ST. ANNE'S COLLEGE OF ENGINEERING AND TECHNOLOGY

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ANGUCHETTYPALAYAM, PANRUTI – 607 106.

Subject Name	**: PROFESSIONAL ETHICS IN ENGINEERING**
Subject code	**: GE 8076**
Regulation	**: 2017**
Year/Semester	**: IV/VIII**

UNIT - I
HUMAN VALUES
Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation –Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

Morals, values and Ethics:

1. **Explain in detail about**

   (i)   Work ethics

   (ii) Honesty.   (April/May 2008 & Nov/ Dec 2016) Write short notes on Honesty.(Nov/Dec 2021)

   (iii) What is meant by work ethics? List and explain elements of work ethics? Nov 2023

(i) Work Ethics:

- ✓ Work ethic is a characteristic attitude of a group of persons or workers towards morality of work.
- ✓ It is being personally accountable and responsible for the work that one does.
- ✓ It is based on a belief that work has a great value.
- ✓ Work ethics is usually associated with people who work hard and do a good job.
- ✓ Workers, working in a team, are not supposed to cause harm to others. Any worker cannot escape accountability
- ✓ Worker has the moral responsibility to see that no other person's right, private or freedom is impaired or transgressed

Elements of work ethics:

- ✓ Many characteristics of work ethic can be summarized using the following three elements:
  - ❖ Interpersonal skills

✦ Initiative

✦ Being dependable

Interpersonal skills:

- ✓ Interpersonal skills include habits, attitudes, manners, appearance, and behavior's we use around other people, which affect how we get along with other people.
- ✓ The development of interpersonal skills begins early in life and is influenced by family, friends, and our observations of the world around us.
- ✓ Most of these characteristics are passed along to us by our parents or guardians.
- ✓ Some aspects of interpersonal skills are even inherited. Appearance and some personality traits are largely influenced by our genes.
- ✓ To improve our interpersonal skills we must first be aware of what we are like from the perspective of other people who interact with us.

Initiative:

- ✓ Initiative is a very important characteristic for information age workers.
- ✓ Direct supervision is often not a feature of the modern workplace.
- ✓ Without initiative, procrastination and missed opportunities can become a real problem.
- ✓ Sometimes poor performance results and leads to loss of a job, without any second chances.

Being dependable:

- ✓ Being dependable is one of the most highly sought after traits for workers in the modern workplace?
- ✓ This includes honesty, reliability, and being on time.
- ✓ People who are not dependable often are very expensive to keep around because of the wasted time and resources their behavior causes.
- ✓ In some cases, even peoples' lives can be lost if another person is not dependable.

(ii) Honesty:

- ✓ Honesty means expressing one's true feelings.
- ✓ To be able to be emotionally honest we must first be emotionally aware.
- ✓ This emotional awareness is related to our emotional intelligence.
- ✓ It is our emotional intelligence may also give us the ability to decide when it is in our best interest to be emotionally honest by sharing our true feelings.
- ✓ Any human being should imbibe honesty -honesty in acts, honesty in speech and honesty in beliefs.

✓ Honesty is the fundamental virtue in human relationship even though it may be difficult to follow some times.

Two aspects of Honesty:

✓ Truthfulness – meeting responsibilities concerning truth -telling.

✓ Trustworthiness – Meeting responsibilities concerning trust.

Honesty is mirrored in many ways. The common reflections are:

✓ Belief's (intellectual honesty)

✓ Communication (writing and speech)

✓ Decisions (ideas, discretion).

✓ Actions (means, timing, place, and the goals).

✓ Intended and unintended results achieved.

Results of dishonesty:

✓ Dishonesty requires more energy than emotional honesty.

✓ When we are emotionally dishonest we lose out on the value of our natural feelings.

✓ When we are emotionally dishonest we are being false, unreal and in opposition to reality.

✓ It takes energy to oppose reality, nature and evolution.

✓ Emotional dishonesty, in authenticity and falseness create distrust and tension in society.

Some of the actions of an engineer that leads to dishonesty are:

✓ Lying

✓ Deliberate deception

✓ Withholding the information

✓ Not seeking the truth

✓ Not maintaining confidentiality

✓ Giving professional judgment under the influence of extraneous factors such as personal benefits and prejudice.

2. **Write short notes on the following human values(i) Civic virtue(ii) Empathy(iii) Commitment(iv)Integrity(April/May 2008) (Nov/Dec 2016, 2021) (or)Define empathy. State and explain the elements and benefits of empathy. Compare empathy and sympathy (Nov/Dec 2017) (or) what is integrity? How integrity plays a major factor in work ethics? Discuss with suitable examples. (April/May 2018). (or) What is empathy? Discuss its role in the spiritual development for excellence in an organization with suitable examples.(Nov/Dec 2018) (or) State and explain the elements and benefits of Empathy. (A/M 2022, N/D 2022)**

(April/May 2023) List any four core human values. Further classify/explain values related to each. Nov 2023 what is integrity? Mention different types of integrity. Nov 2023

(i) <u>Civic virtue:</u>

- ✓ Civic virtue is morality or standard of righteous behavior in relationship to a citizen's involvement in society.
- ✓ It is comprised of actions and attitudes associated with democratic governance and social participation.
- ✓ An individual may exhibit civic virtue by voting, volunteering, organizing a book group, or attending a public-oriented meeting
- ✓ 'Civic' means "of, relating to or belonging to a city, a citizen, or citizenship, municipal or civil society".

Some civic virtues are:

- ✓ Good citizen demand civic virtue.
- ✓ It is the principle of not harming the surroundings.
- ✓ It also includes living peacefully, letting others live peacefully, and caring, sharing, respect for others, protecting the environment and being normally and ethically good.

The duties are of a person exhibiting civic virtues:

- ✓ To pay taxes to the local government and state, in time.
- ✓ To keep the surroundings clean and green.
- ✓ Not to pollute the water, land, and air by following hygiene and proper garbage disposal. For example, not to burn wood, tyres, plastic materials, spit in the open, even not to smoke in the open, and not to cause nuisance to the public, are some of the civic (duties) virtues.
- ✓ To follow the road safety rules.

The rights of a person exhibiting civic virtues are:

- ✓ To vote the local or state government.
- ✓ To contest in the elections to the local or state government
- ✓ To seek a public welfare facility such as a school, hospital or a community hall or transport or communication facility, for the residents.
- ✓ To establish a green and safe environment, pollution free, corruption free, and to follow ethical principles. People are said to have the right to breathe in fresh air, by not allowing smoking in public.
- ✓ People have unalienable right to accept or reject a project in their area. One has the right to seek legal remedy, in this respect, through public interest petition.

(ii) <u>Empathy: (or) State and explain the elements and benefits of Empathy. (A/M 2022)</u>

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- ✓ Empathy means putting self in a position of someone else and thinking as the later and reasoning suitable action.
- ✓ It is also defined as the ability to put one's self into the psychological frame or point of view of another, to know what the other person feels.
- ✓ It includes the imaginative projection into other's feelings and understanding other's background such as parentage, physical and mental state, economic situation and association.
- ✓ To practice empathy, a leader must have or develop in him, the following

Characteristics.
- ✓ Understanding others
- ✓ Service orientation
- ✓ Developing others
- ✓ Leveraging diversity
- ✓ Political awareness

The benefits of empathy include:
- ✓ Good customer relations (in sales and service, in partnering).
- ✓ Harmonious labor relations(in manufacturing)
- ✓ Good vendor –producer relationship (in partnering).
- ✓ Empathy heals
- ✓ Builds trust.
- ✓ Empathy closes the loop

Compare Empathy with Sympathy. (A/M 2022)

S.No	EMPATHY	SYMPATHY
Definition	Understanding what others are feeling because you have experienced it yourself or can put yourself in their shoes.	Acknowledging another person's emotional hardships and providing comfort and assurance.
Example	"I know it's not easy to lose weight because I have faced the same problems myself."	"Trying to lose weight can often feel like an uphill battle."
Relationship	Personal understanding	Understanding the experience of others
Nursing context	A doctor relating with a patient because he or she has been in a similar situation or experience	Doctors comforting patients or their families

Scope	Personal; it can be one to many in some circumstances	From either one to another person or one to many (or one to a group).

(iii) Commitment:

- ✓ Commitment means alignment to goals and adherence to ethical principles during the activities.
- ✓ One must believe in one's action performed and the expected end results (confidence), i.e, the conviction without an iota of doubt that one will succeed.
- ✓ Holding sustained interest and firmness, in whatever ethical means one follows, with the fervent attitude and hope that one will achieve the goals, is commitment.

(iv) Integrity:

- ✓ Integrity refers to a quality of a person's character.
- ✓ Integrity means "soundness of moral character".
- ✓ Integrity means the good qualities like honesty, loyalty, honor, incorruptibility, rectitude, righteousness, uprightness and similar virtues.
- ✓ Integrity reveals one's state of mind attitude and behavior

Integrity involves two fundamental intuitions. They are:

- ✓ Integrity is a formal relation one had to oneself, or between parts or aspects of one's self;
- ✓ Integrity is connected in an important way to acting morally.

A number of accounts of integrity being:

- ✓ Integrity as self-integration
- ✓ Integrity as maintenance of identity
- ✓ Integrity as standing for something
- ✓ Integrity as moral purpose and
- ✓ Integrity as a virtue.

Integrity as Self-Integration

- ✓ It is a matter of persons integrating various parts of their personality into a harmonious, intact whole.
- ✓ Integrity of persons is analogous to the integrity of things: Integrity is primarily a matter of keeping the self-intact and uncorrupted.

Integrity as maintenance of identity:

- ✓ Person's acting according to their commitments, rather than ordering and endorsing desires.
- ✓ 'Commitment' is different kinds of intentions, promises, convictions and relationships of trust and expectation.

Integrity as standing for something:

- ✓ It is a social virtue, one that is defined by a person's relations to others.
- ✓ The social character of integrity is a matter of a person's proper regard for their own best judgment.

Integrity as moral purpose

- ✓ A person's dedication to the pursuit of a moral life and their intellectual responsibility in seeking to understand the demands of such a life.
- ✓ Persons embrace a moral point of view that urges them to be conceptually clear, logically consistent, appraised of relevant empirical evidence.
- ✓ They are careful about acknowledging as well as weighing relevant moral considerations.Persons of integrity impose these restrictions on themselves.They pursue a commitment to do what is best.

3. Explain in detail about

> **i)   Service learning**
>
> **ii)   Respect to others**

What is service learning? Why service learning is important? Explain the characteristics of service learning. (Nov/Dec 2017)

What is service learning? Discuss its role in caring and sharing in society with suitable examples. (Nov/Dec 2018)

Enumerate on the importance and characteristics of service learning. (A/M 2022, N/D 2022)

SERVICE LEARNING:

- ✓ Service Learning is a method of learning by which students learn from their past services rendered to their communities.
- ✓ It is a teaching and learning strategy that integrates meaningful community service with instruction and reflection to enrich the learning experience teach civic responsibility and strengthen communities.
- ✓ It is a tool used by sociologists to encourage students to make connections between classroom learning and the larger community.

Effective service learning programs are:

- ✓ Improve grades of students
- ✓ Increase attendance in school/college

✓ Develop students' personal and social responsibility.

Service-Learning strengthens both education and local communities by:

- ✓ Building effective collaborative partnerships between schools or colleges and other institutions and organizations
- ✓ Engaging parents and other adults in supporting student learning
- ✓ Meeting community needs through the service projects conducted
- ✓ Providing engaging and productive opportunities for young people to work with others in their community.

Characteristics of Service-Learning:

- ✓ Service learning links to academic content and standards.
- ✓ It involves young people in helping to determine and meet real, defined community needs.
- ✓ It is reciprocal in nature, benefiting both the society and the service providers by combining a service experience with a learning experience.
- ✓ It can be used in any subject area so long as it is appropriate to learning goal.
- ✓ It works at all ages, even among young children.
- ✓ It is positive, meaningful and real to the participants.

Illustration for service learning:

- ✓ Example -College students collecting trash out of an urban streambed.
- ✓ They provide a service to the community as volunteers and is highly valued and important.
- ✓ When the students analyze the trash bed and possible sources, they can share the results with residents of the neighborhood along with suggestions for reducing pollution, thus engaging in service – learning.
- ✓ In the service-learning, the students are providing an important service to the community and at the same time, learning about water quality and laboratory analysis, developing an understanding of pollution issues, learning to interpret science issues to the public, and practicing communication skills by speaking to residents.
- ✓ They may also reflect on their personal and career interests in science, the environment, public policy or other related areas.

