moral reasons.

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3. Explain the skills needed to handle problems bout moral issues in Engineering ethics

There are so many engineering disasters which are greater / heavier than the level of acceptable or tolerable risk. Therefore, for finding and avoiding such cases such as nuclear plant accident at Chernobyl (Russia), Chemical plant at Bhopal (India) where a big disaster of gas leakage, occurred in 1980, which caused many fatal accidents. In the same way, oil spills from some oil extraction plants (the Exxon Valdez plant), hazardous waste, pollution and other related services, natural disasters like floods, earth quake and danger from using asbestos and plastics are some more cases for engineering disasters. These fields should be given awareness of engineering ethics. Hence, it is essential for engineers to get awareness on the above said disasters. They should also know the importance of the system of engineering.

When malfunction of the system is a rapid one, the disaster will be in greater extent and can be noticed immediately. When they ate slow and unobserved, the impact is delayed. So, the engineers should not ignore about the functions of these systems. These cases also explain and make the engineers to be familiar with the outline of the case in future and also about their related ethical issues.

Approaches to Engineering Ethics:

i. **Micro-Ethics**: This approach stresses more about some typical and everyday problems which play an important role in the field of engineering and in the profession of an engineer.

ii. **Macro-Ethics**: This approach deals with all the social problems which are unknown and suddenly burst out on a regional or national level.

So, it is necessary for an engineer to pay attention on both the approaches by having a careful study of how they affect them professionally and personally. The engineers have to tolerate themselves with the everyday problems both from personal and societal point of view.

4. Where and How do Moral Problems arise in Engineering?

Any product or project has to undergo various stages such as planning, idea, design, and manufacturing which is followed by testing, sales and services. This has to be done by engineers of various branches like Civil, Mechanical, Electrical, Chemical etc. These engineers may be grouped together as a team or they may be separated from each other with an interconnection or co-ordination.

Inspite of the engineers' full attention and care, sometimes the product or projectmay be unsafe or less useful. This may be due to some reasons

1) The product or project may be designed for early obsolescence or

2) due to under pressure because of running out of time, budgetary etc or

3) by ignorance on the size of the project, or

4) because of the large number of a products sold on the mass market, people may be affected.

Some cases with which different areas covered by engineering ethics:

1. An inspector finds a faulty part in the manufacture of a machine, which prevents the use of that machine for a longer period. But his superior, takes this as a minor mistake and orders that the faulty part to be adjusted so that the delay in the process has to be avoided. But the inspector doesn't want this and so he is threatened by the supervisor.

2. An electronic company applies for a permit to start a Nuclear Power Plant. When the licensing authority comes for visit, they enquire the company authorities on the emergency measures that have been established for safety of the surroundings. The engineers inform them about the alarm system and arrangements have been made in local hospitals for the treatment of their employees and they have no plan for the surrounding people. They also inform that it is the responsibility of the people.

3. A Yarn Dyeing company which dumps its wastes in the nearby river. It causes heavy damage to the people those who are using the river. The plant engineers are aware of this, but they do not change the disposal method because their competitors also doing similarly as it happens to be a cheaper. They also say that it is the responsibility of the local government.

The above given examples clearly explain how the ethical problems arise most often because of wrong judgments and expectations of engineers. These necessitate for establishing some codes of conduct which has to be imposed on engineers' decisions on the basis of ethical view.

Unit II

1. Explain Types of Inquiries

TYPES OF INQUIRY

Inquiry means an investigation. Like general ethics, Engineering ethics also involves investigations into values, meaning and facts. These inquiries in the field of Engineering ethics are of three types.

1. Normative Inquiries
2. Conceptual Inquiries
3. Factual or Descriptive Inquiries

Normative Inquiries

These inquiries are mostly helpful to identify the values which guide the individuals and groups in taking a decision. These are meant for identifying and justifying some norms and standards of morally desirable nature for guiding individuals as well as groups. In most of the cases, the normative questions are given below:

1. How do the obligations of engineers protect the public safety in given situations?

2. When should an engineer have to alarm their employers on dangerous practices?

3. Where are the laws and organizational procedures that affect engineering practice on moral issues?

4. Where are the moral rights essential for engineers to fulfill their professional obligations?

From these questions, it is clear that normative inquiries also have the theoretical goal of justifying moral judgments.

Conceptual Inquiries

These are meant for describing the meaning of concepts, principles, and issues related to Engineering Ethics. These inquiries also explain whether the concepts and ideas are expressed by single word or by phrases. The following are some of the questions of conceptual inquiries:

1. What is the safety and how it is related to risk?

2. What does it mean when codes of ethics say engineers should protect the safety, health and welfare of the public?

3. What is a ‘bribe’?

4. What is a ‘profession’ and ‘professional’?

Factual / Descriptive Inquiries

These help to provide facts for understanding and finding solutions to value based issues. The engineer has to conduct factual inquiries by using scientific techniques. These help to provide information regarding the business realities such as engineering practice, history of engineering profession, the effectiveness of professional societies in imposing moral conduct, the procedures to be adopted when assessing risks and psychological profiles of engineers. The information about these facts provides understanding and background conditions which create moral problems. These facts are also helpful in solving moral problems by using alternative ways of solutions.

These types of inquiries are said to be complementary and interrelated. Suppose an engineer wants to tell a wrong thing in an engineering practice to his superiors, he has to undergo all these inquiries and prepare an analysis about the problem on the basis of moral values and issues attached to that wrong thing. Then only he can convince his superior. Otherwise his judgment may be neglected or rejected by his superior.

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2. Explain how Gilligan view the three levels of moral development. *****

Moral Autonomy is based on the psychology of moral development. The first psychological theory was developed by Jean Piaget. On the basis of Piaget‘s theory, Lawrence Kohlberg developed three main levels of moral development, which is based on the kinds of reasoning and motivation adopted by individuals with regard to moral questions.

1. The Preconventional Level

It is nothing but self-centered attitude. In this level, right conduct is very essential for an individual which directly benefits him. According to this level, individuals are motivated by their willingness to avoid punishment, or by their desire to satisfy their own needs or by the influence of the power exerted by them. This level is related to the moral development of children and some adults who never want to grow beyond a certain limit.

2. The Conventional Level

The level deals with the respect for conventional rules and authority. As per this level the rules and norms of one‘s family or group or society has been accepted as the final standard of morality. These conventions are regarded as correct, because they represent with authority. When individuals are under this level, they always want to please or satisfy others and also to meet the expectations of the society and not their self-interest. Loyalty and close identification with others have been given much importance. No adulttries to go beyond this level.

3. The Post Conventional Level

This level is said to be attained when an individual recognizes the right and the wrong on the basis of a set of principles which are not based on self-interest or social conventions. These individuals are called ―autonomous, because they only think by themselves and also they do not agree that customs are always correct. They want to live by general principles which are universally applied to all people. They always want to maintain their moral integrity, selfrespect and the respect for other autonomous people.

Kohlberg‘s theory of moral development is very much related to the goals of• studying ethics at college level. To become morally responsible, an individual must be able and willing to undergo moral reasoning. Moral responsibility comes out of the foundation of early moral training given by an individual‘s parents and culture. This early training helps to complete the above said three levels of moral development by an individual.

As per Kohlberg‘s view only few people would reach the post conventional level which is based on the assumption that movement towards autonomy is morally desirable. Caorl Gilligan was one of the students of Kohlberg. She criticizes Kohlberg‘s theory on the basis of approaches made by both male and female towards morality. On the basis of her studies and researchs, she criticises Kohlberg‘s theory which is only based on male bias and his studies are of typically male preoccupation with general rules and rights. She also suggests that men are always more interested in resolving moral dilemmas by applying some most important moral rules. But women always want to keep up the personal relationships with all those involved in a situation and they always give attention only on the circumstances responsible for that critical situation and not on general moral rules.She also states that Kohlberg‘s theory is only an ethics of rules and rights. But her theory is known as ethics of care. i.e. context oriented emphasis required to maintain the personal relationship.

LEVELS OF MORAL DEVELOPMENT

Gilligan recasts Kohlberg‘s three levels of moral development on the basis of her own studies of women, as follows:

(i) The Pre-conventional level

This is more or less the same as Kohlberg‘s first level i.e. Right conduct is a selfish thing as solely what is good for oneself.

(ii) The Conventional Level

This level differs from Kohlberg‘s second level. According to her, women don‘t want to hurt others and want to help others i.e., women always want to give up their interests in order to help the others to fulfill their needs.

(iii) The Post Conventional level

This level is also differed from Kohlberg‘s level. In this level, individuals (particularly women) want to balance between caring about other people and their own interests. The main aim here is to balance an individual‘s needs with those of others on the basis of mutual caring. This can be achieved only through context-oriented reasoning and not by abstract rules.

HEINZ‘S DILEMMA‘

Gilligan‘s criticism on the Kohlberg‘s theory can be made very clear with the help of a famous example used by Kohlberg in his questionnaires and interviews. This is called Heinz‘s Dilemma.

This example was about a woman and Heinz, her husband, living in Europe. The woman was affected by cancer. The doctors told her to use an expensive drug to save her life. The pharmacist who also invented that medicine charged ten times the cost of making the drug. In spite of his poverty, Heinz took a lot of effort to borrow money, but he could get only half of the amount needed. He approached to the pharmacist and begged him to sell the medicine at a cheaper price or allow him to pay for it later. But the pharmacist refused to do so.

Finally without any hope, Heinz forcibly entered into the pharmacy and stole the drug.