RESPECT TO OTHERS:

Importance of respecting others:

- ✓ Treating people with respect makes this world a nicer place to live in.
- ✓ It is very easy. All one has to do is," treat people the way you like others to treat you".

- ✓ We live in a country of many languages, culture, races and backgrounds.
- ✓ In order to make all our lives a lot more fun and interesting, we have to get along with each other.
- ✓ To achieve "unity in diversity," we have to respect each other.

Some of the ways to treat people with respect are:

- Don't insult people or make fun of them.
- Value other people's opinion
- Be considerate of people's likes and dislikes.
- Don't tease or harness people.
- It is not good to talk about people behind their back.
- Have respect to other people's feelings.
- Don't compel anybody to do something he/she does not want to do.

We live in a country of many languages, cultures, races, and backgrounds. In order to make all our lives a lot more fun and interesting, we have to get along with each other. To achieve "unity in diversity", we have to respect each other. Some ways to do so are:

- We have to learn something from the other persons.
- We have to show interest and appreciation for other people's cultures and backgrounds.
- We should not have prejudices and racist attitudes.

Engineers and professionals require this attitude of 'respect for others', to achieve better results.

4. **Illustrate the ethical aspect principle of caring and sharing, with an example.**

   Caring:
   - ✓ Caring knows feeling and acting in the interest of others. Considering the experimental nature of engineering work, and that it can have unexpected negative consequences on the public, caring becomes an important human value in relation to engineering work.
   - ✓ Milton Mayer off has emphasized a deeper level of caring between two persons – the care and the cared-for.
     - The goal of caring is to help the other actualize himself.
     - Caring is an extension of one's self.
     - Devotion and constancy are essential elements of caring.
     - Caring for another helps the other to care for and about others.
     - Help in a way that the cared for can go on to help himself.
     - Learning and living a life of caring involves all other values.

Sharing:

- ✓ Sharing is one of a noble act of mankind and a high virtue.
- ✓ Sharing with others should be a part of human nature and life.
- ✓ Sharing should be the motto of good help.
- ✓ This implies sharing of feelings, ideas or thoughts and also materials, resources and profit.
- ✓ Sharing is always mutually beneficial.
- ✓ Whatever possible within our capacity could be shared with sincerity, affection, and kindness?

The role of sharing played in the Industries, corporations or organizations:

- ✓ In industries, corporations, or organizations, people of different cadres like the managing directors, engineers, managers, supervisors and workers have to play their role on sharing concept.
- ✓ A leader or head or manager of an organization should share working conditions with his subordinates and insist that other lower level officers do the same.
- ✓ Sharing of ideas, concept or modifications, may result in a new profitable design of products, they manufacture.

Illustration:

- ✓ A TB-patient beggar in the street – his spit may spread disease – initially he is to be quarantined – to prevent the spread of disease by air – then treated to alleviate his suffering and relieve his pain – rehabilitate him, to make him live on his own and not to go begging any longer.

5. **Explain the following in details; i) write briefly on the human value Courage. ii) Explain various actions of an engineer leading to dishonesty.**

   i) Write briefly on the human value Courage.

   Courage:

   - ✓ Courage is the tendency to accept and face risks and difficult tasks in rational ways.
   - ✓ Courage implies self-respect and governs confrontations with danger and risk.
   - ✓ It is not excessive rashes or cowardice, but it is the middle ground.
   - ✓ Taking calculated risks and boldness in facing crises are the hallmarks of courage as a human value.
   - ✓ It defines the mental makeup of an individual in taking bold decisions even under adverse situations.

The classification of courage:

Courage is classified into three types, based on the types of risks, namely

- ✓ Physical courage

- ✓ Social courage
- ✓ Intellectual courage.

Ways to build courage:

- ✓ Self-confidence is the basic requirement to nurture courage.
- ✓ Courage requires strength of mind, innovative ideas, will to survive, stamina to hang on, sincerity of purpose and seriousness of attempt.
- ✓ These attributes or qualities are natural for some and some acquire them through education and experience in life.
- ✓ Less courageous people must be trained and educated in the moral values of courage.

The important ways of building courage are given below:

1. Raise your consciousness.
2. Move from fear to action, even if you expect to fail.

The expressions of courage:

The expressions of courage are:

- ✓ Facing the criticism
- ✓ Owning responsibility
- ✓ Accepting the mistakes or errors when committed and exposed.

Illustration:Prof. SathishDhawan, Chief of ISRO, was reported to have exhibited his courage and owned responsibility, when the previous space mission failed, but credited Prof.A.P.J.AbdulKalam when the subsequent mission succeeded.

Characteristics of the courageous people have shown in their profession.

The courageous people own and have shown the following characteristics in their professions:

- ✓ Perseverance (sustained hard work).
- ✓ Experimentation (preparedness to face the challenges, that is , unexpected or unintended results),
- ✓ Involvement (attitude, clear and firm resolve to act), and
- ✓ Commitment (willing to get into action and to reach the desired goals by any alternative but ethical means).

ii) Various actions of an engineer leading to dishonesty:

- ✓ **Lying:** Honesty implies avoidance of lying. Engineer may communicate wrong or distorted test results intentionally or otherwise. It is giving wrong information to the right people.

- ✓ **Deliberate deception:** Engineers judges or decides on matters which he is not familiar or with insufficient data or proof, to impress upon the customer or employer. It is self-deceit.
- ✓ **Withholding the information:** Hiding the facts during communication to one's superior or subordinate, intentionally or otherwise.
- ✓ **Notwithstanding the truth**: Engineers accept the information or data without applying their mind and seeking the truth.
- ✓ **Not maintaining confidentiality:** It is giving right information to wrong people.
- ✓ Giving professional judgment under the influence of extraneous factors such as personal benefits and prejudice. The laws, experience, social welfare, and even conscience are given a go-bye.

6. Explain 'valuing time' and 'Co-operation' in detail.

Valuing Time:

Time:

Time is a measure of one's usefulness and success; it is a moral value.

Time Management:

Time management is the rational way to ensure that our limited time is always used effectively.

Since the time cannot be stopped or it cannot be saved up for further use, therefore, the every minute of our lifetime should be effectively planned and used.

Time as a resource:

- ✓ Engineers must learn to think of their time and their subordinate's time as a very valuable resource for 'time is money'.
- ✓ Time is a resource that is unique in that it cannot be accumulated or stored like money.
- ✓ We are forced to use the time whether we can use it effectively or not. It cannot be turned on and off like equipment or used by someone else. But, like other resources, it may be effectively or ineffectively managed and it can be controlled.

Some common time wastes identified by engineers are;

- ✓ Unscheduled and scheduled meetings.
- ✓ Lack of adequate planning
- ✓ Poor delegation.
- ✓ Too much socializing
- ✓ Ineffective communication
- ✓ Assuming unnecessary public responsibilities

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- ✓ Lack of goals and objectives
- ✓ Poorly organized supervision
- ✓ Poor use of telephone.

The essential steps required to manage one's time are:

- ✓ Clear objectives
- ✓ Prioritize tasks
- ✓ Stick to scheduled tasks
- ✓ Allow time to manage your time
- ✓ The unexpected
- ✓ Managing time-wasters

Co-operation:

- ✓ Co -operation means extending help to others, for a good cause. Co -operation may be through an idea, a suggestion, an assistance or physical work which extends to others forcommon benefit.
- ✓ Willingness to understand others think and act together and putting this into practice is cooperation.

The benefits of cooperation:

- ✓ Cooperation promotes co linearity, coherence (blend), co-ordination(activities linked in sequence or priority) and the synergy (maximizing the output, by reinforcement). The whole is more than the sum of the individuals.
- ✓ It helps in minimizing the input resources(including time) and maximizes the outputs, which include quantity, quality, effectiveness, and efficiency.

The outcomes of absence of cooperation:

- ✓ The absence of cooperation leads to lack of communication, misinformation, void in communication, and undue delay between supply, production, marketing, and consumption.
- ✓ This is likely to demoralize and frustrate the employees, leading to collapse of the industry over time and an economic loss to the society.

The impediments to successful cooperation

The impediments to successful cooperation are:

- ✓ Clash of ego of individuals
- ✓ Lack of leadership and motivation
- ✓ Conflicts of interests, based on region, religion, language, and caste.
- ✓ Ignorance and lack of interest.

- ✓ By careful planning, motivation, leadership, fostering and rewarding team work, professionalism and humanism beyond the 'divides', training on appreciation to different cultures, mutual understanding 'cooperation' can be developed and also sustained.

7. **Write explicitly on the ethical value 'self-confidence'.(Or) Explain the importance of 'self-confidence' in ethics (May /June 2016)**

Self –Confidence:
- ✓ Certainty in one's own capabilities, values, and goals, is self-confidence.
- ✓ People with self-confidence are usually positive thinking, flexible and willing to change.
- ✓ They respect others so much as they respect themselves.
- ✓ People with self-confidence exhibit courage to get into action and unshakable faith in their abilities, whatever may be their positions.
- ✓ They are not influenced by threats or challenges and are prepared to face them and the natural or unexpected consequences.
- ✓ The self confidence in a person develops a sense of partnership, respect, and accountability, and this helps the organization to obtain maximum ideas, efforts, and guidelines from its employees.

The characteristics of a person with self-confidence:

The people with self-confidence have the following characteristics:
- ✓ A self – assured standing.
- ✓ Willing to listen to learn from others and adopt(flexibility)
- ✓ Frank to speak the truth
- ✓ Respect others efforts and give due credit.

Factors that shape self-confidence in a person:

The factors that shape self-confidence in a person are:
- ✓ Heredity (attitudes of parents) and family environment (elders)
- ✓ Friendship (influence of friends/colleagues)
- ✓ Influence of superiors/role models
- ✓ Training in the organization (e.g./training by Technical Evangelists at Infosys Technologies).

Effective methodologies in developing self-confidence in a person:

The following methodologies are effective in developing self-confidence in a person:
- ✓ Encouraging SWOT analysis. By evaluating their strength and weakness, they can anticipate and be prepared to face the results.

- ✓ Training to evaluate risks and face them (self-acceptance)
- ✓ Self-talk. It is conditioning the mind for preparing the self to act, without any doubt on his capabilities. This makes one accepts himself while still striving for improvement
- ✓ Study and group discussion, on the history of leaders and innovators(e.g., Sam Walton of Wal-Mart, USA).

8. Differentiate human values with disvalues.(Nov/Dec2006)

Human values are:

- ✓ Basic moral values one ought to possess to live as a citizen or as a person.
- ✓ It decides the standard of behaviour
- ✓ Some universally accepted values are freedom justice and equality.
- ✓ Other principles of values are love, care, honesty, integrity, self-respect.

Principles that compose the foundation of human values:

Key principles composing the foundation of human values:

- ✓ The innate dignity of human life
- ✓ Respect and consideration for the other
- ✓ The interconnection between humankind and the environment and thus the need to care for and preserve the earth.
- ✓ The importance of integrity and service
- ✓ An attitude of non-violence.
- ✓ The individual and collective quest for peace and happiness.

Human values can be broadly grouped under the following five headings:

- ✓ Love
- ✓ Truth
- ✓ Right conduct
- ✓ Peace and
- ✓ Non-violence

Love is the undercurrent that flows through and supports the other four values. Love is the divine energy inherent in everyone and in all.Any principles or values contradictory to those mentioned above are disvalues.

Illustration:

Just as prejudice is seated in disvalues (that count one human as more valuable than another, one race as superior to another, one culture as inherently inferior to another etc), today's dysfunctional 'health care' system is grounded in whole sets of disvalues that place patient safety secondary to profit, necessary community services secondary to over-reimbursed services, and employee loyalty to the organization above their own.

9. i) Explain why the study of human values is very essential to engineers and list some important human values.

ii) Write a short note on 'work ethic'?

iii) List some important time wasters. How can one manage his/her time properly? (Nov/Dec2008)

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Need to study human values:

- ✓ Globalization
- ✓ Increased contact between people and nations
- ✓ Cultural distinction's –maintained understanding global community

Work Ethics:

- ✓ Work ethic is a characteristic attitude of a group of persons or workers towards morality of work.
- ✓ It is being personally accountable and responsible for the work that one does.
- ✓ It is based on a belief that work has a great value.

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- ✓ Work ethics is usually associated with people who work hard and do a good job.

- ✓ Workers, working in a team, are not supposed to cause harm to others. Any worker cannot escape accountability

- ✓ Worker has the moral responsibility to see that no other person's right, private or freedom is impaired or transgressed

Elements of work ethics:

Many characteristics of work ethic can be summarized using the following three elements:

- ✓ Interpersonal skills

- ✓ Initiative; and

- ✓ Being dependable

Common time wastes:

Some common time wasters identified by engineers are:

- ✓ Unscheduled and scheduled meetings

- ✓ Lack of adequate planning

- ✓ Poor delegation.