The question here is ―Was the theft morally right or wrong?‖ By asking this question among the males, Kohlberg has received two sets of answers:

One is based on the conventional level i.e. Heinz did a wrong thing. Another one is based on the post conventional level i. e Heinz was correct as the life of the wife is more important than the property right of the pharmacist. But when the same question was asked among the women, they gave (all women) same answer. They replied that Heinz was wrong. They further told that instead of stealing the medicine, Heinz could have tried alternative solutions. They also told that Heinz should have convinced the pharmacist to give the medicine.

From the above, Kohlberg concluded that women‘s decisions are always based on conventional rule and also they always have different opinions in applying the general moral rules and principles about the right to live. On the basis of the Kohlberg‘s comment on the women, Gilligan came to a different conclusion. She tells that it shows greater sensitivity to people and personal relationships.

She concluded that the decision taken by women is context-oriented and not on the basis of general rules ranked in order of priority. Now, the question here is, how Gilligan‘s theory of moral development relates to moral autonomy as a goal of studying ethics at the college level?

Autonomy requires independent reasoning on the basis of moral concern and not separated from other people. As per Gilligan‘s theory and Kohlberg‘s theory, moral autonomy should be consistent with _context-oriented‘and also with an awareness general moral principles and rights.

3. Discuss the different models of professional roles.

The main aim of the profession of engineering is to improve the public safety, wealth and welfare. In order to perform these functions, the engineer has to play various models to channalise his attitudes towards the achievement of objectives. They are as follows:

(1) Savior

The engineers are responsible for creating an utopian society in which everything is possible and can be achieved without much effort — This can only be achieved through technological developments made by the engineers, for safe-guarding the society from poverty, inefficiency, waste and manual labour.

(2) Guardian

Engineers only know the directions through which technology will be developed. So, they should be given position of high authority based on their expertise skills in determining what is in the best interests of the society. They should act as guardians to the technological improvements.

(3) Bureaucratic Servant

Engineers‘ role in the management is to be the servant who receives and translates the directive of management into better achievements. They have to solve the problems given by the management, within the limits set by the management.

(4) Social servant

The role of engineers is not only providing service to others but also their responsibility to the society. The interests of the society can be expressed to the engineers it either directly or indirectly. So, the engineers, with the co-operation of the management, have the work of receiving society‘s directives and satisfying the desires of the society.

(5) Social enabler and catalyst

The engineer has to play a role of creating a better society and should be the cause of making social changes. Service given by the engineers to the society includes carrying out the social directives . Engineers are needed to help the management and the society to understand their needs and to create decisions about technological development.

(6) Game Player

We cannot say that engineers are servants or masters of anyone. They are playing the economic game rules which may be effective at a given time. Their aim is to play successfully within the organization enjoying the happiness of technological work and the satisfaction of winning and moving ahead in a completive world.

Unit III

1. Explain the responsibilities of engineers to society.

The engineers have so many responsibilities for serving the society.

- A primary duty is to protect the safety of human beings and respect their right of consent.
- A comprehensive perspective of relevant information.
- Unrestricted free personal involvement in all steps of a project.
- Being accountable for the results of a project.
- Exhibiting technical competence and other characteristics of professionalism.

CONSCIENTIOUSNESS:

- Conscientious moral commitment means sensitivity to the full range of relevant moral values.
- Sensitivity to responsibilities that is relevant.
- Willingness to develop the skill and expend the effort needed to reach the best balance possible among these considerations.
- Conscientiousness means consciousness because mere intent is not sufficient. Conceiving engineering as social experimentation restores the vision of engineers as guardians of the public interest in that they are duty bound to guard the welfare and safety of those affected by engg projects.

RELEVANT INFORMATION:

Conscientiousness is blind without relevant factual information. Moral concern involves a commitment to obtain and assess all available pertinent information. Another dimension to factual information is the consequences of what one does. While regarding engg as social experimentation points out the importance of context, it also urges the engineer to view his or her specialized activities in a project as part of a larger whole having a social impact that may involve a variety of unintended effects.It can be explained as:

1. To understand and grasp the circumstance of a persons work. It is necessary to know how that work has a moral importance.

2. Blurring the circumstance of a persons work derived from his specialization and division of labour is to put the responsibilities on some one else in the organization.

The above said means neglecting the importance of persons work also makes acquiring a full perspective difficult along with a second feature of factual information. So giving regard to engineering as social experimentation, points out the importance of circumstances of a work and also encourage the engineers to view his specialized activities in a project as a part of a large social impact.

MORAL AUTONOMY

- People are morally autonomous when their moral conduct and principles of action are their own.
- Moral beliefs and attitudes must be a critical reflection and not a passive adoption of the particular conventions of one‘s society, religion or profession.
- Moral beliefs and attitudes cannot be agreed to formally and adhered to merely verbally.
- They must be integrated into the core of one‘s personality and should lead to committed action.
- It is wrong to think that as an employee when one performs _acts’ serving company‘s interests, one is no longer morally and personally identified with one‘s actions.
- Viewing engg as a social experimentation helps to overcome this flawed thought and restores a sense of autonomous participation in one‘s work.
- As an experimenter, an engineer is exercising the specialized training that forms the core of one‘s identity as a professional.
- A social experiment that can result in unknown consequences should help inspire a critical and questioning attitude about the adequacy of current economic and safety standards.
- In turn, this leads to better personal involvement with work.

ACCOUNTABILITY:

Responsible people accept moral responsibility for their actions.

- Accountability is the willingness to submit one‘s actions to moral scrutiny and be open and responsive to the assessment of others.
- It should be understood as being culpable and blameworthy for misdeeds.

Submission to an employer‘s authority creates in many people a narrow sense of accountability for the consequences of their action. This is because of

i) Only a small contribution is made by one individual, when large scale engineering work is fragmented. The final product which is far away from one‘s immediate workplace, does not give a proper understanding of the consequences of one‘s action.

ii) Due to the fragmentation of work, a vast diffusion of accountability takes place. The area of personal accountability is delimited to the portion of work being carried out by one.

iii) The pressure to move on to another new project does not allow one to complete the observations long enough. This makes people accountable only for meeting schedules and not for the consequences of action.

iv) To avoid getting into legal issues, engineers tend to concentrate more on legal liabilities than the containment of the potential risks involved in their area of work.

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2. Compare and Contrast Engineering experiments with standard experiments

Engineering is entirely different from standard experiments in few aspects.

These differences are very much helpful to find out the special responsibilities of engineers and also help them in knowing about the moral irresponsibility's which are involved in Engineering

EXPERIMENTAL CONTROL: In standard experiments, members are in two different groups. Members of one group receive special experimental treatment. The other group members, called _control group' do not receive special treatment, though they are from the same environment in all other respects. But this is not true in engineering, since most of the experiments are not conducted in laboratories. The subjects of experiments are human beings who are outside the experimenter's control.

Thus it is not possible to study the effects of changes in variable on different groups. Hence only historical and retrospective data available about various target groups has to be used for evaluation. Hence engineering as a social experimentation seems to be an extended usage of the concept of experimentation.

INFORMED CONSENT: It has two elements, knowledge and voluntariness. The subjects (human beings) should be given all the information needed to make a reasonable decision. Next, they must get into the experiment without being subjected to force, fraud or deception. Supplying complete information is neither necessary nor in most cases possible. But all relevant information needed for making a reasonable decision on whether to participate should be conveyed. Generally, we all prefer to be the subject of our own experiments rather than those of somebody else.

Conditions defining Informed or Valid Consent

- The consent is given voluntarily
- The consent is based on information a rational person would want, together with any other information requested and presented to them in understandable form.
- The consenter was competent to process the information and make rational decisions.
- Information has been widely disseminated.

- The subject‘s consent is offered by proxy by a group that collectively represents many subjects like interests, concerns and exposure to risk.

KNOWLEDGE GAINED

Scientific experiments have been conducted to acquire new knowledge. Whereas engineering projects are conducted as experiments not for getting new knowledge. Suppose the outcome of the experiment is best it tells us nothing new but affirms that we are right about something Mean while the unexpected outcomes put us on search for new knowledge.

There are so many aspects which are of virtual importance for combining every type of engineering works to make it suitable to look at engineering projects as experiments. The main three important aspects are:

Any project is carried out in partial ignorance due to

- The uncertainties in the abstract model used for the design calculations,
- The uncertainties in the precise characteristics of the materials purchased,
- The uncertainties caused by variations in processing and fabrication of materials and
- The uncertainties about the nature of stresses the finished product will encounter.

Indeed, Engineer‘s success lies in the ability to accomplish tasks with only a partial knowledge of scientific laws about nature and society.

The final outcome of engineering projects, like those of experiments, is generally uncertain. Very often, possible outcomes are not even known and great risks may be presented which could never be thought of.

The following uncertainties occur in the model designs

- Model used for the design calculations.
- Exact characteristics of the material purchased.
- Constancies of materials used for processing and fabrication.
- About the nature of the pressure the finished product will encounter.
- Good and effective engineering depend upon the knowledge possessed about the products at the initial and end stages.

Effective Engineering relies upon knowledge gained about products both before and after they leave the factory- knowledge needed for improving current products and creating better ones. That is, ongoing success in engineering depends upon gaining new knowledge.

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3. What does the Balanced Outlook on Law stress in directing engineering practice? **

The _balanced outlook on law‘ in engineering practice stresses the necessity of laws and regulations and also their limitations in directing and controlling the engineering practice. Laws are necessary because, people are not fully responsible by themselves and because of the competitive nature of the free enterprise, which does not encourage moral initiatives. Laws are needed to provide a minimum level of compliance. The following codes are typical examples of how they were enforced in the past.

Code for Builders by Hammurabi Hummurabi the king of Babylon in 1758 framed the following code for the builders:—If a builder has built a house for a man and has not made his work sound and the house which he has built has fallen down and caused the death of the householder, that builder shall be put to death. If it causes the death of the householder‘s son, they shall put that builder‘s son to death. If it causes the death of the householder‘s slave, he shall give slave for slave to the householder. If it destroys property, he shall replace anything it has destroyed; and because he has not made the house sound which he has built and it has fallen down, he shall rebuild the house which has fallen down from his own property .If a builder has built a house for a man and does not make his work perfect and the wall bulges, that builder shall put that wall in sound condition at his own cost‖ This code was expected to put in self-regulation seriously in those years.

Whenever there is crisis we claim that there ought to be law to control this.

Whenever there is a fire accident in a factory or fire cracker‘s store house or boat capsize we make this claim, and soon forget. Laws are meant to be interpreted for minimal compliance.

On the other hand, laws when amended or updated continuously would be counter productive. Laws will always lag behind the technological development. The regulatory or inspection agencies such as Environmental authority of India can play a major role by framing rules and enforcing compliance. In the early 19th century, a law was passed in USA to provide for inspection of the safety of boilers and engines in ships. It was amended many times and now the standards formulated by the American Society of Mechanical Engineers are followed.

Industrial Standards

Standards make the interchange of components. and serves as readymade substitute for lengthy design. Specification are also reducing the production costs. when the standards have been followed carefully ,the quality will be attained in a very easy way. Examples of standards may range from automobiles tire sizes and load rating to computer languages.

Type of standards:

1.Quality –

Moderate value

Eg: types and grains in wood working life of the product

Quality related to service

Capability in achieving the target

Eg: Accreditation procedures for institution.

Safety

To safeguard from injury and thereby to reduce income loss and property damage

Eg: Methods of handling waste disposal,

Acceptance in procedures for usage

Flexibility communications and reliable design

Eg:Procedures for testing and designing the symbols

Physical properties and functions

Interchangeability and conventional handling procedure measurement accuracy

Eg: Standards in length, time and weights.

Standards are created by the companies for their internal use and by the professional associations for industry in wide use. They can also be prepared as part of laws and official regulations.

Standards help both the manufactures and the client/public. They help to keep competitiveness in industry and give channels to the smaller producers to compete with the larger ones. They secure a measure of quality and generate realistic trade off decisions. In past standards were mostly descriptive. Now they move to performance standards are most essential for application.

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4. What is importance of code to ethics? Explain what is role of code of ethics?

The codes of ethics have to be adopted by engineering societies as well as by engineers. These codes exhibit the rights, duties and obligations of the members of a profession. Codes are the set of laws and standards.

A code of ethics provides a framework for ethical judgement for a professional. A code cannot be said as totally comprehensive and cover all ethical situations that an engineer has to face. It serves only as a starting point for ethical decision making.A code expresses the circumstances to ethical conduct shared by the members of a profession.It is also be noted that ethical codes donot establish the new ethical principles.They repeat only the principles and standards that are already accepted as responsible engineering practice.A code defines the roles and responsibilities of professionals.

CODES OF ETHICS - ROLES OR FUNCTIONS

- Inspiration and Guidance:
- Codes provide positive stimulus for ethical conduct and helpful guidance by using positive language.
- Codes should be brief to be effective and hence such codes offer only general guidance.
- Supplementary statements or guidelines to give specific directions are added by a number of societies or professional bodies.

Support:

- Codes give positive support to those seeking to act ethically.
- An engineer under pressure to act unethically can use one of the publicly proclaimed codes to get support for his stand on specific moral issues.
- Codes also serve as legal support for engineers.

Deterrence and discipline:

- Codes can be used as a basis for conducting investigations on unethical conduct.
- They also provide a deterrent for engineers to act immorally.
- Engineers who are punished by professional societies for proven unethical behavior by revoking the rights to practice as engineers are also subjected to public ridicule and loss of respect from colleagues and local community.
- This helps to produce ethical conduct even though this can be viewed as a negative way of motivation.

Education and mutual understanding:

The codes can be used for discussion and reflection on moral issues and thereby improve the understanding of moral responsibilities among all engineers, clients, public and good organizations.

Contributing to the profession‟s public image:

Codes present the engineering profession as an ethically committed society in the eyes of the public thus enhancing their image.

Protecting status quo:

Codes establish ethical conventions, which can help promote an agreed upon minimum level of ethical conduct.

Promoting business interests:

Codes can place unwarranted restraints of commerce on business dealings codes help to improve the business interests.

Limitations of Codes of Ethics

- Codes are restricted to general and vague wording. They cannot be straightaway applied to all situations. It is impossible to foresee the full range of moral problems that can arise in a complex profession like engg
- They cannot serve as the final moral authority for professional conduct..
- Engineering codes often have internal conflicts.
- Only a few practicing engineers are the members of Professional societies and so they cannot be compelled to abide by their codes.
- Many engineers who are the members of professional societies are not aware of the existence of codes of their societies and they never go through it.
- Codes can be reproduced in a very rapid manner.
- Codes are said to be coercive

Unit IV

1. **Explain business ethics?**

We need to study business ethics to make better decisions for ourselves, the businesses we work for and the society we live it.

Society as a Whole Benefits

- Corporate compliance with the law is insufficient alone to ensure ethical conduct b/c the laws do not encompass all expressions of ethical behavior.
- stakeholder theory vs. profit maximization theory

People Feel Better

- Studying ethical concepts and theories will help individuals define ethical conduct and learn to use a strategy or framework for making decisions.
- Studying ethical concepts and theories helps us understand ourselves and others better.

U**nethical Behavior Can Be Very Costly**

- Corporations are in positions of power that allow them to do greater damage to others when they act unethically or socially irresponsibly.
- Increased exposure to liability and the passage of onerous legislation controlling/monitoring business activity.
  - **Civil and criminal actions against wrongdoing corps. & their executives**.
  - Congress passed the Sarbanes-Oxley Act of 2002 which increased penalties for corporate wrongdoers & established rules designed to deter and prevent future wrongdoing.
  - **Purpose of Statute**: Encourage & enable corporate executives to be ethical & socially responsible.
    - Negative impact of public criticism on reputation and corps ability to earn profits.
    - Negative impact within the firm

We will examine four ethical theories:

- rights theory
- justice theory
- utilitarianism
- profit maximization

These four theories can be classified in two ways:

Teleological Ethical Theories = Focus on the consequences of a decision
Deontological Ethical Theories = Focus on the decision itself.

RIGHTS THEORY

- Encompasses a variety of ethical philosophies holding that certain human rights are fundamental and must be respected by other humans

- Focus is on each individual member of society and his/her rights
- Each of us faces a moral obligation not to harm the fundamental rights of others

Modern Rights Theories

- Propose mixed deontological theories b/c strict Kantianism‘s duties are absolute and sometimes create inappropriate results.
- Abide by a moral rule unless a more important rule conflicts with it. (In other words, don‘t compromise a person‘s right unless a greater right takes priority over it.)

Major Strength:

It protects fundamental rights unless some greater right takes precedence.

Major Criticisms:

Difficult to achieve agreement about which rights are protected. (Rights fundamental to industrialized nations may be unknown or severely restricted in developing nations. Doesn‘t consider the costs or benefits associated w/rights

Creates a sense of entitlement that may have a negative impact on motivation.

JUSTICE THEORY

- John Rawls, published A Theory of Justice, in 1971
- Argued it was right for gov‘ts to redistribute wealth in order to help the poor and disadvantaged.

Greatest Liberty Principle: Each person has an equal right to basic rights and liberties. This is limited by the Difference Principle: Social inequalities are acceptable only if they cannot be eliminated without making the worst-off class even worse off.

Focus is on outcomes. Are people getting what they deserve?

- **Strength**: Basic premise - The protection of those who are least advantaged in society.
- **Criticisms**: Doesn‘t examine the costs of producing the equality.

UTILITARIANISM

- Identified most with 19th century philosophers Jeremy Bentham and John Stuart Mill
- Requires a decision maker to maximize utility for society as a whole
- Max Utility = achieving the highest level of satisfactions over dissatisfactions
- It judges our actions based on outcomes (teleological)
- **Strength:** Easy to articulate the standard of conduct – Merely do what is best for society as a whole.
- **Criticisms:**
  - Difficulty in measuring benefit & harm to all members of society.
  - Unequal distribution of costs & benefits may lead to detrimental results for a particular class or group of people.

PROFIT MAXIMIZATION

- Maximize the business‘ long-run profits within the limits of the law
- Based on the Laisse Faire Theory of Capitalism first expressed by Adam Smith in the 18th century
- Argues total social welfare is optimized if humans are permitted to work toward their own selfish goals
- The role of gov‘ts and the law is limited solely to ensuring the workings of a free market (by NOT interfering w/economic liberty, eliminating collusion among competitors, & promoting accurate information in the marketplace.
- **Strength:** Allocation of society‘s resources to those units that are most efficient increases overall productivity and maximizes total social utility.
- **Criticisms:**
    - Doesn‘t concern itself with HOW wealth is allocated in society. Market imperfections and a person‘s station at birth interfere w/his ability to compete.
    - The ability of laws and market forces to control corporate behavior is limited

Non Sequiturs = A conclusion that does not follow from the facts or premises one sets out.

Appeals to Pity = Generate support for a proposition by focusing on a victim‘s predicament.

False Analogies = An analogy essentially argues that since something is like something else in one or more ways, it is also like it in some other respect. We should make sure that the two situations are similar enough to make the analogy valid.

Begging the Question = Taking for granted or assuming the thing you are trying to prove; circular reasoning.

Argumentum ad Populum = Argument to the people. An emotional appeal to popular beliefs, values or wants. The fallacy is that just because many or all people believe something does NOT mean it is true.

Bandwagon Fallacy = Similar to argumentum ad populum. States that we should do something merely because one or more other people or firms do it.