- ✓ Too much socializing

- ✓ Ineffective communication

- ✓ Assuming unnecessary public responsibilities

- ✓ Lack of goals and objectives

- ✓ Poorly organized supervision

- ✓ Poor use of telephone.

10. i) Write in detail on the value 'Character'.

ii) Write briefly on 'Spirituality'   (May /June 2016)

What is spirituality? What are the spiritual traits to be followed for excellence in an organisation? Discuss with suitable examples. (April/May 2018)

Character:

- ✓ Character is the expression of the personality of a human being, and it reveals itself in one's conduct.

- ✓ It is the pattern of virtues (morally desirable features).

- ✓ Character includes attributes that determine a person's moral and ethical actions and responses.

- ✓ It is also the ground on which morals and values blossom.

People are divided into categories according to common tendencies such as:

- ✓ Ruthlessness

- ✓ Aggressiveness
- ✓ Ambition
- ✓ Constricting selfishness
- ✓ Stinginess
- ✓ Cheerfulness
- ✓ Generosity
- ✓ Goodwill

Developed social and unformed social character:

- ✓ The character is exhibited through conduct.
- ✓ Character is determined by the expectations of society.
- ✓ Many act and live within the social norms refusing to fall below the required social minimum, failing to rise above the maximum expected of a normal member of the group.
- ✓ People whose lives are determined and directed by the prevailing habits, fashions, beliefs, attitudes, opinions and values of the society in which they live have at best a developed social character.
- ✓ People whose lives do not even conform to the minimum standards, and fail to acquire the socially –required behaviours, attitudes and values have an unformed social character.

Individual Character:

- ✓ They are the people whose beliefs, attitudes and values are determined internally by the strength of their own convictions.
- ✓ These are individuals with developed minds and formed characters of their own.

The four main types of temperaments distinguished from the times of Hippocrates, are:

1. The Sanguine
2. The Choleric
3. The Phlegmatic
4. The Melancholic

M.Ribot recognizes the forms of character as:

a) The sensitive (humble, contemplative and emotional)
b) The active (great and the mediocre), and
c) The apathetic(purely apathetic or dull), and
d) The intelligent

'Pillars of character'

The 'pillars of character' are six. The six pillars of character are the ethical values.

They are:

1. Trustworthiness
2. Respect
3. Responsibility
4. Firmness
5. Caring
6. Citizenship

- ✓ Respect means showing high regard for self, others, authority, property and country. It includes showing appreciation for cultural diversity by valuing all people as human beings.
- ✓ Responsibility is:
  - Being accountable for one's actions
  - Being dependable in carrying out obligations and duties
  - Integrity or fairness means showing the inner strength and courage to be truthful, trustworthy, fair and honest.
  - Caring means being kind, considerate, courteous, helpful, friendly and generous to others, and compassionate.
  - Citizenship means accepting and adopting civic rights and duties as a citizen of the country.
- ✓ Managers have to influence and employ creative means of stressing the importance of good character in the workplace, in the following ways:
  - Employee Hiring, Training, and Promotion Activities
  - Internal Communication
  - External Communication
  - Financial and Human Resources
  - Community Outreach
- ✓ Managers stress the importance of good character in the workplace, in employee hiring, training and promotion activities by:
  - Instituting and adopting an organization policy statement positive character in the workplace.
  - Prominently and explicitly include character considerations in recruiting procedures, during interviews and in the hiring deliberations.
  - Emphasize the importance of character and adherence to the 'six pillars' of character in orientation, initial job training, and during in-service training.
  - Include of fundamental character values such as honesty, promise keeping, accountability, fairness, caring, in appraisals

- Institute recognition and reward system
- Think of employees as present or future mentors, coaches and volunteers.

ii)**Spirituality:**

Spirituality refers to the way of living. It emphasizes a constant awareness and recognition of the spiritual dimension (mind and its development) of nature and people,with a dynamic balance between the material development and the spiritual development. It is a sense of meaning and purpose, 'a sense of self'.

Spirituality in workplaces:

Spirituality is promoted in workplaces by adhering to the following activities:

- ✓ Verbally respect the individuals as humans and recognize their values in all decisions.
- ✓ Get to know the people with whom you work and know what is important to them. Know their goals, desires, and dreams.
- ✓ Support causes outside the business.
- ✓ Encourage leaders to use value-based discretion in making decisions.
- ✓ Demonstrate your own self –knowledge and spirituality in all your actions.
- ✓ Do unto others as you would have them do unto you.

The spiritual traits to be developed for excellence in corporate activities are:

- ✓ Self-awareness
- ✓ Alertness in observation and quickness in decision making
- ✓ Being visionary and value based
- ✓ Holism
- ✓ Compassion
- ✓ Respect for diversity
- ✓ Moral Autonomy
- ✓ Creative thinking and constant reasoning
- ✓ Ability to analyze and synthesize
- ✓ Positive views of adversity
- ✓ Humility
- ✓ Sense of vocation

Examples of Practicing your Spirituality: Prayer is an effort to communicate with the Creator, Higher Power, and God or to an object of worship. Prayer is one of the main ways

we practice our spirituality. ... They pray at sunset to thank the Creator, Higher Spirit and God for a good day.

11. Discuss the role and importance of ethics in engineering (Nov / Dec 2021) (or) Detail on the scope and importance of professional ethics in engineering. (A/M 2022)(N/D 2022) what is ethics? List and explain the ethics in relation to other studies. Nov 2023

What is Ethics?

- ✓ The term ethics is derived from the Greek word 'ethos', which meant 'customs'.
- ✓ Ethics is the study of the characteristics of morals.
- ✓ First of all, ethics is the quest for and the understanding of the good life, living well, a life worth living.
- ✓ In a wider perspective, ethics is putting every activity and goal in its place. It is concerned with knowing what is worth doing and what is not worth doing; knowing what is worth wanting and knowing what is not worth wanting.
- ✓ Ethics defined: Ethics is defined as the discipline dealing with what is good and bad and with moral duty and obligation.
- ✓ Some of the universally accepted ethical principles are integrity, honestly, humanity responsibility, accountability, confidentiality, discipline, loyalty, collegiality conscientiousness competency, diligence, wisdom, courage, temperance justice, etc

VARIOUS DISCIPLINES OF ETHICS (Forms/Types of Ethics)

The term 'ethics' is a broad, general term. In practice, there are different disciplines of ethics. They are:

1. Personal Ethics

- ✓ Personal ethics is concerned with the rules by which an individual lives his or her personal life.
- ✓ It also deals with how we treat others in our day-to-day lives.

2. Business Ethics

- ✓ Business ethics is concerned with truth and justice and has a variety of aspects such as the expectation of society, fair competition, advertising, public relations, social responsibilities, consumer autonomy, and corporate behavior.
- ✓ It involves choices on an organization level rather than a personal level.

3. Engineering Ethics

- ✓ Engineering ethics is concerned with the rules and standards governing the conduct of engineers in their role as professionals.

- It is the body of philosophy guiding the way that engineers should conduct themselves in their role as professionals.

4. Medical Ethics

- Medical ethics is concerned with the rules and standards governing the conduct of doctors and other medical practitioners in their role as professionals.

5. Legal Ethics

- Legal ethics is concerned with the codes that guide the professional conduct of lawyers, judges, etc.

6. Accounting Ethics

- Accounting ethics is concerned with the codes that guide the professional conduct of accountants.

WHAT IS ENGINEERING ETHICS?

Engineering ethics is concerned with:

(i) The study of the moral issues and decisions confronting individuals and organizations engaged in engineering field; and

(ii) The study of related issues about the moral ideals, characters, policies, and relationships of people and corporations involved in technological activity.

- It refers to the ethical obligations that engineers have to follow because of their professional status.
- It not only emphasizes how engineers should conduct themselves; it also encompasses how the engineers ought to be having in their professional work.
- **Definition:** Engineering ethics may be defined as the identification, study and resolution of ethical problems occurring in the practice of the engineering profession.
- The concept of engineering ethics is not applicable only for engineers. It can also be applied to others who engage in any technological enterprises, such as scientists, technicians, technical writers, production staffs, supervisors, sales staffs, doctors, lawyers, and the general public.

Engineering Ethics Vs Professional Ethics

- In general, the terms engineering ethics and professional ethics are used interchangeably. But the professional ethics is wider in scope than the engineering ethics, In fact, the engineering ethics is a part of professional ethics.
- Professional ethics is the discipline aimed at understanding the moral values that ought to guide all professional practices, including engineering, medicine, law and other practices. But the engineering ethics refers to the set of specific moral problems and issues related to engineering profession only.

AIMS IN STUDYING ENGINEERING ETHICS

The study of engineering ethics is necessary for all engineering students because of the following reasons

1. Stimulating the moral imagination

- ✓ The engineering ethics course is to stimulate the moral imagination of engineering students.
- ✓ Imagination is necessary for engineers in anticipating the consequences of actions as professionals and in finding solutions to ethical problems encountered in their professional life.

2. Recognizing ethical issues

- ✓ The ethical problems encountered in engineering practice, often, are very complex. Also they involve conflicting ethical principles.
- ✓ The engineering ethics course helps engineers in recognizing various ethical issues.

3. Developing analytical skills

- ✓ The technical and analytical skills required for analyzing moral issues are quite different than that for exercising good engineering practice.
- ✓ While analyzing moral issues, one requires clear thinking about concepts such as utility. Justice, rights, duties, and respect for persons.
- ✓ The aim of engineering ethics is to train the engineers to analyze complex problems.

4. Drawing out a sense of responsibility

- ✓ The engineering ethics course encourages the engineers to desire to fulfill ethical ideals rather than ethical requirements.
- ✓ Ethical requirements Vs Ethical ideals: Ethical requirements are basic obligations and duties. But ethical ideals go beyond basic obligations and duties.
- ✓ Thus engineering ethics promotes a sense of responsibility and the moral autonomy of future engineers.

5. Addressing unclarity, uncertainty, and disagreement

- ✓ The engineering ethics helps the engineers in addressing unclarity, uncertainty, and disagreement about moral issues.
- ✓ As we know, resolving ethical issues expose a certain amount of vagueness, ambiguity, uncertainty, and disagreement.

The study of engineering ethics helps engineers to learn to resolve these problems in the most ethical manner.

12. Explain the role of Yoga in professional ethics. (Nov / Dec 2021). (or) Analyze the significance of yoga and meditation for professional excellence and stress management. (A/M 2022) (A/M 2023)

- ✓ Yoga is considered a mind-body type of complementary and alternative medicine practice.
- ✓ Yoga brings together physical and mental disciplines to achieve peacefulness of body and mind, helping you relax and manage stress and anxiety.
- ✓ Yoga has many styles, forms and intensities. Hatha yoga, in particular, may be a good choice for stress management. Hatha is one of the most common styles of yoga, and beginners may like its slower pace and easier movements. But most people can benefit from any style of yoga — it's all about your personal preferences.
- ✓ The core components of hatha yoga and most general yoga classes are:
- ✓ Poses. Yoga poses, also called postures, are a series of movements designed to increase strength and flexibility. Poses range from lying on the floor while completely relaxed to difficult postures that may have you stretching your physical limits.
- ✓ Breathing. Controlling your breathing is an important part of yoga. In yoga, breath signifies your vital energy. Yoga teaches that controlling your breathing can help you control your body and quiet your mind.

Health benefits of Yoga

The potential health benefits of yoga include:

- ✓ Stress reduction: A number of studies have shown that yoga can help reduce stress and anxiety. It can also enhance your mood and overall sense of well-being.
- ✓ Improved fitness: Practicing yoga can lead to improved balance, flexibility, range of motion and strength. And this means you're less likely to injure yourself in other physical endeavours or in your daily activities.
- ✓ Management of chronic condition: Yoga can help reduce risk factors for chronic diseases, such as heart disease and high blood pressure. Yoga might also help alleviate chronic conditions, such as depression, pain, anxiety and insomnia.

Compare Yoga with other stress reduction methods.

- ✓ As yoga combines several techniques used for stress reduction, it can be said to provide the combined benefits of breathing exercises, stretching exercises, fitness programs, meditation practice, and guided imagery, in one technique.
- ✓ However, for those with great physical limitations, simple breathing exercises, meditation or guided imagery might be a preferable option and provide similar benefits.
- ✓ Yoga also requires more effort and commitment than taking pills or herbs for stress reduction.