Argumentum ad Baculum = Argument to the club. The arguer uses threats or fear to bolster his position.

Argumentum ad Hominem = Argument against the man. This tactic attacks the speaker, NOT his reasoning.

Argument from Authority = Arguments from authority rely on the quality of an expert or person in position of authority, NOT the quality of the individuals argument. Similar is the argument to reverence or respect.

False Cause = This fallacy results from observing two events and concluding that there is a causal link between them when there is no such link. This occurs b/c we do not attempt to find all the evidence proving or disproving the causal connection.

The Gambler‟s Fallacy = Results from the mistaken belief that independent prior outcomes affect future outcomes.

Reduction and Absurdum = ―Slippery Slope‖ argument. Carries an argument to its ―logical‖ end without considering whether it is an inevitable or probable result

Appeals to Tradition = Infer that because something has been done a certain way in the past, it should be done the same way in the future.

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2. Explain various elements of Intellectual Property Rights?

The Intellectual Property Rights (IPR) will have wide range of socio economic technological and political impacts. The obligation under the Trade Related Intellectual Property Rights System (TRIPS) means all the members of World Trade Organization (WTO) are supposed to implement natural systems of minimum standards.

Rapid technology obsolescence and fierce competitions lead one to protect the innovations using the tools of IPR such as patents, trademarks, service marks, industrial design registration, copy rights and trade secrets. The legal frame work for IPR is in a stage of dynamic adjustments and changes to accommodate the challenges and new situations that result from convergence of technology. The prime importance of intellectual property in India is well established almost at all levels like statutory administrative and judicial.

The agreement established by the World Trade Organization (WTO) and agreed by Trade Related aspects of Intellectual Property System (TRIPS) was ratified by India in January 1995. This agreement has established some minimum standards for protection thereby enforcing the intellectual property rights in member countries. This sort of enforcement of agreement / law is required to promote effective and sufficient protection of intellectual property rights in order to reduce distortions and impediments for international trade. Such agreements establish the norms and conditions with regard to the following intellectual properties.

a. Patents

b. Plant Varieties

c. Undisclosed information

d. Design of Integrated Circuits

e. Industrial Design

f. Trademarks

g. Copyrights and

ii Geographical Indications.

Intellectual property (IP) is the information and original expression that derives its original value from creative ideas with a commercial value. Intellectual property permits the people to have fully independent ownership for their innovations and creativity like that for their own physical property. By providing guard for such innovations, the owner of IP can be encouraged for further innovations to the benefit of the society in general. It may not be possible to protect IP and obtain intellectual property rights unless they have been applied for and sanction obtained. Many countries having large number of local industries with innovative designs have specific laws to safeguard the innovations by some regulations with respect to copying of inventions, identifying symbols and creative slogans. As in other developing countries, India too showed for quick enforcement of intellectual property right protection laws. India has to comply being a member of WTO for such implementation of laws at least by 2005. As Biligates, the CEO of Microsoft Corporation and IPR conscious business leader, has distinguished India as a promising base for software development. India‘s IPR scene is no deterrent to foreign companies. These laws consist of distinct types of intangible properties.

Essential elements of intellectual property rights IPR is a broad term for covering

1) Patents for inventions

2) Copyrights for material

3) Trademarks for broad identity and

4) Trade secrets.

These properties are termed in general as ―Intellectual Property‖. Intellectual Property is an asset that can be bought or sold, licensed and exchanged. But ofcourse unlike other properties, intellectual property is intangible; rather it cannot be identified by its specific parameters. These properties are protected on a national basis.

Patents

This refers to innovations — new or improved product and processes which are meant for industrial applications. This is a territorial right which needs registration for a limited time. Patent is a contract between an inventor as an individual and the society as a whole. The inventor has exclusive right to prevent anybody making use of and/or selling a patented invention. Ofcourse this is only for a specific period of time till the inventor discloses the details of invention to the public. Unlike other rights, this protects effect,

but not image or expression. A well crafted patent can give monopoly rights to business in its area. A patent is expensive but the preparatory step are cheaper. The legal authority in this patent rights the World Trade Organization (WTO) agreement with respect to Trade Related Aspects of Intellectual Property Right (TRIPS), This provides the international standard for the required duration of 20 years from the date of filing the patent. Once this period is over, people are free to make use of this invention as they like. However, though the member has a right to prevent others making use of hispatented invention, the owner has no right to make use or sell the invention itself. Patents are granted under national laws. These rights are enforceable by civil laws rather than criminalproceedings.

The TRIPS agreement should provide patent for any invention, be aproductora process, provided they are entirely new, involving an inventive method and suitable for industrial applications. In other words the patent must be a novel and a useful one and capable of practical application and more specifically it must be ―non obviousness‖.

Requirement for Patents

While applying for a patent certain documents have to be submitted as essential requirements. Some of them are as follows:

1. Problem of invention

2. Current report of the problem to be addressed

3. Solution or procedure to the problem

4. Extent of novelty or inventive

5. Application or uses

6. Details of the inventor

7. Resources of funds

Types of patents

i) Utility patents

ii) Design patents

iii) Plant patents

I) Utility patents

Utility patent can be granted to anyone who invents or discovers any new and useful process, machine, manufacture or composition of matter, or any new and useful improvement thereof. Utility time is of 20 years. ―Process‖ refers to industrial and manufacturing methods. ―Manufacture‖ refers to articles manufactured. ―Composition of matter‖ relates to chemical compositions and may include mixtures of ingredients as well as new chemical compounds.

ii) Design patents

Design patent can be granted to any one who invents a new, original ornamental design for an article of manufacture. A design patent protects the ornamental design (i.e., appearance) of the article. A design patent has a term 14 years from the date of filing.

iii) Plant patents

Plant patent can be granted to any one who invents or discovers and asexually reproduces a new variety of plant. A plant patent has a term of 20 years from the date of filing

Copy rights

A copyright is a very specific and exclusive right even for reproduction of an original work This is for material, literacy, aesthetic material, music, film, sound recording, broad casting, software and multimedia. This provides automatic right for protecting any original creation, which is not in need of registration but with limited time. There is no need to seek lawyer‘s help for settlement. Protection to copy right does not give any procedure, principle, concept or method of operation, regardless of the format in which it is explained. In other words protection of copyright is limited to an inventor‘s particular expression of an idea, concepts or process in a tangible medium. Copy right is sanctioned to prevent others from:

a) copying the work

b) publishing and selling copies commercially

c) renting or lending the work in open market

d) performing or demonstrating the work in public

The TRIPS agreement provides a minimum duration of copyright protection to the tune of the life of the inventor or author plus 50 years. Anyhow rights granted exclusively to the copy right owner may permit others in making fair use of the owner‘s work, like for the purpose of review, comment, reporting, teaching, researches, etc. Of course, the impact of copying an inventor‘s work‘s commercial value is considered to know whether the copying is for ―fair use‖. To secure protection for copy right, the particular work must be an original work made or written in a tangible medium of expression. The test for such originality consists of two conditions.

First, work must originate from the inventor and not a copy from others‘ works. Next, the invention or work must have sufficient amount of creativity. Moreover the work must be fixed in a ―tangible medium of expression‖.

Trade marks

Trademark is for broad identity of specific goods and services permitting differences to be made among different trades. This is a territorial right, which needs registration, but without any time limit. Lawyer is needed for guidelines. It is better to have some sort of lack of confusion with other trade marks.

Trade marks are basically intended to indicate clearly the source of any sign or combination of signs of goods. Some times this is called as service marks to point out the source of services so as to distinguish one service from others. These marks also symbolize distinctly the quality of the goods or the services. These marks are in the form of certain wordings‘, which differentiate any one product or service from another one.

These can be in the format of logos, designs, sounds, symbols, etc. The TRIPS agreement provides the same type of protection for trademarks. Registration of these marks is issued for definite period of time. However, in order to avoid public confusion, encourage competitions and protect the inventor‘s good will, the registration may be renewed. With reference to intellectual property area, trade marks are national in origin and should comply with provision of TRIPS agreement. These marks should be distinctive or in other words, it should be capable of distinguishing the goods or services of one inventor from that of others.

The Engineer should be clear about Trademarks, legislation or other terms. Normally, a mark‘s strength is usually expressed across a spectrum. The terms that are normally used for trademarks are generic, descriptive and suggestive. These spectrums include the above said terms from the weakest end to the strongest end. Words, symbols or devices that are not so distinctly distinguishing the goods from others are at the weakest ends, as they are common terms used to identify the goods themselves. These are termed as generic terms and are not protectable as trademarks.

But the descriptive terms clearly indicate or inform the specific purpose, functions, physical characteristic and end use of the product. But comparatively the suggestive marks do not at a glance describe the goods for which the mark is used; yet they rather require some imagination or perception to arrive at a conclusion about the nature of the goods. Suggestive marks are inherently distinctive and protectable. The other type of trademarks include arbitrary marks and fanciful marks which are inherently distinctive.

Trade secrets

A trade secret means information, which is kept confidential as a secret. This is generally not known in the relevant industry, providing an advantage to its owner over other competitors For engineers, inventors, and designers, the trade secrets are to be maintained secretly. Such trade secrets include some formulae, methods, programs, processes or data collections etc. If there is any improper disclosure or use of the trade

secret by another persons, the engineer or inventor may claim and recover damages resulting from illegal use.

The trade secrets are not normally registered like other types of intellectual property. The information of the trades is simply kept confidential. The protection covers as long as the secret is kept confidential. Once the trade secret is made open to the public, its protection ends. International theft of trade secrets may constitute a crime and under both the state and federal laws.

TRIPS agreements provide the protection for trade secrets under the heading _protection of undisclosed information‘. The engineer in competitive field should feel their responsibility and status while making use of such trade secrets till its disclosure. If the information of a trade secret is available through any legitimate means and if any engineer or any different inventor is responsible illegally for such leaking, then the trade secret may become ineligible for protection.

Enforcement of Intellectual Property Rights are definitely private rights .If any one uses the material without the inventors‘ permission, the I.P right owners can use any remedies available under the civil law .It is always better to make sure that the inventor bring the existence of I.P to others‘ notice in some sort of dealings with them, so as to reduce the channels of others using the specific I.P. If any I.P rights are purposely used illegally on a commercial scale, the owner can seek legal actions under the criminal offence. But the particular circumstances need to be studied carefully to find out whether such illegal actions amount to a criminal offence (or) is it an issue that can be solved with the help of a civil law.

Need for protection to IPR

The protection of intellectual property rights is an essential element of economic policy for any nation. Only such protection can stimulate research, creativity and technological innovations by giving freedom to individual inventor and companies to gain the benefits of their creative efforts.

It is a very important issue to plan to protect the intellectual property rights. The main needs are to

a) Prevent plagiarism

b) Prevent others using it

c) Prevent using it for financial gain

d) Fulfill obligation to funding agency

e) Support income generation strategy

Importance of IPR

The intellectual property rights are granted to the inventors for their freedom for other creation. These rights are very important, as they

a) give the inventors exclusive rights of dealing

b) permit avoiding of competitors and raise entry barriers

c) permit entry to a technical market

d) generate steady income by issuing license

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3. Explain in detail about "Employee Rights".

Employee rights are any rights, moral or legal which refer to the status of being an employee. These rights include some of the professional rights such as the right to disobey the unethical instructions and the rights to express their dissatisfaction on the company policies without any bad effects from the side of the employer. It also implies all the basic human rights which are reasonable to the situation of employment such as the right of not to be discriminated against.

Employee rights also have the institutional rights which arise safely out of an employee's contracts created by organizational policies or contracts. These rights are known an ―Contractual Employee Rights‖. The rights to receive a salary of a certain amount, right to receive some company's benefits such as periodic increments in the pay and profits sharing etc, are some examples of contractual employee rights. Another form of employee's rights are called. ―Non Contractual Employee Rights.‖ These are the rights that occur even if not formally recognized in the specific contracts or company policies. These rights include right to choose outside activities, right to employer confidentiality, right to due process from employer and right to non discrimination and absence of sexual harassment at the work place. Choice of outside activities As per this right, all the employees can engage in non-work or outside activities of their own choice without any compulsion or deserved punishment from their employers. This right is also a part of the human right of employees to attain legitimate interests without any interference from the employers. But there may be some bad violations of this right as it has not been protected by any law. For example, an employer can scold heavily or threaten his employee when he tries to engage in outside activities and also an employer can slash out or fire by words his employee when he does some activities which harm the image of the company.

In order to protect the public image, an institution can put some limits on the right of the employees to engage in outside activities. They are as follows When the outside activities of employees lead to violating or detriment to the duties of their job, then the rights of employees to engage in outside activities become limited. For example,

(i) an employee has a right to smoke, but not in work place which is supposed to be a pleasant and safe work environment for other employees.

(ii) When the outside activities of employees form a conflict of interest, then employers have the right to take action against the employees. For example, stop an employee from moon lighting.

(iii) Employees have no right to damage their employer‘s interest outside the office-hours.

PRIVACY

Right to privacy of employees means the right to stop access to and use of information about oneself i.e., the employers should not interfere into the private life of the

(vi) A male engineer enjoys telling unwanted sex jokes to his secretary who is not interested to listen.

So, sexual harassment may be in the form of threats of penalties, offers of rewards, assaults and annoyance.

Sexual harassment may take place anywhere, such as work place, public place, schools, colleges etc. In a work place it involves lowering the economic status of women. It is an assault on the dignity of the victim. A duty-ethicist gives a strong disapproval of the sexual harassment. It is the duty of the co-workers to treat women in proper manner with due respect. An utilitarian argues that it spoils the happiness and self-fulfillment of the victims. employees. This right is also limited in certain cases by employer‘s rights. The following examples will show how the function of employers conflict with the right of privacy of employees.

i) Before hiring an employee for the post of cashier, the employer can ask questions about their criminal records.

ii) Before appointing a person in the sales department the employer should conduct personality test which includes knowing whether he uses drinks (alcohol) and sexual contact in an illegal manner.

iii) A supervisor can unlock and search the table of his subordinate without his permission when he had doubts about his trust - worthiness.

iv) In order to avoid theft, employer has the right to fix hidden cameras in the work place. Some of the above said examples sometimes may be misused by the employers in order to manage the company effectively. This unwanted interference of the employers is said to be morally problematic and need some kind of justifications.

For example, a company may stick tiny microphones on the identity cards of its employees without telling them, so that the employer will be able to hear what they talk and where they are. This activity upsets the employees and the employees would object to the tricks made by the employer. But at the same time, if they are fully informed about the device at the time of their appointment that the device is to be used as a condition of employment, the employees may not be in a position to object.

An utilitarian will answer that such activity would make the worker unhappy and it would lead to a general anxiety among the employees. Their conversational flow would be affected. The use of such device would ruin the trust of the employer. It would also lead to some kind of harassments.

A duty ethicist argues that this kind of activity breaks the duty to respect the people and demoralize them. The intimate relationships may be affected and also that the personal freedom of employees may be affected. So, the right to privacy is limited by the legitimate actions of employers' to obtain and use information of employees only for effective management of the company. But this information should not be given to outsiders. Then only the trust relationship between employer and employee can be maintained.

Right to due Process

It is the right to fair procedures which helps to safeguard the exercise of other rights. This right offers fair procedures in firing I slashing, demotion and taking disciplinary actions, There are two procedures in implementing the right to due process.

i) Written explanations should be given to employees who are discharged, demoted or transferred. The reasons for their punishments should be clearly informed to them in a written format.

ii) An appeal procedure should be established and should be made available to all employees who believe that their rights have been violated. This procedure should be simple and easy to use and work quickly.

Government employees and labor union members have this procedures. In case of private companies, they establish their own procedures.

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4. What are the factors which may impede the flow of information for repeated mistakes in design? Explain with case studies?

Engineers should learn not only from their own earlier design and operating results, but also from other engineers.

Engineers repeat the past mistakes of others due to the following reasons.

- Lack of established channels of communication.
- Misplaced pride in not asking for information
- Embarrassment at failure or fear of litigation.
- Negligence.

Examples:

1. The Titanic lacked sufficient number of life boats resulting in the death of 1522 out of 2227 (life boat capacity available was only 825), a few decades later Arctic perished due to the same problem.

2. In June 1966, a section of the Milford Haven Bridge in Wales collapsed during construction. A bridge of similar design, erected by the same bridgebuilder in Melbourne, Australia, also partially collapsed in the month of October, same year. During this incident 33 people were killed and many were injured.

3. Malfunctions occurred at nuclear reactors at various locations and the information reports were with Babcock and Wilcox, the reactor manufacturer. In spite of these, no attention was paid leading to a pressure relief valve giving rise to the Three Mile Island nuclear accident on March 28, 1979.

Unit V

1. What is environmental ethics? Explain its significance. Give some of the Environmental issues of concern to engineers.

Environmental ethics believes in the ethical relationship between human beings and the natural environment. Human beings are a part of the society and so are the other living beings. When we talk about the philosophical principle that guides our life, we often ignore the fact that even plants and animals are a part of our lives. They are an integral part of the environment and hence have a right to be considered a part of the human life. On these lines, it is clear that they should also be associated with our guiding principles as well as our moral and ethical values.

We are cutting down forests for making our homes. We are continuing with an excessive consumption of natural resources. Their excessive use is resulting in their depletion, risking the life of our future generations. Is this ethical? This is the issue that environmental ethics takes up. Scientists like Rachel Carson and the environmentalists who led philosophers to consider the philosophical aspect of environmental problems, pioneered in the development of environmental ethics as a branch of environmental philosophy. The Earth Day celebration of 1970 was also one of the factors, which led to the development of environmental ethics as a separate field of study. This field received impetus when it was first discussed in the academic journals in North America and Canada. Around the same time, this field also emerged in Australia and Norway. Today, environmental ethics is one of the major concerns of mankind.

When industrial processes lead to destruction of resources, is it not the industry's responsibility to restore the depleted resources? Moreover, can a restored environment make up for the originally natural one? Mining processes hamper the ecology of certain areas; they may result in the disruption of plant and animal life in those areas. Slash and burn techniques are used for clearing the land for agriculture.

Most of the human activities lead to environmental pollution. The overly increasing human population is increasing the human demand for resources like food and shelter. As the population is exceeding the carrying capacity of our planet, natural environments are being used for human inhabitation.

Thus human beings are disturbing the balance in the nature. The harm we, as human beings, are causing to the nature, is coming back to us by resulting in a polluted environment. The depletion of natural resources is endangering our future generations. The imbalance in nature that we have caused is going to disrupt our life as well. But environmental ethics brings about the fact that all the life forms on Earth have a right to live. By destroying the nature, we are depriving these life forms of their right to live. We are going against the true ethical and moral values by disturbing the balance in nature. We are being unethical in treating the plant and animal life forms, which coexist in society. Human beings have certain duties towards their fellow beings. On similar lines, we have a set of duties towards our environment. Environmental ethics says that we should base our behavior on a set of ethical values that guide our approach towards the other living beings in nature.

Environmental ethics is about including the rights of non-human animals in our ethical and moral values. Even if the human race is considered the primary concern of society, animals and plants are in no way less important. They have a right to get their fair share of existence. We, the human beings, along with the other forms of life make up our society. We all are a part of the food chain and thus closely associated with each other. We, together form our environment. The conservation of natural resources is not only the need of the day but also our prime duty.