UNIT 2
ENGINEERING ETHICS

Syllabus: Senses of 'Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories

Senses of 'Engineering Ethics

1. Explain the scope of Engineering Ethics. Highlight the importance of Ethics.

Scope:

- ✓ Engineering is transforming science into useful products for human comfort.
- ✓ Engineering is something that engineers do, and what they do has profound effects on others.
- ✓ Ethics in engineering then is the ability as well as responsibility of an engineer to judge his decisions from the context of the general wellbeing of the society.
- ✓ It is the study of moral issues that confront engineers and engineering organizations when some crucial decisions are taken.
- ✓ Engineering research and practice requires that the task being performed considers all the pros and cons of a certain action and its implementation.
- ✓ Professional engineering bodies like IEEE, ASME, IEI etc., have evolved comprehensive ethics codes relevant to their respective professions, based on the rich experience of their members.
- ✓ Independent organizations like NSPE have prepared value based ethical codes applicable to all engineering professions.
- ✓ Teaching engineering ethics in academic institutions is undertaken largely through many case studies for creating awareness interactively among engineering students of all disciplines.
- ✓ By studying engineering ethics, the students develop awareness and assessment skill of the likely impact of their future decisions on moral and ethical grounds.
- ✓ Ethical standards in engineering are influenced by many factors:
  - Engineering as an experimentation for the good of mankind is a notable factor involving far reaching consequence,
  - Ethical dilemmas make engineering decisions relatively difficult to make.
  - Risk and safety of citizens as a social responsibility is a prime concern of an engineer,

- Technological Advancement can be very demanding on the engineering skill in the global context, Moral values and responsible conduct will play a crucial role in decision making. The study of engineering ethics within an engineering program helps students prepare for their professional lives.

✓ A specific advantage for engineering students who learn about ethics is that they develop clarity in their understanding and thought about ethical issues and the practice in which they arise.

✓ The study of ethics helps students to develop widely applicable skills in communication, reasoning and reflection. These skills enhance students' abilities and help them engage with other aspects of the engineering program such as group work and work placements.

Professional ethics

✓ Profession is a commitment to a designated and organized occupation by virtue of being an authority over a body of knowledge with requisite skills acquired through specialized training.

✓ An occupation becomes a profession when a group of people sharing the same occupation work together in a morally acceptable way with members setting and following a certain ethics code. A professional is a practitioner belonging to a specific profession. Professional ethics, as opposed to personal values and morality, is a set of ethical standards and values a practicing engineer is required to follow. It sets the standards for professional practice, and is only learned in a professional school or while practicing one's own profession. Today, it is an essential part of professional education because it helps students deal with issues they will face.

✓ The scope of engineering ethics envelopes diverse activities like
- Engineering as a social experimentation
- Engineers responsibility for safety
- Role of engineers, managers, consultants etc.
- Rights of engineers
- Moral reasoning and ethical theories
- Responsibility to employers
- Global issues and concerns

✓ The best way to teach engineering ethics is by using case studies—not just the disaster cases that make the news, but the kinds of cases that an engineer is more likely to encounter.

✓ Many real time cases are available or some hypothetical cases can be constructed and there are methods for analyzing them.

- ✓ Engineering ethics can be taught in a free-standing course, but there are strong arguments for introducing ethics in technical courses as well.
- ✓ If the subject of professional ethics is how members of a profession should, or should not, affect others in the course of practicing their profession, then engineering ethics is an essential aspect of engineering itself and education in professional responsibilities should be part of professional education in engineering, just as it is in law and medicine.

2. **Explain in details about the senses of Engineering Ethics.(May/June 2016)**

Senses of Engineering Ethics (Nov/Dec 2017 - 2mark)

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

(*a*) Knowing moral values, finding accurate solutions to moral problems and justifying moral judgments in engineering practices,

(*b*) Study of decisions, policies, and values that are morally desirable in the engineering practice and research, and

(*c*) Using codes of ethics and standards and applying them in their transactions by engineers. The descriptive sense refers to what specific individual or group of engineers believe and

Act, without justifying their beliefs or actions.

3. **(i) Discuss in detail about the various types of Moral issues (ii) Specify the various types of Ethical inquiries available.[April 2014] [April/May 2016][Nov/Dec 2022]**

(i) Variety of Moral Issues

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

1. Resource Crunch

- ✓ Due to pressure, through time limits, availability of money or budgetary constraints, and technology decay or obsolescence.
- ✓ Pressure from the government to complete the project in time (e.g., before the elections), reduction in the budget because of sudden war or natural calamity (e.g., Tsunami) and obsolescence due technology innovation by the competitor lead to manipulation and unsafe and unethical execution of projects.
- ✓ Involving individuals in the development of goals and values and developing policies that allow for individual diversity, dissent, and input to decision-making will prevent unethical results.

3

2. Opportunity

✓ Double standards or behaviour of the employers towards the employees and the public. The unethical behavior of World Com (in USA), Enron (in USA as well as India) executives in 2002 resulted in bankruptcy for those companies,

✓ Management projecting their own interests more than that of their employees. Some organizations over-emphasize short-term gains and results at the expense of themselves and others,

✓ Emphasis on results and gains at the expense of the employees, and

✓ Management by objectives, without focus on empowerment and improvement of the infrastructure. This is best encountered by developing policies that allow 'conscience keepers' and whistle blowers and appointing ombudsman, who can work confidentially with people to solve the unethical problems internally.

3. Attitude

✓ Poor attitude of the employees set in due to

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

   (*b*) Absence of grievance redressal mechanism,

   (*c*) Lack of promotion or career development policies or denied promotions,

   (*d*) Lack of transparency,

   (*e*) Absence of recognition and reward system, and

   (*f*) Poor working environments.

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

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

(ii) Briefly illustrate three types of inquiries (Nov/Dec 2017)

✓ The three types of inquiries, in solving ethical problems are: normative inquiry, conceptual inquiry, and factual or descriptive inquiry. The three types of inquiries are discussed below to illustrate the differences and preference.

1. Normative Inquiry

✓ It seeks to identify and justify the morally-desirable norms or standards that should guide individuals and groups.

✓ It also has the theoretical goal of justifying particular moral judgments.

✓ Normative questions are about what ought to be and what is good, based on moral values.

For example,

✓ How far does the obligation of engineers to protect public safety extend in any given situation?

✓ When, if ever, should engineers be expected to blow whistle on dangerous practices of their employers?

✓ Whose values ought to be primary in making judgment about acceptable risks in design for a public transport system or a nuclear plant? Is it of management, senior engineers, government, voters or all of them?

✓ When and why is the government justified in interfering with the organizations?

✓ What are the reasons on which the engineers show their obligations to their employees or clients or the public

2. **Conceptual Inquiry**

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

(*a*) What is meant by safety?

(*b*) How is it related to risk?

(c) What is a bribe? Offering, giving, solicitation or receiving of any item of value as a means of influencing the actions of an individual.

(*d*) What is a profession?

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

3. **Factual or Descriptive Inquiry**

✓ It is aimed to obtain facts needed for understanding and resolving value issues.

✓ Researchers conduct factual inquiries using mathematical or statistical techniques.

✓ The inquiry provide important information on business realities, engineering practice, and the effectiveness of professional societies in fostering moral conduct, the procedures used in risk assessment, and psychological profiles of engineers.

✓ The facts provide not only the reasons for moral problems but also enable us to develop alternative ways of resolving moral problems. **For example,**

✓ How were the benefits assessed?

✓ What are procedures followed in risk assessment?

✓ What are short-term and long-term effects of drinking water being polluted?

4. **Discuss in detail about the concept of (Nov/Dec 2016, 2021)[Nov/Dec 2022]**

(a)Moral Dilemmas. (b)Moral Autonomy (Apr/May 2016) (Define Moral Autonomy

Nov/Dec 2017) What is meant by moral autonomy? (April/May 2018) Discuss the factors influencing a person's concern and skills required to improve moral autonomy (Nov/Dec 2017) Define 'Moral Dilemma'. Explain in brief any three causes of Moral Dilemma. Nov 2023 Define 'Moral Autonomy'. List any four skills required to improve moral autonomy. Nov 2023

MORAL DILEMMA

Definition

- ✓ Dilemmas are situations in which moral reasons come into conflict, or in which the application of moral values are problems, and one is not clear of the immediate choice or solution of the problems. Moral reasons could be rights, duties, goods or obligations.

- ✓ These situations do not mean that things had gone wrong, but they only indicate the presence of moral complexity.

- ✓ This makes the decision making complex. For example, a person promised to meet a friend and dine, but he has to help his uncle who is involved in an accident — one has to fix the priority.

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

1. **The problem of *vagueness*:** One is unable to distinguish between good and bad (right or wrong) principle. Good means an action that is obligatory.

For example, code of ethics specifies that one should obey the laws and follow standards. Refuse bribe or accept the gift, and maintain confidentiality

2. The problem of *conflicting reasons*: One is unable to choose between two good moral solutions. One has to fix priority, through knowledge or value system.

3. The problem of *disagreement*: There may be two or more solutions and none of them mandatory. These solutions may be better or worse in some respects but not in all aspects. One has to interpret, apply different morally reasons, and analyze and rank the decisions. Select the best suitable, under the existing and the most probable conditions.

Steps to Solve Dilemma

The logical steps in confronting moral dilemma are:

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

2. Collection of all information, data, and facts (factual inquiry) relevant to the situation.

3. Rank the moral options i.e., priority in application through value system, and also as obligatory, all right, acceptable, not acceptable, damaging, and most damaging etc. For example, in fulfilling responsibility, the codes give prime importance to public safety and protection of the environment, as compared to the individuals or the employers (conceptual inquiry).

4. Generate alternate courses of action to resolve the dilemma. Write down the main options and sub-options as a matrix or decision tree to ensure that all options are included.

5. Discuss with colleagues and obtain their perspectives, priorities, and suggestions on various alternatives.

6. Decide upon a final course of action, based on priority fixed or assumed. If there is no ideal solution, we arrive at a partially satisfactory or 'satisfying' solution.

MORAL AUTONOMY

- ✓ Moral autonomy is defined as, decisions and actions exercised on the basis of moral concern for other people and recognition of good moral reasons.

- ✓ Alternatively, moral autonomy means 'self-determinant or independent'. The autonomous people hold moral beliefs and attitudes based on their critical reflection rather than on passive adoption of the conventions of the society or profession.

- ✓ Moral autonomy may also be defined as a skill and habit of thinking rationally about the ethical issues, on the basis of moral concern.

- ✓ Viewing engineering as social experimentation will promote autonomous participation and retain one's professional identity.

- ✓ Periodical performance appraisals, tight-time schedules and fear of foreign competition threatens this autonomy.

- ✓ The attitude of the management should allow latitude in the judgments of their engineers on moral issues.

- ✓ If management views *profitability* is more important than *consistent quality and retention of the customers* that discourage the moral autonomy, engineers are compelled to seek the support from their professional societies and outside organizations for moral support.

- ✓ It appears that the blue-collar workers with the support of the union can adopt better autonomy than the employed professionals.

- ✓ Only recently the legal support has been obtained by the professional societies in exhibiting moral autonomy by professionals in this country as well as in the West. The engineering skills related to moral autonomy are listed as follows:

- ✓ Proficiency in recognizing moral problems in engineering and ability to distinguish as well as relate them to problems in law, economics, and religion,
- ✓ Skill in comprehending, clarifying, and critically-assessing arguments on different aspects of moral issues,
- ✓ Ability to form consistent and comprehensive view points based on facts,
- ✓ Awareness of alternate responses to the issues and creative solutions for practical difficulties,
- ✓ Sensitivity to genuine difficulties and subtleties, including willingness to undergo and tolerate some uncertainty while making decisions,
- ✓ Using rational dialogue in resolving moral conflicts and developing tolerance of different perspectives among morally reasonable people.
- ✓ Maintaining moral integrity. Autonomy which is the independence in making decisions and actions is different from authority.
- ✓ Authority provides freedom for action, specified within limits, depending on the situation.
- ✓ Moral autonomy and respect for authority can coexist.
- ✓ They are not against each other. If the authority of the engineer and the moral autonomy of the operator are in conflict, a consensus is obtained by the two, upon discussion and mutual understanding their limits.

5. **Discuss in details about**

   a) Gilligan's Theory (b) Kohlberg's Theory [Nov 2015] State Kohlberg's Theory. Compare and contrast the theories of moral autonomy by Gilligan's Theory and Kohlberg's Theory (April/May 2018). Discuss the theories of moral autonomy by Kohlberg and Gilligan (Nov/Dec 2018) Discuss any two theories of Moral Autonomy. (A/M 2022) [Nov/Dec 2022](A/M 2023) Define the following a) Gilligan's Theory (b) Kohlberg's Theory Nov 2023

   <u>**Kohlberg Theory**</u>

   - ✓ Moral development in human being occurs overage and experience.
   - ✓ Kohlberg suggested there are three levels of moral development, namely pre-conventional, conventional, and post-conventional, based on the type of reasoning and motivation of the individuals in response to moral questions.
   - ✓ In the pre-conventional level, right conduct for an individual is regarded as whatever directly benefits oneself.

- At this level, individuals are motivated by obedience or the desire to avoid punishment or to satisfy their own needs or by the influence by power on them. All young children exhibit this tendency.
- At the conventional level, people respect the law and authority. Rules and norms of one's family or group or society is accepted, as the standard of morality.
- Individuals in this level want to please or satisfy, and get approval by others and to meet the expectations of the society, rather than their self-interest (e.g., good boy, good girl). Loyalty is regarded as most important. Many adults do not go beyond this level.
- At the post-conventional level, people are called autonomous. They think originally and want to live by universally good principles and welfare of others.
- They have no self-interest. They live by principled conscience. They follow the golden rule, 'Do unto others as you would have them do unto you'.
- They maintain moral integrity, self-respect and respect for others.
- Kohlberg believed that individuals could only progress through these stages, one stage at a time.
- He believed that most of the moral development occurs through social interactions.

Gilligan's Theory

- Carol Gilligan found that Kohlberg's theory had a strong male bias.
- According to Gilligan's studies, men had a tendency to solve problems by applying abstract moral principles.
- Men were found to resolve moral dilemma by choosing the most important moral rule, overriding other rules.
- In contrast, women gave importance to preserve personal relationships with all the people involved.
- The context oriented emphasis on maintaining personal relationships was called the *ethics of care*, in contrast with the *ethics of rules and rights* adopted by men. Gilligan revised the three levels of moral development of Kohlberg, as stages of growth towards ethics of caring.
- The pre-conventional level, which is same as that of Kohlberg's first one, right conduct, is viewed in a selfish manner solely as what is good for oneself.
- The second level called *conventional level*, the importance is on not hurting others, and willing to sacrifice one's own interest and help others. This is the characteristic feature of women.

- ✓ At the post-conventional level, a reasoned balance is found between caring about others and pursuing the self-interest.
- ✓ The balance one's own need and the needs of others, is aimed while maintaining relationship based on mutual caring. This is achieved by context-oriented reasoning, rather than by hierarchy of rules.

The difference in these two theories is explained through the well-known example, *Heinz's dilemma*.

- ✓ Heinz being poor and a debtor could not buy the costly medicine for his sick wife, at ten times the normal cost.
- ✓ Initially he begged the Pharmacist to sell at half the price or allow him to pay for it later.
- ✓ Pharmacist refused to oblige him either way.
- ✓ Finally he forcibly entered the Pharmacy and stole the drug.
- ✓ According to Kohlberg study, men observed that the theft was morally 'wrong' at the conventional level, because the property right was violated.
- ✓ But men at the post-conventional level, concluded that the theft was 'right', as the life of the human being was in danger.
- ✓ But women observed that Heinz was wrong. They observed that instead of stealing he could have tried other solutions (threatening or payment in installments?) to convince the Pharmacist.
- ✓ Gilligan however attributed the decision by women as context-oriented and not on the basis of rules ranked in the order of priority.

THEORIES ABOUT RIGHT ACTION (ETHICAL THEORIES)

6. **Discuss in details the various theories about right action. (Nov/ Dec 2021) Discuss in detail about various ethical theories and their uses (May/ June, Nov/Dec2016)**

   Uses and Criteria

   The ethical theories are useful in many respects.

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

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

   1. The theory must be clear and (coherent) formulated with concepts that are logically

connected.

2. It must be internally consistent, i.e., none of its principles conflicts with any other

- Each person is entitled to the most extensive amount of liberty compatible with an equal amount for others,

- Differences in social power and economic benefits are justified only when they are likely to benefit everyone, including members of the most disadvantaged groups.

- The first principle is of prime importance and should be satisfied first. Without basic liberties other economic or social benefits cannot be sustained for long.

- The second principle insists that to allow some people with great wealth and power is justified only when all other groups are benefited. In the business scenario, **for example**, the free enterprise is permissible so far it provides the capital needed to invest and prosper, thereby making job opportunities to the public and taxes to fund the government spending on the welfare schemes on the poor people.

- **C.W.D. Ross**, the British philosopher introduced the term *prima facie duties*, which means duties might have justified exceptions. In fact, most duties are prima facie ones; some may have obligatory or permissible exceptions.

- Ross assumed that the prima facie duties are intuitively obvious (self-evident), while fixing priorities among duties.

- He noted that the principles such as 'Do not kill' and 'protect innocent life' involve high respect for persons than other principles such as, 'Do not lie' (less harmful). This theory is criticized on the fact, that the intuitions do not provide sufficient guideline for moral duty.

- He has listed various aspects of Duty Ethics that reflect our moral convictions, namely:

    1. Fidelity: duty to keep promises.

    2. Reparation: duty to compensate others when we harm them.

    3. Gratitude: duty to thank those who help us.

    4. Justice: duty to recognize merit.

    5. Beneficence: duty to recognize inequality and improve the condition of others.

    6. Self-improvement: duty to improve virtue and intelligence.

    7. Non-malfeasance: duty not to injure others.

3. Rights Theory

- Rights are entitlement to act or to have another individual act in a certain way.

- Minimally, rights serve as a protective barrier, shielding individuals from unjustified infringement of their moral agency by others.

- For every right, we have a corresponding duty of non-interference.

- The RIGHTS approach to ethics has its roots in the 18th century philosopher **Immanuel Kant**, who focused on the individual's right to choose for oneself.

- According him, what makes human beings different from mere things is, that people have dignity based on their ability to choose freely what they will do with their lives, and they have a fundamental moral right to have these choices respected.

- People are not objects to be manipulated; it is a violation of human dignity to use people in ways they do not freely choose. Other rights he advocated are:

1. *The right to access the truth*: We have a right to be told the truth and to be informed about matters that significantly affect our choices.

2. *The right of privacy*: We have the right to do, believe, and say whatever we choose in our personal lives so long as we do not violate the rights of others.

3. *The right not to be injured*: We have the right not to be harmed or injured unless we freely and knowingly do something to deserve punishment or we freely and knowingly choose to risk such injuries.

4. *The right to what is agreed*: We have a right to what has been promised by those with whom we have freely entered into a contract or agreement.

D. *Human rights*: Human rights are explained in two forms, namely liberty rights and welfare rights. Liberty rights are rights to exercise one's liberty and stresses duties on other people not to interfere with one's freedom. The four features of liberty rights (also called *moral rights*), which lay the base for Government Administration, are:

1. Rights are natural in so far as they are not invented or created by government.

2. They are universal, as they do not change from country to country.

3. They are equal since the rights are the same for all people, irrespective of caste, race, creed or sex.

4. They are inalienable i.e., one cannot hand over his rights to another person such as selling oneself to slavery.

4. The Virtue Theory

- This emphasizes on the character rather than the rights or duties. The character is the pattern of virtues (morally-desirable features).

- The theory advocated by Aristotle, stressed on the tendency to act at proper balance between extremes of conduct, emotion, desire, attitudes to find the golden mean between the extremes of 'excess' or 'deficiency'.

- The examples shown below illustrate the theory: On the other hand, the Virtue Theory proposed by **Mac In tyre**, highlighted on the actions aimed at achieving common good

and social (internal) good such as social justice, promotion of health, creation of useful and safe technological products and services.

- Five types of virtues that constitute responsible professionalism, namely public-spirited virtues, proficiency virtues, team-work virtues, self-governance virtues, and cardinal virtues.

5. Self-realization Ethics Define ethical Egoism. Nov 2023

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

6. Justice (Fairness) Theory

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

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

7. **Explain in detail the traits of Self Interest, Customs and Religions[Nov/Dec 2022]**
   SELF-INTEREST

- Self-interest is being good and acceptable to oneself.
- It is pursuing what is good for oneself. It is very ethical to possess self-interest. As per utilitarian theory, this interest should provide for the respect of others also.
- Duty ethics recognizes this aspect as duties to ourselves. Then only one can help others. Right ethicist stresses our rights to pursue our own good.
- Virtue ethics also accepts the importance of self-respect as link to social practices. In Ethical Egoism, the self is conceived in a highly individualistic manner.
- It says that every one of us should always and only promote one's own interest. The ethical egoists do not accept the well-being of the community or caring for others. However this self-interest should not degenerate into egoism or selfishness, i.e., maximizing only own well in the pursuit of self-interest.
- The ethical egoists hold that the society benefits to maximum when

(a) The individuals pursue their personal good

(b) The individual organizations pursue maximum profit in a competitive enterprise.

- This is claimed to improve the economy of the country as a whole, besides the individuals. In such pursuits, both individuals and organizations should realize that independence is not the only important value.

- We are also interdependent, as much as independent. Each of us is vulnerable in the society. Self-respect includes recognition of our vulnerabilities and interdependencies. Hence, it is compatible with caring for ourselves as well as others.

- Self-interest is necessary initially to begin with. But it should be one of the prime motives for action; the other motive is to show concern for others, in the family as well as society. One's self-interest should not harm others.

- The principles of 'Live and let (others) live', and 'reasonably fair competition' are recommended to professionals by the ethicists.

CUSTOMS

- Ethical Pluralism: Various cultures in our pluralistic society lead to tolerance for various customs, beliefs, and outlooks.

- Accordingly ethical pluralism also exists. Although many moral attitudes appear to be reasonable, the rational and morally concerned people cannot fully accept any one of the moral perspectives. There are many varied moral values, which allow variation in the understanding and application of values by the individuals or groups in their everyday transactions.

- It means that even reasonable people will not agree on all moral issues and professional ethics.

Ethical Relativism: According to this principle, actions are considered morally right when approved by law or custom, and wrong when they violate the laws or customs.

- The deciding factor is the law or the customs of the society. Should we accept the principle of relativism or not? A few reasons to accept this are explained in the following paragraphs:

1. Laws appear to be objective ways for judging values. The laws and customs tend to be definite, clear and real, but not always. Further moral reasons allow objective criticism of laws, as being morally lacking.

   ✓ **For example,** the Apartheid laws of South Africa violated the human rights of the native Africans. No legal protection was available for native citizens for a long time. Now, of course, these laws have been repealed.

2. Ethical relativism assumes that the values are subjective at the cultural level. Moral standards

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also vary from culture to culture.

- ✓ The objectivity is supported by the existing laws of that society. The relative morality accepted, supports the virtue of tolerance of differences among societies.

- ✓ This argument is also not fully acceptable. As per ethical relativism, the actions and laws of the Nazis and Hitler who vowed on Anti-Semitism and killed several million Jews would be accepted as right.

3. Moral relationalism or moral contextualism: According to this, the moral judgments must be made in relation to certain factors, which may vary from case to case.

- ✓ The morally important factors for making judgments include the customs and laws. The virtue ethicists hold that the practical wisdom should prevail upon assessing the facts and in the judgment.

- ✓ This principle was accepted by the early anthropologists because they had a specific tendency to over-stress the scope of moral difference between cultures.

- ✓ The human sacrifices and cannibalism were accepted. But the modern anthropologists insist that all cultures shall exhibit the virtue of social welfare and safety against needless death or physical or mental harm.

- ✓ Moral differences were based on the circumstances and facts and not on the difference in moral attitudes.

- ✓ For example, the pharaohs buried the live attendants along with their dead king with the belief that they would continue to serve the king in his afterlife.

RELIGION

- Religions have played major roles in shaping moral views and moral values, over geographical regions. Christianity has influenced the Western countries, Islam in the Middle-East countries, Buddhism and Hinduism in Asia, and Confucianism in China.

- Further, there is a strong psychological link between the moral and religious beliefs of people following various religions and faiths. Religions support moral responsibility.

- They have set high moral standards. Faith in the religions provides trust and this trust inspires people to be moral. The religions insist on tolerance and moral concern for others.

- Many professionals who possess religious beliefs are motivated to be morally responsible. Each religion lays stress on certain high moral standards.

- For example, Hinduism holds polytheistic (many gods) view, and virtues of devotion and surrender to high order. Christianity believes in one deity and emphasizes on virtues of Love, Faith, and Hope.