ISSUES

1) Releasing harmful substance into water and air
2) ii) Using toxic substance in food processing
3) iii) Disturbing land and water balances

Disasters Affecting Environment Though numerous accidents and disasters have taken place in the world, some of them and their related tragedies are still in the mind of the people. To quote some case studies, Bhopal gas tragedy, Chernobyl nuclear plant explosion, Artificial rains, Meuse valley disaster at Belgium, Oleum gas leak in Delhi, HPCL disaster in Vizag, Donova (USA) steel and chemical plant disaster, Tehri Dam in U.P. State, etc.

ACID RAIN Industries and thermal power plants release innumerable quantities of nitrogen oxide and sulphur every day. These gases react with the atmospheric moisture thereby forming nitrates, sulfates, nitric acid and sulfuric acid droplets. These compounds emitting at a particular place may be transmitted even hundred kilometers downstream and may be deposited on ground and vegetation lands, directly as _Acid rains‘.

Everybody knows1 that rain is the purest water, but Acid rain‘ refers to any precipitated or suspended particles, snow, dew etc., which are acidic. As mentioned Acid rain is mostly due to emission of SOx to an extent of 70% and due to NOx emission to an extent of 30%. Acid rain is dangerous to men, materials, and vegetation. This may entirely disturb the ecologça1 balances globally. The environmental world wide usage of fossil fuel by different industrial nations buildup a screen of carbon-di-oxide in the atmosphere, resulting in a greenhouse effect very seriously damaging the entire earth. Similarly the other notable causes of acid rain are mainly due to the release of freon from technological products damaging the protective ozone layer of the earth‘s atmosphere.

Effects of Acid Rain

1) Bacterias that are essential for life systems to be active are killed.
2) High acidity results in reduced growth and killing of fishes.
3) Accumulation of organic matter in lake and streams increases the degree of water pollution.
4) Concentration of heavy particles like copper, zinc, lead, and manganese are increased in water.
5) Germination of seeds is affected affecting the growth of trees.
6) Vanishing of greenery and destruction of forests:
7) Affecting of the soil by decreasing its fertility: beneficial microorganisms are reduced.
8) Stone cancer‘ or _Stone leprosy‘ are due to acid rain.. Other similar pollutions are due to Asbestos in air and drinking water, and release of mercury, cadmium and PCB (in Japan).

ETHICAL PROBLEMS AND ITS ISSUES

In our country, increase of population and decrease of natural resources like air, lands, forests, lakes and oceans have very serious environmental ill effects. Apart from voluntary conservation efforts, a shared effort to exercise democratic and international controls is most essential. Democratic controls include establishing rules and norms, stringent legislation, control equipment, and assessment of the technology applied in the approved projects. Often the questions that arise in this sort of ethical issues are: - Who is affecting? Who are affected? Does the environment get disturbed‘? When does the disturbance take place? And how does it happen? Engineers are supposed to have full confidence in their respective projects. They would have to be very careful to foresee the entire environmental effects of their project or work in advance. They have to plan themselves how to control those consequences without further or frequent redesigns, with an idea of considering engineering as experimentation. They must have forethought and budget of fund release for the _safe exits‘ and subsequent corrective measures as the case may be. But there is a risk in having faith and belief that no further action is required once the project reports have been approved. Engineer‘s contention must remain still that engineering should be understood as social experimentation and still the experiment must be continued.

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2. Explain the issues related to computer ethics and internet with your personal experience

No matter which re-definition of computer ethics one chooses, the best way to understand the nature of the field is through some representative examples of the issues and problems that have attracted research and scholarship. Consider, for example, the following topics:

1. Computers in the Workplace
2. Computer Crime
3. Privacy and Anonymity
4. Intellectual Property
5. Professional Responsibility
6. Globalization

1. Computer in the Workplace

As a ―universal tool‖ that can, in principle, perform almost any task, computers obviously pose a threat to jobs. At the same time, computers are often far more efficient than humans in performing many tasks. Therefore, economic incentives to replace humans with computerized devices are very high. Indeed, in the industrialized world many workers already have been replaced by computerized devices.

The employment outlook, however, is not all bad. Consider, for example, the fact that the computer industry already has generated a wide variety of new jobs: hardware engineers, software engineers, systems analysts, webmasters, information technology teachers, computer sales clerks, and so on. Thus it appears that, in the short run, computer-generated unemployment will be an important social problem; but in the long run, information technology will create many more jobs than it eliminates.

Another workplace issue concerns health and safety When information technology is introduced into a workplace, it is important to consider likely impacts upon health and job satisfaction of workers who will use it.

2. Computer Crime

In this era of computer _viruses" and international spying by ―hackers‖ who are thousands of miles away, it is clear that computer security is a topic of concern in the field of Computer Ethics. The problem is not so much the physical security of the hardware, but rather ―logical security‖, which can be divided into five aspects:

1. Privacy and confidentiality.

2. Integrity- assuring that data and programs are not modified without proper authority.

3. Unimpaired service.

4. Consistency- ensuring that the data and behavior will be the same ever.

5. Controlling access to resources.

Computer crimes, such as embezzlement or planting of logic bombs, are normally committed by trusted personnel who have permission to use the computer system. Computer security, therefore, must also be concerned with the actions of trusted computer users.

Another major risk to computer security is the so-called ―hacker‖ who breaks into someone's computer system without permission. Some hackers intentionally steal data or commit vandalism, while others merely ―explore‖ the system to see how it works and what files it contains. Even if the hacker did not make any changes, the computer's owner must run through a costly and time-consuming investigation of the compromised system

3. Privacy and Anonymity

In the early 1 970s, major computer privacy laws were passed in the USA. Ever since then, computer-threatened privacy has remained as a topic of public concern. The ease and efficiency with which computers and computer networks can be used to gather, store, search, compare, retrieve and share personal information make computer technology especially threatening to anyone who wishes to keep various kinds of ―sensitive‖ information out of the public domain or out of the hands of those who are perceived as

potential threats. It is more difficult to protect privacy in computer, as large amount of data on individuals and companies are stored centrally. Moreover many numbers of other individuals can easily access them. Privacy is meant as the basic right of an individual to control access to the information about himself. This is an ethical issue. Invasion of privacy is harmful for the following ethical reasons.

1. Leakage of personal information can lead to mental harassment or blackmailing

2. Personal information is considered as a personal property. Any unauthorized use of such information is a theft.

Questions of anonymity on the internet are sometimes discussed in the same context with questions of privacy and the internet, because anonymity can provide many of the same benefits as privacy. For example, if someone is using the internet to obtain medical or psychological counseling, or to discuss sensitive topics (for example, AIDS, abortion, gay rights, venereal disease, political dissent.), anonymity can afford protection similar to that of privacy. Similarly, both anonymity and privacy on the internet can be helpful in preserving human values such as security, mental health, self fulfillment and peace of mind.

Unfortunately, privacy and anonymity also can be exploited to facilitate unwanted and undesirable computer-aided activities in cyberspace, such as money laundering, drug trading,terrorism, or preying upon the vulnerable.

4. Intellectual Property

One of the more controversial areas of computer ethics concerns the intellectual property rights connected with software ownership. Some people believe that software ownership should not be allowed at all. They claim that all information should be free, and all programs should be available for copying, studying and modifying by anyone who wishes to do so. Some would argue that software companies or programmers would not invest weeks and months of work and significant funds in the development of software if they could not get the investment back in the form of license fees or sales.

A very controversial issue today is a patent on a computer algorithm. A patent provides an exclusive monopoly on the use of the patented item, so the owner of an algorithm can deny others use of the mathematical formulas that are part of the algorithm. Mathematicians and scientists are outraged, claiming that algorithm patents effectively remove parts of mathematics from the public domain, and thereby threaten to cripple science.

5. Professional Responsibility

Computer professionals find themselves in a variety of professional relationship with other people, as

employer — employee

client — professional

professional — professional

society — professional

These relationships involve a diversity of interests, and sometimes these interests can come into conflict with each other. Responsible computer professionals, therefore, will be aware of possible conflicts of interest and try to avoid them. In order to take proper decision on the computer related ethical issues, many of the companies and organizations have established computer codes of ethics for proper use of computer. Professional organizations in the USA, like the Association for Computing Machinery (ACM) and the Institute of Electrical and Electronics Engineering (IEEE), have established codes of ethics, curriculum guidelines and accreditation requirements to help computer professionals understand and manage ethical responsibilities.

6. Globalization

Global Laws- Computer ethics today is rapidly evolving into a broader and even more important field, which might reasonably be called ―global information ethics‖. If any one wish to protect their freedom of speech on the internet, there are no special laws available to guard them. Nearly two hundred countries are interlinked by the internet. Though there may be a specific law in United States Constitution, it is just a _local law' on the internet. It does not apply to the rest of the world. While so many countries are involved, issues like freedom of speech, protection of intellectual property rights, invasions of privacy and many others are to be governed by some laws.

Global Cyber business

The world is very close to having technology that can provide electronic privacy and security on the internet sufficient to safely conduct international business transactions. Once this technology is in place, there will be a rapid expansion of global ―cyber business‖ Accepted business practices in one part of the world be perceived as ―cheating: or ―fraud‖ in other parts of the world.