- Buddhism is non-theistic and focuses on compassion and Islam on one deity and adherence of ishan (piety or pursuit of excellence) and prayer. Judaism stresses the virtue of 'tsedakah' (righteousness).

- But many religious sects have adopted poor moral standards, e.g., many religious sects do not recognize equal rights for women. The right to worship is denied for some people.

- People are killed in the name of or to promote religion. Thus, conflicts exist between the 'secular' and religious people and between one religion and another. Hence, religious views have to be morally scrutinized.

8. **Explain in detail about professional and professionalism. [April 2014](April/ May 2016, 2018) (OR) Discuss the motives for professionalism and the models for professional Engineers (Nov/Dec 2018) Give a detail note on models of Professional engineers. (A/M 2022) What is profession? List and explain three characteristics of profession. Nov 2023What is professionalism? Explain any four professional roles. Nov 2023**

- ✓ A profession is defined as any occupation /job/ vocation that requires advance expertise (skills and knowledge), self-regulation and concerted service to the public good. It brings a high status, socially and economically.

- ✓ **Professional** relates to a person or any work that a person does on profession and which requires expertise (skills and knowledge), self-regulation and results in public good. The term professional means a '**person**' as well as a '**status**'.

- ✓ **Professionalism** is the status of a professional which implies certain attitudes or typical qualities that are expected of a professional. According to Macintyre, professionalism is defined as the services related to achieving the public good, in addition to the practices of profession.

- ✓ The characteristics of a profession are:

    1. **Advanced expertise:**

       Many professions require sophisticated skills (do-how) and theoretical knowledge (know-how and why). Formal education, training, continuing education, updating are needed.

    2. **Self-regulation:**

       Professional societies play important role in setting standards for admission to profession, rafting codes of ethics, enforcing standards of conduct and representing the profession before the public and the Government.

    3. **Public Good:**

The occupation provides some important public good, by concerted efforts to maintain ethical standards.

- ✓ **For example:** A physician promotes health, a Lawyer protects the legal rights and an Engineer provides a product or a project for use by the public towards their health, welfare and safety.
- ✓ Teaching is also claimed as a profession as it helps shaping and training the minds of the students, young as well as old.
- ✓ Some argue that jobs such as carpenters, barbers, porters, and drivers are to be recognized as profession.
- ✓ A thorough analysis of the activities expected of these jobs is to made and checked with explanation of the requirements of a profession before being deciding it as profession.
- ✓ **For example**, having been engaged for driving one's vehicle is not a profession. But an ace driver who is engaged by a travel agency to drive different types of cars for tourists extends courtesy to the customers, requires education, expertise (a valid driving license) and respect to the public.
- ✓ His job may be termed as a profession. A mercenary is not a professional as he acts against public good.

ENGINEERING AS SOCIAL EXPERIMENTATION

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics –A Balanced Outlook on Law

PART – B

Engineering as Experimentation:

1. **(i) Explain how codes of ethics guides an engineer in the professional behavior.(May/ June 2016)**

    (ii) Discuss briefly the role of industrial standards. (Apr/May 2015)[Nov/Dec 2022]

    (i) Code of ethics in professional behaviour:

    ✓ **Integrity**–Members shall'straightforward and honest in all professional and business relationships.'

    ✓ The ACCA Rulebook (and the IESBA Code) goes on to state that integrity implies not merely honesty, but fair dealing and truthfulness.

    ✓ **Objectivity –** Members shall not allow bias, conflicts of interest or the undue influence of   Others to compromise their professional or business judgement.

    ✓ **Professional competence and due care** – Members have a continuing duty 'to maintain professional knowledge and skill at a level required to ensure that clients or employers receive competent professional service'. Members shall 'act diligently in accordance with applicable technical and professional standards when providing professional services'.

    ✓ **Confidentiality –** Members shall respect the confidentiality of information 'acquired as a result of professional and business relationships', and shall not disclose any such information to third parties 'without proper and specific authority or unless there is a legal or professional right or duty to disclose'. Similarly, confidential information acquired as a result of professional and business relationships shall not be used to the personal advantage of members or third parties.

    ✓ **Professional behaviour –** Members shall comply with relevant laws and regulations and shall avoid any action that may discredit the profession.

    Also professional behaviour includes

    - self-interest,

    - self-review,

- advocacy,

- familiarity, and

- intimidation

(ii) Role of industrial standards

- ✓ Standardization primarily means setting up standards or measuring sticks by which extent, quality, quantity, value performance or service may be gauged or determined.

- ✓ In simple terms, it is the process of defining and applying conditions required to ensure that a given range of requirements can be easily met with minimum changes in an economical and reproducible manner by the latest technique.

- ✓ It facilitate

    - Interchangeability

    - Accuracy in measurement

    - Ease of handling

    - Prevention of harms

    - Decreased production costs

    - Quality products.

- ✓ Standards are framed by the companies for in-house useSometimes standards are also prescribed as parts of laws and official regulations.

2. **Compare and contrast engineering experiments with standard experiments with suitable examples. (Apr/May2005, May/June 2006, April/May 2011) (Nov/Dec 2017) (April/May 2018) (Nov/Dec 2018) (A/M 2022)[Nov/Dec 2022]**

Purpose of knowing the differences:

- ✓ Help to highlight engineer's special responsibilities

- ✓ Aids our thinking about moral responsibilities of all those engaged in engineering.

Comparison and contrast

- ✓ The engineering experiments involve human beings as experimental subjects.

- ✓ In fact clients and customers have more control, as they own the authority of that project.

- ✓ So here the experimental subjects say clients or end user are out of the engineering experimenter's control, unlike standard experiments.

- Scientific experiments are conducted to gain knowledge, while "engineering projects are experiments that are not necessarily designed to produce very much knowledge.

Experimental control

- In standard experiments, experimental control involves selecting members for two different groups randomly.
- The first group members are given the special, experimental treatment, whereas the members of others group are not given that special treatment.
- Even both the groups are subjected to the same environment;
- The group that was not given the special treatment is called as the 'control group'

Informed Consent

- The experimenters whose experiments involve human subjects have moral and legal obligations to inform about all the relevant facts about the experiments to the person who participates in experiments.
- They have to get 'informed consent' from the people involved in the experiments.

Informed consent consists of two main elements: knowledge, and voluntariness:

- Knowledge: the human subjects (i.e., the persons who participate in experiments) should be given all the information to make a reasonable decision.
- Voluntariness: the human subjects should show their willingness to be a human model voluntarily.

Valid consent

- The 'informed consent' can be called as 'valid consent' when the following three conditions are met:
- The consent should be given voluntarily and not by any force.
- The consent should be based on all the information needed for a rational person to make a reasonable decision.
- Moreover, the information should be presented in a clear and easily understandable manner.
- The consenter should be competent enough to process the information and to make rational decisions.

3. Discuss the ethical issues involved in challenger case study. (Apr/May 2015, Apr/May 2008)

- The Space Shuttle Challenger disaster occurred on January 28, 1986, when the NASA Space Shuttle orbiter Challenger (OV-099)(mission STS-51-L) broke apart 73 seconds into its flight, leading

to the deaths of its seven crew members, which included five NASA astronauts and two Payload Specialists.

✓ The spacecraft disintegrated over the Atlantic Ocean, off the coast of Cape Canaveral, Florida, at 11:39 EST. Disintegration of the vehicle began after an O-ring seal in its right solid rocket booster (SRB) failed at liftoff.

✓ The O-ring was not designed to fly under unusually cold conditions as in this launch.

✓ Its failure caused a breach in the SRB joint it sealed, allowing pressurized burning gas from

✓ within the solid rocket motor to reach the outside and impinge upon the adjacent SRB aft field joint attachment hardware and external fuel tank.

✓ This led to the separation of the right-hand SRB's aft field joint attachment and the structural failure of the external tank. Aerodynamic forces broke up the orbiter.

Ethical issues:

✓ The crew compartment and many other vehicle fragments were eventually recovered from the ocean floor after a lengthy search and recovery operation.

✓ The exact timing of the death of the crew is unknown; several crew members are known to have survived the initial breakup of the spacecraft.

✓ The shuttle had no escape system, and the impact of the crew compartment with the ocean surface was too violent to be survivable.

4. (i) Explain in detail the powerful support and proper role of law in engineering. (Nov/Dec 2017)

(ii) Explain the concept, 'engineering as social experimentation' with examples.(Nov/Dec 2015) (A/M2023)

(i)Powerful support and proper role of law in engineering

✓ The laws can authoritatively establish reasonable minimal standards of professional conduct.

✓ The laws can provide a self-interested motive for most of the people and corporations to comply

✓ The laws act as a protector of ethical engineers.

✓ That is, they serve as a powerful support and defense to those who wish to involve in ethical activities.

✓ Engineering law (or law in engineering) is the empirical study of the application of laws and legal strategy in engineering.

✓ Applied law aims to explain how law interacts within industry.

- ✓ The current school of thought within the academic community of lawyers and engineers is the pragmatic paradigm.
- ✓ Commonly, professionals have a Bachelor in Engineering and a Bachelors in Law, and increasingly commonly a Masters of Business Administration.
- ✓ Pragmatic application of laws means the empirical study of how a corporate legal frameworks should be adopted.

(ii)'Engineering as social experimentation'

- ✓ Experimentation plays an important role in the process of designing the product.
- ✓ When it is decided to change a new engineering concept into its first rough design, preliminary tests or simulation should be conducted.
- ✓ Using formal experimental methods, the materials and methods of designing are tried out.
- ✓ These tests may be based on more detailed designs.
- ✓ The test for designing should be evolved till the final product produced. With the help of Feedback of several tests, further modification can be made if necessary.
- ✓ Beyond these tests and experiments, each engineering project has to be viewed as an experiment.
- ✓ Example: Software engineering and test: – How much? Expensive! – Sophistication level of software, how deployed matters – Historical information about software test is used to know how much is needed now – But your project helps contribute knowledge to how much is needed later!

5. **Discuss the different roles played by codes of ethics set by professional societies.(May/June2016) (Nov/Dec 2005, May/June 2006, Nov/Dec 2006, Apr/May 2008, Apr/May 2011 May/June 2012) [Nov/Dec 2022](A/M 2023) Explain the limitation of code of ethics. Nov 2023 Explain four essential roles 'code of ethics'. Nov 2023 Discuss the role played by the codes of ethics set by the professional societies. Nov 2023**

Codes of ethics

- ✓ The primary aspect of codes of ethics is to provide the basic framework for ethical judgment for a professional.
- ✓ The codes of ethics, also referred as codes of conduct, express the commitment to ethical conduct shared by members of a profession.
- ✓ In other words, these codes furnish common, agreed-upon standards for professional conduct.

Fundamental Canons of code of ethics

- ✓ Engineers, in the fulfillment of their professional duties, shall
- ✓ Hold paramount safety, health and welfare of the public in their performance of their professional duties.
- ✓ Perform services only in areas of their competence.
- ✓ Issue public statements only in an objective and truthful manner
- ✓ Act in professional matters for each employer or client as faithful agents or trustees.
- ✓ Avoid deceptive acts in the solicitation of professional employment.

Different roles and functions of codes of ethics

- ✓ Code of ethics support engineers
    - ▪ Codes give positive support to those seeking to act ethically,
    - ▪ Give engineers some group backing in taking stands on moral issues,
    - ▪ Serve as legal support for engineers criticized for living up to work related professional obligations.
- ✓ Code of ethics help in deterrent and discipline
    - • Serve as formal basis for investigating unethical conduct,
    - • If investigation is possible motive for not acting immorally is exempted,
    - • Investigations require paralegal proceedings to get the truth without violating personal rights of those being investigated.

6. Give the code of ethics promulgated by Institute of Electrical and Electronics Engineers. (Nov/Dec 2005)

IEEE – code of ethics

- ✓ IEEE - Institute of Electrical and Electronics Engineers
- ✓ Formed in 1963 as a merger of AIEE (American Institute of Electrical Engineers) and IRA (Institute of Radio Engineers)
- ✓ World's largest professional/technical organization for advancement of technology Majority of IEEE societies are in areas of ECE.

IEEE membership requires adherence to IEEE code of ethics:

- ✓ To accept responsibility in making decisions consistent with the safety, health and welfare of the public,

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and to disclose promptly factors that might endanger the public or the environment;

- ✓ To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist;

- ✓ To be honest and realistic in stating claims or estimates based on available data;

- ✓ To reject bribery in all its forms.

- ✓ To improve the understanding of technology, its appropriate application, and potential consequences

- ✓ To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations;

- ✓ To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others;

- ✓ To treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin;

- ✓ To avoid injuring others, their property, reputation, or employment by false or malicious action

- ✓ To assist colleagues and co-workers in their professional development and to support them in following this code of ethics.

    - ❖ Engineers, scientists and technologists affect the quality of life for all people in our complex technological society.

    - ❖ In the pursuit of their profession, therefore, it is vital that IEEE members conduct their work in an ethical manner so that they merit the confidence of colleagues, employers, clients and the public.

7. (i) What is meant by informed consent when bringing an experimental product to the market?

(ii) How ethical codes provide discipline among the engineers? (May/June 2014)

(i)Informed consent when bringing an experimental product to the market

- ✓ Informed consent is a process for getting permission before conducting a healthcare intervention on a person.

- ✓ A health care provider may ask a patient to consent to receive therapy before providing it, or a clinical researcher may ask a research participant before enrolling that person into a clinical trial.

- ✓ Informed consent is collected according to guidelines from the fields of medical ethics and research ethics.

- ✓ An informed consent can be said to have been given based upon a clear appreciation and understanding of the facts, implications, and consequences of an action.
- ✓ To give informed consent, the individual concerned must have adequate reasoning faculties and be in possession of all relevant facts.
- ✓ Impairments to reasoning and judgment that may prevent informed consent include basic intellectual or emotional immaturity, high levels of stress such as PTSD or a severe intellectual disability, severe mental illness, intoxication, severe sleep deprivation, Alzheimer's disease, or being in a coma.
- ✓ Some acts can take place because of a lack of informed consent.
- ✓ In cases where an individual is considered unable to give informed consent, another person is generally authorized to give consent on his behalf, e.g., parents or legal guardians of a child (though in this circumstance the child may be required to provide informed assent) and conservators for the mentally ill.

(ii)Ethical codes provide discipline among the engineers

- ✓ Hold paramount the safety, health, and welfare of the public.
- ✓ Perform services only in areas of their competence.
- ✓ Issue public statements only in an objective and truthful manner.
- ✓ Act for each employer or client as faithful agents or trustees.
- ✓ Avoid deceptive acts.
- ✓ Conduct themselves honorably, responsibly, ethically, and lawfully so as to enhance the honor, reputation, and usefulness of the profession.
- ✓ If engineers' judgment is overruled under circumstances that endanger life or property,
- ✓ they shall notify their employer or client and such other authority as may be appropriate.
- ✓ Engineers shall approve only those engineering documents that are in conformity with
- ✓ applicable standards.
- ✓ Engineers shall not reveal facts, data, or information without the prior consent of the client or employer except as authorized or required by law or this Code.
- ✓ Engineers shall not permit the use of their name or associate in business ventures with any
- ✓ person or firm that they believe is engaged in fraudulent or dishonest enterprise.
- ✓ Engineers shall not aid or abet the unlawful practice of engineering by a person or firm.

8. **What are the different roles and functions of code of ethics? (Nov/Dec2015) What are industrial standards? List the purpose of industrial standards. Nov 2023**

   Industrial standards

   - ✓ Standards are framed by companies for their in-house use i.e., internal use, and byprofessional associations and trade associations for industry-wide use.

   - ✓ Sometimes standards are also prescribed as parts of laws and official regulations.

   Standard facilitate:

   - ✓ Interchangeability;

   - ✓ Accuracy in measurement;

   - ✓ Ease of handling;

   - ✓ Prevention of harms;

   - ✓ Decreased production cost;

   - ✓ Quality products, etc.

   Industrial standards consists of:

   - ✓ Explicit specifications

   - ✓ When followed with care ensure interchangeability and

   - ✓ Quality,

     Examples tyre sizes, load ratings , computer languages

   Standards are established by

   - ✓ Companies for in-house use,

   - ✓ Professional associations for industry wide use,

   - ✓ Prescribed as laws and

   - ✓ Regulations which may frequently arise from lack of adherence to voluntarystandards.

   Benefits of standards are

   - ✓ Help manufacturers, client , public,

   - ✓ Reduces over emphasis on brand names,

   - ✓ Preserve competitiveness,

   - ✓ Small manufacturers can compete,

- ✓ Ensure quality

- ✓ International standards are becoming a necessity.

9. **What is Milgram's experiment with"accountability"? What conclusions were drawn? Discuss.**

   (May/June 2012)

   Accountability

   - ✓ Understood in the narrow sense of being blameworthy for misdeeds

   - ✓ Refers to be willing to submit to one's actions to moral scrutiny and be open to assessments of others.

   - ✓ Involves willingness to give moral reasons for one's conduct when required.

   Need and objective of Milgram's experiment

   - ✓ Submission to an employer's authority creates a narrow sense of accountability for consequences of their actions

   - ✓ Subjects would come to lab thinking they were to participate in a memory / learning test

   Experimenter and Learner

   - ✓ Experimenter was an authoritative figure representing scientific figure

   - ✓ Orders shock to learners

   - ✓ Learners are those willing to take memory and learning test and willing to follow orders of authority figure.

   'Set up' referred to as

   - ✓ Whenever learner failed in a memory test electric shock to be given, shocks to be increased for each memory failure, no real shocks.

   Result observed in Milgram's experiment:

   - ✓ When separated by glass window, more than half were willing to follow orders (450volts), inspite of seeing learner strapped in chair.

   - ✓ Same result when subjects heard learner's screams and protest

   - ✓ When both were in same room number of subjects willing to continue shock reduced by half.

   Interpretation of the results

   - ✓ Strong psychological tendency in people to be willing to abandon personal accountability.

   - ✓ Ascribed all initiative to legitimate authorityCloser the physical proximity more difficult it becomes

to deprive oneself of personal accountability.

10. **Write about the role of law in engineering and what are the problems with law in engineering.**

   (Nov/Dec 2017)(A/M 2023) Discuss the problem associated with laws in engineering and Enumerate

   the proper role of law engineering. Nov 2023

   Legal regulations are becoming more numerous and more specific

   - ✓ Effort taken to deregulate various spheres of our lives
   - ✓ But in crisis we hear 'there ought to be a law'.

   Problems of ethical conduct in us due to

   - ✓ We live under rule of law
   - ✓ Decisions on ethical issues delegated to law
   - ✓ Still problems in ethical conduct will occur in practical issues by those supporting deregulation.

   Minimal compliance

   - ✓ Caused by existence of minutely detailed rules
   - ✓ When companies search for loop holes when violating law
   - ✓ Refer to standards with readymade specifications adopting handbook mentality and repetition of mistakes.

   Examples for minimal compliance.

   - ✓ Titanic- why enough life boats to accommodate all when British norms required only a minimum
   - ✓ Tampa bay bridge- why not designed with possible collisions in mind
   - ✓ But code required only wind loads (not impact loads) to calculate horizontal forces.

   Laws are updated continually – outcome:

   - ✓ By continually updating the laws with further specifications may be counterproductive Law lags technology
   - ✓ Danger of overburdening rules and regulators.

   Non laws

   - ✓ Public have a sense of security by new laws
   - ✓ Non laws are laws without enforceable sanctions.

- ✓ Serve as window dressing, a false display of caring
- ✓ Law may have unreasonable provisions

What do good laws do

- ✓ Effectively enforced good laws produce benefits
- ✓ Minimal standards of professional conduct are established
- ✓ Provide self interested motive for corporations
- ✓ Serve as powerful support who wish to act ethically
- ✓ Referring a law one can act as a responsible engineer.

11. What is research ethics. Discuss the models of research ethics with suitable examples.

(April / May 2018) (Nov/Dec 2018)

- ✓ Research that involves human subjects or participants raises unique and complex ethical, legal, social

  and political issues. Research ethics is specifically interested in the analysis of ethical issues that are

  raised when people are involved as participants in research.

- ✓ **Research Ethics** is a world-wide set of principles governing the way any **research** involving

  interaction between the researcher and other humans or human tissue or data relating to humans, is

  designed, managed and conducted.

- ✓ Assuming that the purpose of research ethics review is to support the ethical conduct and

  Dissemination of good quality research, a question can be raised concerning whether ethics review of

  research really improves the practice of researchers.

- ✓ Specifically, we might distinguish the activities that go on as part of the review process from

  those activities that constitute the data collection phase of the research, and ask under what conditions the

  former have a positive impact on the latter.

- ✓ Two different models of ethics review can be distinguished, term them 'compliance' and

  'reflexivity'-based reviews.

- ✓ Compliance-based models of review require researchers to show how they are complying with

  a

  given set of rules or protocols for research.

- ✓　　　Reflexivity-based models require researchers to articulate the ethical issues involved in their research

  and to explain and justify the way in which they plan to manage them.

- ✓　　　It is suggested here that there is reason to think that reflexivity-based models of ethics review are

  more likely to have a positive effect on the practice of social science research than compliance-based reviews.

Compliance based review:

- ✓　　　One way that ethics committees affect practice is by enforcing changes to protocols. The committee

  has a notion of how things should be done, and they tweak the research protocols in order to ensure that the research fits in with that thinking.

- ✓　　　This approach is most consistent with a conception of ethics committees as applying discretion in the application of a set of rules to research. Theresearchers then have to comply with the rules set. In effect researchers have little choice about this.

- ✓　　　This sort of review model will improve researchwhere the following conditions are met:
  - The ethical problems that arise can be fixed by a protocol tweak
  - The researchers do what they say to the committee that they are going to do
  - The committee understand the research well enough to make sensible suggestions
  - The rules laid down make sense in the context where the research is proposed to take place.

Reflexivity focused review:

- ✓　　　Sharon Gewirtz has argued for what she terms 'ethical reflexivity' in sociological analysis, particularly where such analysis is intended to influence policy. She takes ethical reflexivity to consist of the following:

  1. Making explicit the ethical values and principles that inform our analyses.
  2. Justifying them where possible or at least where necessary.
  3. Weighing up the potential ethical implications of our work

- ✓　　　To be ethically reflexive in this way would require us to:

  (1) Make explicit the ethical values and principles governing our research in data collection,

analysis and dissemination;

(2) Justify them, as well as the practical steps we take (or propose to take) with respect to making our practice match those principles; and,

(3) Weigh up the potential ethical implications of the data collection, analysis and dissemination of the work.

✓ The committee is a disinterested body with expertise in ethics and experience of research which exists

in order to:

- Ensure that researchers are able to offer a proper ethical justification for what they are doing
- offer practical advice on research and dealing with ethical assumptions
- reveal and test researchers' assumptions about what they are doing;
- help the internalization of reflective practice by enforcing it, and
- Where appropriate, problematize areas of practice where researchers might otherwise be complacent.

Post-protocol review:

✓ Committees may receive applications from the same people on repeated occasions. In some circumstances it would be appropriate for a committee to undertake an additional ethics review after the end of the data collection phase of a project, in conjunction with the researchers, in order to see what lessons can be learned.

✓ That is, on this view ethics review is part of improving practice on an ongoing basis, rather than a

One-off check of a protocol. (This would clearly be most appropriate for committees embedded within institutions)

12. **What are codes of ethics? State and explain the functions of codes of ethics and objections to codes of ethics.(Nov/Dec 2017)**

Code of ethics:

✓ The primary aspect of codes of ethics is to provide the basic framework for ethical judgment

for a professional.

✓ The codes of ethics, also referred as codes of conduct, express the commitment to ethical conduct shared by members of a profession.

✓ In other words, these codes furnish common, agreedupon standards for professional conduct.

✓ The codes of ethics express the ethical principles and standards in a coherent, comprehensive, and accessible manner.

✓ The codes of ethics also define the roles and responsibilities of professions.

✓ The codes of ethics help the professionals to apply moral and ethical principles to the specific situations encountered in professional practice.

Functions of Code of ethics:

✓ Inspiration and Guidance;

✓ Support for responsible conduct;

✓ Deterring and disciplining unethical professional conduct;

✓ Education and promotion of mutual understanding;

✓ Contributing to a positive public image of the profession;

✓ Protecting the status quo and suppressing dissent within the profession; and

✓ Promoting business interests through restraint of trade.

Objecvtions to code of ethics:

✓ Codes of ethics are broad guidelines, restricted to general and vague wording/ phrases.

✓ The codes cannot be applied directly to all situations.

✓ Engineering codes often have internal confects, which may result in moral dilemmasThe codes cannot

serve as the final moral authority for professional conduct.

✓ The proliferation of codes of ethics for different branches of engineering gives a feeling that ethical codes are relative.

13. **What is the importance of codes of ethics? Explain in detail. (Nov / Dec 2021) (or) Discuss the importance of duty ethics and virtue in engineering profession. (A/M 2022)**

Introduction

- ✓ One of the trademarks of contemporary professions is code of ethics.