Global Education

If inexpensive access to the global information net is provided to rich and poor alike, to poverty stricken people in ghettos, to poor nations in the ―third world‖, etc. for the first time in history, nearly everyone on earth will have access to daily news from a free press; to texts, documents and art works from great libraries and museums of the world

PROFESSIONAL ISSUES

The use of computers creates some professional issues. Sometimes, it will make the job more complex and involve high degree of technical proficiency.

i) Computer Failures

Failure of computers can occur due to the errors in hardware and software. Hardware errors will not occur frequently and they can be solved easily. But software errors are very serious as they destroy the entire network.

ii) Computer Implementation

While creating a new computer system, the old system should not be avoided. The old system should still be in operation

iii) Health conditions

While supervising computer personnel and designing computer terminals, the engineers should check that whether there are enough facilities made available to reduce the back problems, to provide wrist support and proper keyboard layout and to offer proper lighting and flicker control.

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3. Explain the role of engineers as Managers and how they are used as Expert Witness.

Sometimes, engineers work as consultants to give expert supporting evidence in appropriate circumstances. The concentration of engineers may be on the past, such as explaining the causes of accidents, malfunctions and other activities and functions which involve technology. They also focus on the future such as public planning, policy making, that involve technology. In general, engineers are often hired by one of the opponent parties of a dispute. This creates special ethical issues about the functions of the engineers. It is important to analyze how the engineers act as expert witnesses and advisers.

ENGINEERS ACT AS EXPERT WITNESS IN THE COURTS

In the judicial system, engineers can be hired, by either the plaintiff or by the defence to witness both the civil and the criminal proceedings. Some engineers occasionally, act as expert witness and some others may do such act as a routine work and they become specialists in forensic engineering. Forensic engineering means the application of engineering skills and knowledge within the judicial system. They may act as witnesses in the cases such as defective products, personal injury, damage to properties, traffic accidents and even air crashes. Their witnessing has been considered by the Justices while giving judgment as to who has to be pald compensatory damages for injuries, loss of property or violation of rights. Their witnessing has also been considered in case of ―exemplary damages. i.e., violation of rights by involving fraud, malice or other wrong doings.

Engineers are hired by lawyers to serve the interest of their clients. Engineers when hired, have obligations to focus their qualifications accurately when called by the court. They also have a responsibility of confidentiality. Their basic and primary responsibility is to be objective in finding the truth and telling it honestly. The proper role of engineers as expert witnesses, depending on the shared understanding, creates, moral responsibility within society. Their role must be understood in terms of the morally justified aims of a legal system with regard to the professional standards as per the codes of ethics.

The main objective of a legal system is to find out the truth about events perceived by the disputing parties. So, the primary purpose of the court system is to manage a difficult system of legal rights that explains legal justice. For promoting legal justice, the court system depends on the expert witnesses. For this work, the expert witnesses should be paid by the courts.

ABUSES OF ENGINEERS AS EXPERT WITNESSES

a) Hired Guns

When engineers are hired by lawyers to help them to exhibit the facts in a favorable way to their clients, they are called hired guns. As the hired guns, engineers break the standards of honesty and also violate paying due care while conducting investigations.

For example, a mason falls down while climbing on a wooden ladder and is injured very seriously. The mason files a case against the producer of the ladder for claims. In the court, the witnesses gave some conflicting testimony. Some said that the accident happened due to a crack in the ladder, while other argued that the mason climbed very carelessly and this caused the ladder to crack. The manufacturer of the ladder hired a structural engineer and he wrote a report in favour of the manufacturer.

In the above case, the engineer‘s act is improper. As per moral considerations, he has to give the facts and correct report. But as a hired gun, he is forced to give a false report. It is one kind of abuse of the qualification of the engineer

b) Financial Prejudices or Financial Influences

When engineers are paid by one adversarial party, it will create some bias in finding out the truth. This type of bias influences the engineer‘s investigations, supporting evidences and presentation of their qualification. When the engineers are hired on the basis of contingency-fee arrangement, the influence will increase strongly. In most of the cases, lawyers also pay contingency fee to serve their clients better. But in adversarial circumstances, contingency-fee-arrangement leads to bias judgment of expert witnesses. Money influences in more ingenious ways. In case of forensic engineers, who make their living only from serving as expert witnesses they will always support the lawyers who have hired them.

c) Ego Biases

Many of the adversarial circumstances establish some competitive attitudes among the engineers who act as expert witnesses. This ego problem will greatly influence the judgment given by the expert witnesses. When

ego exists among engineers who act as expert witnesses, they always have the opinion that their side is innocent and the opponent side is guilty.

d) Sympathy Biases

In all the courts, people‘s sufferings evokes a sadness. It is very easy to identify‘ the difficult situations of victims. Really, an engineer who acts as an expert witness may feel great sympathy for the opposite side when he understands the truth. This bias can disturb the disinterested investigations of the facts. To overcome these influences, the engineers, when serving as expert witnesses, must take a special effort to maintain their integrity. The court must also depend on a balanced view of both sides, by examining the expert witnesses of opposing lawyers regarding possible biases.

ENGINEERS AS EXPERT ADVISERS IN PLANNING AND POLICY MAKING

Economists, sociologists, and other professionals play an important role in public policy-making and planning. Like them, engineers also play a very good role in planning and policy-making. In case of decisions regarding public policy-making and public planning involvement of technology is great.

While forming general strategies for society (policy-making), the public officials and the general public need some type of objective studies about the cost and benefits of alternative methods and systems of housing, transportation, energy use, land use and national defence. Likewise, in case of forming projects (planning), they require expert advice about the feasibility, risks and benefits of the projects.

In order to do the above properly, large amount of money is paid to consulting engineers for their favorable judgment about options. The results presented to the public are usually value-laden i.e., influenced by value assumptions based on political controversies. Engineers have to consider the values of honesty, public trust and respect for the common good.

As expert advisers, engineers have to give suggestions based on assumptions. So, clients always force the engineers to limit studies to the assumptions favorable to them. If the studies are of objective nature, they involve high cost in forecasting alternative assumptions. But the clients are not willing to pay for such studies. They only pressurize the engineers to use specific assumptions which are favorable to them. When engineers are frank in their reports about the restrictions created by these assumptions, their reports will be impartial only within limits. In this way, technical complicity leads to moral complicity. In case of policy-making, policy forecasts are made by consulting corporations who use engineers as advisers. These engineers have to frame the policy only on the opinion of the public.

NORMATIVE MODELS OF ADVISERS

Engineers who serve as planning advisers and policy analysts, have the responsibilities to their clients and also to the general public. These responsibilities are always of conflicting nature. To avoid these conflicts the following normative models can be used.

a) Hired Guns

As per this model, the obligations of the clients are to be given primary importance. The studies made by the engineers must conform only to the desires of the clients. Assumptions on the uncertainties must be presented in the direction favorable to the case of the client.

b) Value-Neutral Analysts

As per this model, engineers have to be fully impartial with regard to their findings. They have to avoid bias and favouritism and also any form of recommendations. Their past has to be identified in all the options and analyzed carefully.

c) Value-Guided Advocates

As per this model, engineering consultants have to adopt strong supporting viewsin controversial problems. But at the same time, they must remain honest and independent in their professional judgments. They have to understand that the values are blended with facts. They must give primary importance only to the views of the general public. The last model is the most appropriate one for thinking about policy analysis. Policy analysts and the engineers have a trust-based relationship with their clients and also have some responsibilities to the public. Both the clients and the public need help and guidance from the engineers in order to fulfill their needs. These recommendations should be expressed as the best judgment of the expert advisers.

To conclude, as expert advisers in public planning and policy making, engineers should have the following characteristics:

a) Honesty

Honesty is necessary to avoid deceiving and to be frank in giving all the relevant facts. It is also necessary to be truthful in interpreting the facts. Honesty in technical data is essential to be honest in engineer‘s role and for the values guiding his studies.

b) Competence

It means being well trained and having proper experience in the relevant field and also having the required additional skills for planning and policy making.

c) Diligence

It means carrying out the given job carefully and in a prompt way.

d) Loyalty

It refers to serving the interest of the clients. It includes avoiding conflicts of interest, maintaining confidentiality and expressing concern for the interests of the clients.

Case Study

Chernobyl Case Study

This disaster happened in the nuclear power plant complex at Chemobyl near Kiev (Ukrain) in April, 1986. This disaster happened during the construction of units 5 & 6. The reactors were called RBMK. The RBMK reactors were graphite-moderated and use boiling — water pressure tubes. The engineers were on a test on reactor 4 to decide how long the mechanical inertia of the turbine — generators rotating mass could keep the generator turning and producing electric power after the shut off of the steam supply. This test was arranged to be conducted during a scheduled plant shut down for general maintenance purposes.

To produce 1200 Megawatts output the RBMK reactor requires 3600 megawatts of thermal power. To conduct the test, the unit had been reduced its out put up to 700 Megawatts. But due to an unexpected demand, the power dispatch controller of Kiev (Ukrain) requested the officials of plant 4 to maintain the high output. This necessitates the postponement of the rest. But for conducting the test, the reactor operators had already disconnected the emergency core-cooling system. This was the first mistake done; more over another mistake was that a control device was not properly reprogrammed to maintain power at 700 to 1000 megawatts level. After the demand was over, the plant 4 was authorized to reduce the power and its output falls to 30 mega watts, where as it was very difficult to control the reactor. instead of shutting down the reactor, the operators tried to conduct the test. So they raised all the control rods to increase the power.

The power output was only 200 Mega Watts. This was very low as far as the test was concerned. Yet the test was continued. Circulating pumps had to be started. Under normal levels of power output it would be helpful to the safety of the reactor. But at an output of 200 Megawatts, it required many manual adjustments to maintain the balance between steam and water, The operators stopped all the emergency signals and automatic shutdown controls.

This made the reactor in an unsafe position. It allowed the reactor to run freely. With this dangerous condition of the reactor, the engineers started the test. They closed the steam valves and removed the steam load in an effective manner. The temperature of the reactor increased. In the RBMK reactor water was used only as a medium for transferring the heat. Due to the increase in the temperature of the reactor, it became hotter and the fission rate was increased. This made the increase of the power of the reactor

The effect of the power was equivalent to half ton of TNT inside the reactor core. Due to the malfunctioning, the fuel power in the core did not have time to get melted and it spread inside the reactor core as broken pieces. The fuel deprived of its protection cover sjie1d mixed with the water. Within a second, a large explosion occurred. The explosion of the nuclear power heavily damaged the concrete floor of the building and separated the reactor from the refueling area. Because of the formation of hydrogen gas, the reactor caught fire. This caused the graphite to glow and the fuel cast out over the compound of the plant and also the radioactive waves began to spread out in air.But the surrounding people did not know about this. They came to know only after some hours later. Due to this acute radiation many of the workers in the

Chernobyl complex died immediately. Due to this disaster the toll of death was estimated approximately as 8000. This radioactive power leakage affected even Europe. Even after seven years of the accident, the pilots happened to realize about this power still in the air. The agricultural products were affected due to contamination of radioactive water. After the disaster, the reactor was put into a concrete base but it was not an air tight box, so the radioactive dust could easily escape. So, some tunnels were dug under the reactor and cooling pipes were installed which were carrying liquid nitrogen. This disaster caused the death of many lives and also affected the agricultural products for many years. This accident was also due to improper training and carelessness of the personnel.

Challenger Case Study

The orbiter of the Challenger had three main engines fuelled by liquid hydrogen. The fuel was carried in an external fuel tank which was jettisoned when empty. During lift-off, the main engines fire for about nine minutes, although initially the thrust was provided by the two booster rockets. These booster rockets are of the solid fuel type, each burning a million pound load of aluminum, potassium chloride, and iron oxide The casing of each booster rocket is about 150 feet long and 12 feet in diameter. This consists of cylindrical segments that are assembled at the launch site. There are four-field joints and they use seals consisting of pairs of O-rings made of vulcanized rubber. The O-rings work with a putty barrier made of zinc chromate. The engineers were employed with Rockwell International (manufacturers for the orbiter and main rocket),Morton-Thiokol(maker of booster rockets), and they worked for NASA. After many postponements, the launch of Challenger was set for morning of Jan 28, 1986.Allan J. McDonald Was an engineer from MortonThiokol and the director of the Solid Rocket Booster Project. He was skeptic about the freezing temperature conditions forecast for that morning, which was lower than the previous launch conditions. A teleconference between NASA engineers and MT engineers was arranged byAllan. Arnold Thompsonand Roger Boisjoly, the seal experts at MT explained to the other engineers how the booster rocket walls would bulge upon launch and combustion gases can blow past the O-rings of the field joints

On many of the previous flights the rings have been found to have charred and eroded. In freezing temperature, the rings and the putty packing are less pliable. From the past data gathered, at temperature less than 65°F the O-rings failure was certain. But these data were not deliberated at that conference as the launch time was fast approaching. The engineering managers Bob Lundand Joe Kilminster agreed that there was a safety problem. Boisjoly testified and recommended that no launch should be attempted with temperature less than53°F. These managers were annoyed to postpone the launch yet again. The top management of MT wasplanning for the renewal of contract with NASA, for making booster rocket. The managers told BobLund ―to take-off the engineering hat and put on your management hat‖. The judgment of the engineers was not given weightage. The inability of these engineers to substantiate that the launch would be unsafe was taken by NASA as an approval by Rockwell to launch. At 11.38 a.m. the rockets along with Challenger rose up the sky. The cameras recorded smoke coming out of one of the filed joints on the right booster rocket. Soon there was a flame that hit the external fuel tank. At 76 seconds into the flight, the Challenger at a height of 10 miles was totally engulfed in a fireball. The crew cabin fell into the ocean

killing all the seven aboard. Some of the factual issues, conceptual issues and moral/normative issues in the space shuttle challenger incident, are highlighted hereunder for further study

Bhopal Disaster

The pre-event phase

The UCIL factory was built in 1969 to produce the pesticide Sevin (UCC's brand name for carbaryl) using methyl isocyanate (MIC) as an intermediate. A MIC production plant was added in 1979.After the Bhopal plant was built, other manufacturers including Bayer produced carbaryl without MIC, though at a greater manufacturing cost. However, Bayer also uses the UCC process at the chemical plant once owned by UCC at Institute, West Virginia, USA

The chemical process employed in the Bhopal plant had methylamine reacting with phosgene to form MIC, which was then reacted with 1-naphthol to form the final product, carbaryl. This "route" differed from the MIC-free routes used elsewhere, in which the same raw materials were combined in a different manufacturing order, with phosgene first reacting with naphthol to form a chloroformate ester, which was then reacted with methylamine. In the early 1980s, the demand for pesticides had fallen, but production continued, leading to buildup of stores of unused MIC.

Earlier leaks

In 1976, two trade unions complained of pollution within the plant. In 1981, a worker was splashed with phosgene. In a panic, he removed his mask, inhaling a large amount of phosgene gas which resulted in his death 72 hours later. UCC was warned by American experts who visited the plant after 1981 of the potential of a "runaway reaction" in the MIC storage tank. Local Indian authorities had warned the company of the problem as early as 1979, but constructive actions were not undertaken by UCIC at that time. In January 1982, a phosgene leak exposed 24 workers, all of whom were admitted to a hospital. None of the workers had been ordered to wear protective masks. One month later, in February 1982, a MIC leak affected 18 workers.In August 1982, a chemical engineer came into contact with liquid MIC, resulting in burns over 30 percent of his body. Later that same year, in October 1982, there was another MIC leak. In attempting to stop the leak, the MIC supervisor suffered intensive chemical burns and two other workers were severely exposed to the gases.

During 1983 and 1984, there were leaks of MIC, chlorine, monomethylamine, phosgene, and carbon tetrachloride, sometimes in combination.

Contributing factors

Factors leading to the magnitude of the gas leak mainly included problems such as; storing MIC in large tanks and filling beyond recommended levels, poor maintenance after the plant ceased MIC production at the end of 1984,

failure of several safety systems due to poor maintenance, and safety systems being switched off to save money— including the MIC tank refrigeration system which could have mitigated the disaster severity. The situation was worsened by the mushrooming of slums in the vicinity of the plant, non-existent catastrophe plans, and shortcomings in health care and socio-economic rehabilitation.

Other factors identified by the inquiry included: use of a more dangerous pesticide manufacturing method, largescale MIC storage, plant location close to a densely populated area, undersized safety devices, and the dependence on manual operations.Plant management deficiencies were also identified – lack of skilled operators, reduction of safety management, insufficient maintenance, and inadequate emergency action plans.

Work conditions

Attempts to reduce expenses affected the factory's employees and their conditions. Kurzman argues that "cuts...meant less stringent quality control and thus looser safety rules. A pipe leaked? Don't replace it, employees said they were told ... MIC workers needed more training? They could do with less. Promotions were halted, seriously affecting employee morale and driving some of the most skilled ... elsewhere".Workers were forced to use English manuals, even though only a few had a grasp of the language.

By 1984, only six of the original twelve operators were still working with MIC and the number of supervisory personnel was also halved. No maintenance supervisor was placed on the night shift and instrument readings were taken every two hours, rather than the previous and required one-hour readings.Workers made complaints about the cuts through their union but were ignored. One employee was fired after going on a 15-day hunger strike. 70% of the plant's employees were fined before the disaster for refusing to deviate from the proper safety regulations under pressure from the management.

In addition, some observers, such as those writing in the Trade Environmental Database (TED) Case Studies as part of the Mandala Project from American University, have pointed to "serious communication problems and management gaps between Union Carbide and its Indian operation", characterised by "the parent companies [sic] hands-off approach to its overseas operation" and "cross-cultural barriers".

Equipment and safety regulations

The MIC tank alarms had not been working for four years and there was only one manual back-up system, compared to a four-stage system used in the United States. The flare tower and several vent gas crubbers had been out of service for five months before the disaster. Only one gas scrubber was operating: it could not treat such a large amount of MIC with sodium hydroxide (caustic soda), which would have brought the concentration down to a safe level. The flare tower could only handle a quarter of the gas that leaked in 1984, and moreover it was out of order at the time of the incident. To reduce energy costs, the refrigeration system was idle. The MIC was kept at 20 degrees Celsius, not the 4.5 degrees advised by the manual.

Even the steam boiler, intended to clean the pipes, was inoperational for unknown reasons. Slip-blind plates that would have prevented water from pipes being cleaned from leaking into the MIC tanks, had the valves been faulty, were not installed and their installation had been omitted from the cleaning checklist.The

water pressure was too weak to spray the escaping gases from the stack. They could not spray high enough to reduce the concentration of escaping gas. In addition to it, carbon steel valves were used at the factory, even though they were known to corrode when exposed to acid. According to the operators, the MIC tank pressure gauge had been malfunctioning for roughly a week. Other tanks were used, rather than repairing the gauge. The build-up in temperature and pressure is believed to have affected the magnitude of the gas release.UCC admitted in their own investigation report that most of the safety systems were not functioning on the night of 3 December 1984. The design of the MIC plant, following government guidelines, was "Indianized" by UCIL engineers to maximise the use of indigenous materials and products. Mumbai-based Humphreys and Glasgow Consultants Pvt. Ltd., were the main consultants, Larsen & Toubro fabricated the MIC storage tanks, and Taylor of India Ltd. provided the instrumentation. In 1998, during civil action suits in India, it emerged that the plant was not prepared for problems. No action plans had been established to cope with incidents of this magnitude. This included not informing local authorities of the quantities or dangers of chemicals used and manufactured at Bhopal.