- ✓ Codes of ethics are propagated by various professional societies.

- ✓ These codes of conduct are guidelines or specific group of professionals to help them perform their roles;

  to know how to conduct themselves, and to know how to resolve various ethical issues.

- ✓ These codes convey the rights, duties, and obligations of the members of the profession.

- ✓ Now we shall examine the codes of ethics of professional engineering societies, in detail, in the following sections.

What Are Codes of Ethics?

- ✓ The primary aspect of codes of ethics is to provide the basic framework for ethical judgment for a professional.

- ✓ The codes of ethics, also referred as codes of conduct, express the commitment to ethical conduct shared

  by members of a profession. In other words, these codes furnish common, agreed-upon standards for professional conduct.

- ✓ The codes of ethics express the ethical principles and standards in a coherent, comprehensive, and accessible manner.

- ✓ The codes of ethics also define the roles and responsibilities of professions.

- ✓ The codes of ethics help the professionals to apply moral and ethical principles to the specific situations encountered in professional practice.

- ✓ These codes are based on five canons i.e., principles of ethics-integrity, competence, individual responsibilities, professional responsibilities, and human concerns.

- ✓ It is also to be noted that ethical codes do not establish new ethical principles. They use only those

  principles that are already well established and widely accepted in society.

- ✓ Thus the codes of ethics create an environment within a profession where ethical behavior is the norm.

Positive Roles of Codes of Ethics (Functions of codes of ethics)

The codes of ethics propagated by professional societies play a variety of roles. They are:

1. Inspiration

2. Guidance

3. Support for responsible conduct

4. Deterring and disciplining unethical professional conduct.

5. Education and promotion of mutual understanding

6. Contributing to a positive public image of the profession

7. Protecting the status quo and suppressing dissent within the profession; and

8. Promoting business interests through restraint of trade

1. Inspiration

✓ Ethical codes provide a positive inspiration for the professionals to exercise their obligations effectively.

✓ These codes inspire the engineers to apply moral principles under the various conflicting situations.

2. Guidance

✓ The ethical codes provide guidelines for achieving the obligations of professionals.

✓ These codes also provide specific guidelines, which tell how to apply the code to the unique situations.

3. Support

✓ The ethical codes offer positive and potential support to engineers to perform their duties in ethical

manner.

✓ Al times, the codes con serve as legal support for those engineers who are tangled in professional obligations and conflicts.

4. Deterrence and Discipline

✓ The ethical codes can be used for deterring and disciplining unethical professional conduct.

✓ These codes are also considered as the formal basis for investigating unethical conduct.

5. Education and Mutual Understanding

- ✓ The ethical codes can be used in educational institutions and other places for emphasizing the importance

  of moral issues and values.

- ✓ They are also useful to encourage a shared understanding among professionals, the public, and government organizations concerning the moral responsibilities of engineers.

6. Contributing to the Profession's Public Image

- ✓ The ethical codes can confer a positive image to the public of an ethically committed profession.

- ✓ The codes enable the engineers to serve the public more effectively.

7. Protecting the Status Quo

- ✓ The codes institute ethical conventions. These ethical conventions can promote a minimum, acceptable level of ethical conduct.

- ✓ The codes can also suppress the dispute within the profession.

8. Promoting business interests

- ✓ The codes of ethics promote business interests through restraint of trade.
- ✓ They help in facilitating morally feasible business dealings to the professionals.

Note: Some of the reputed engineering societies that have published codes of ethics are

1. American Society of Mechanical Engineers (ASME),

2 American Society of Civil Engineers (ASCE);

3 Institute of Electrical And Electronics Engineers (IEEE);

4. The institution Of Engineers (India);

5. National Society of Professional Engineers (NSPE), and

6. American institute Of Chemical Engineers (AIChE)

Codes and the experimental nature of engineering

- ✓ The perspective of engineering as social experimentation provides some useful clues in prioritizing and raking the various functions of the ethical codes.

- ✓ The supportive function of engineering codes is viewed as the primary important function. Because the supportive function of engineering codes enable the engineers to express their views freely,

especially

about safety to those affected by engineering projects.

- ✓ The disciplinary function of engineering codes is recognized as the secondary important function.

  Because this function is essential in engineering as it ensures all clear and enforceable rules.

- ✓ The guidance, inspirational, and educational functions of engineering codes are also important.

  Because they promote mutual understanding among those affected by them.

- ✓ The functions of protecting the status quo and promoting only business interests in violation of free competition should be avoided altogether.

Thus it should be kept in mind that codes are only a small part of engineering ethics. Also codes are not sacred wit and should always be open to critical examination. The codes should be applied with caution, keeping in view their limitations.

Limitations of Codes (Objections to codes)

The four major limitations of codes of ethics are as follows:

- ✓ Codes of ethics are broad guidelines, restricted to general and vague working/phrases. The codes

  Cannot be applied directly to all situations. Also it is impossible to predict all aspects of moral problems that can arise in a complex, dynamic engineering profession.

- ✓ Engineering codes often have internal conflicts, which may result in moral dilemmas. That is, several entries in codes overlap with each other, so there are Internal conflicts. But the codes do not provide a method for resolving these conflicts.

- ✓ The codes cannot serve as the final moral authority for professional conduct

- ✓ The proliferation of codes of ethics for different branches of engineering gives a feeling that ethical

  codes are relative

PROPOSALS FOR PROMOTING ETHICS

The specific ways in which engineering societies can promote ethics are as follows.

- ✓ Engineering societies act as the forum debating what should be in a professional code of ethics.

- ✓ Engineering societies could promote ethics by establishing awards for engineers and employers who

  exhibit commendable ethical conduct.

- ✓ Engineering societies could assist and protect engineers who have been discharged because they stick

  on to high ethical standards.

- ✓ Engineering societies could establish 'ethics helplines' or other services whereby engineers could seek advice on difficult ethical issues.

- ✓ Engineering societies could investigate charges of wrongdoing by members because of malice or false information.

- ✓ Engineering societies could also promote the discussion and understanding of engineering ethics by depicting on the application of their codes.

14. **How can an engineer become a responsible experimenter? Explain in detail. (Nov / Dec 2021)**

    Explain 'Engineers as Responsible Experimenters'. Nov 2023

    What are the general responsibilities of engineers to society?

    - ✓ Engineers are primarily considered as technical enablers or facilitators, rather than being the sole experimenters.

    - ✓ Engineer's responsibility is shared with management, the public and others.

    - ✓ The other unique responsibilities of engineers include monitoring projects. Identifying risks, providing customers and clients the required information to make reasonable decisions.

    - ✓ While exercising engineering duties, the engineers should display the virtue of being morally responsible persons.

    What are the general features of morally responsible engineers?

    There are four characteristic features of morally responsible engineers, from the perspective of engineering as social experimentation. They are:

    1. **A conscientious commitment to live by moral values:** The primary duty of morally responsible engineers is to protect the safety of human subjects and respect their right of consent.

    2. **A comprehensive perspective:** The morally responsible engineers should have a constant awareness

of the experimental nature of the project, forecasting of its possible side effects, and a decent effort to monitor them.

3. Autonomy: The morally responsible engineers are the one who are personally motivated to have a dedicated involvement in all aspects of a project.

4. Accountability: The morally responsible engineers should be accountable for the results of their projects.

Now let us examine the above four elements, in detail in the following sections.

1. Conscientiousness:

✓ Conscientiousness means commitment to live according to certain values. It implies consciousness.

✓ Engineers have to be sensitive to a range of moral values and responsibilities, which are relevant in a given situation.

✓ Also engineers should have the willingness to develop the skill and apply the effort needed to reach the best balance possible among various considerations.

✓ Open eyes, open ears, and an open mind are required to evaluate a given situation, its implications and to determine who are involved or affected.

✓ The notion 'engineering as social experimentation' reiterates the role of engineers as guardians of the public interest. That is, engineers have to guard the welfare and safety of those affected by engineering projects.

✓ Moreover, the welfare and safety of the public should not be over looked in the hunt for new knowledge, the chase for profits, a narrow obedience to rules, etc.,

✓ Thus the engineering social experimentation should be restricted by the participant's consent-voluntary and informed consent.

2. Relevant Information:

✓ Conscientiousness is impossible without relevant factual information.

✓ Engineers have to show the commitment to obtain and property gauge all the information related to meeting one's moral obligations.

✓ The two general ways of losing perspective on the context and the nature of one's wok are given below.

1. To grasp the context of one's work, one should be aware of the moral Implications of that work.

Example: There is nothing wrong for an engineer to try to design a good signal transmitter. But if he

ignores the fact that his design will be used for the potential illegal purposes, than he is said to be showing a lack of moral concern.

2. To shift the responsibilities and blames to others in the organizations.

Example: A firm manufactures a product with some minor design flaws, so the sales of the product are poor. In this circumstance, the design engineers throw the blame on the production or sales department.

- ✓ The above two cases illustrate the situations of lack of moral concern.
- ✓ Thus, conceiving engineering as social experimentation, it is important that engineers act as responsible agents. The responsible agents require
- ✓ Imaginative forecasting of possible bad side effects;
- ✓ The development of an attitude of 'defensive engineering' and 'preventive Technology'
- ✓ Careful monitoring of projects, and
- ✓ Respect for people's right to give informed consent.

3. Moral Autonomy

- ✓ As we have already discussed, the moral autonomy is the ability to think critically and independently about moral issues and apply this moral thinking to situations that arise during the professional engineering practice.
- ✓ It is understood that an individual's personality depends on the integration of his moral beliefs and attitudes. Because the moral beliefs and attitudes lead to a committed action.
- ✓ As an experimenter, an engineer has to undergo an extensive and updated training to form his identity as a professional.
- ✓ Regarding engineering as social experimentation can help to restore a sense of autonomous participation and a sense of personal involvement with one's work.
- ✓ Now a days, the magnitude of moral autonomy to be experienced by engineers is highly influenced by the attitude of company's management.
- ✓ When there is a threat for engineer's moral autonomy, then engineers can look for moral support from their professional societies and other outside organizations.

4. Accountability

- ✓ The term accountability means being responsible, liable, and answerable or obligated.

- In proper terms, the accountability refers to the general tendency of being willing to submit one's actions to any type of moral scrutiny and be responsive to others assessments.
- It involves a willingness to present morally convincing reasons for one's actions and conduct.
- Morally responsible people are expected to accept moral responsibility for their actions.
- According to Stanely Milgram, people are not willing to accept personal accountability when placed under authority.
- There exist a lot of differences and separations between casual influence and moral accountability in all professions including engineering.
- Because of modem engineering practices, the complications in accepting one's moral accountability further worsened. Some of these situations are explained below:
- Modern engineering projects involve teamwork, in which each member contributes a small portion of the project, so this practice has narrowed the sense of personal accountability
- The modern organizations are based on the principle of 'division of work. Due to this division of work, the personal accountability also stretched within hierarchies of authority.
- Mostly there is a pressure to move on to a new project before completing the current one. This practice also lessons the sense of personal accountability of the project.
- Finally, a preoccupation with legalities in a time of proliferating malpractice lawsuits.

SAFETY, RESPONSIBILITIES AND RIGHTS

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – OccupationalCrime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination

PART-B

1. What is meant by conflict of interest? Distinguish between General and professional conflicts of interest and discuss the various types of conflicts of interest.(Nov/Dec 2017)

Definition:

- ✓ A **conflict** of **interest** (COI) is a situation in which a person or organization is involved in multiple **interests**, financial or otherwise, and serving one **interest** could involve working against another.

- ✓ The presence of a **conflict** of **interest** is independent of the occurrence of impropriety.

- ✓ A widely used definition is: "A conflict of interest is a set of circumstances that creates a risk that professional judgement or actions regarding a primary interest will be unduly influenced by a secondary interest."

- ✓ *Primary interest* refers to the principal goals of the profession or activity, such as the protection of clients, the health of patients, the integrity of research, and the duties of public officer.

- ✓ *Secondary interest* includes personal benefit and is not limited to only financial gain but also such motives as the desire for professional advancement, or the wish to do favours for family and friends.

- ✓ These secondary interests are not treated as wrong in and of themselves, but become objectionable when they are believed to have greater weight than the primary interests.

- ✓ Conflict of interest rules in the public sphere mainly focus on financial relationships since they are relatively more objective, and quantifiable, and usually involve the political, legal, and medical fields.

Types:

1. Actual Conflict of interest:

- ✓ This refers to the situation where the objectivity is lost in decision making, and the inability to discharge the duty to the employer.

- ✓ t is the result of weaker judgment and service. A Civil Engineer working in the PWD has a financial interest in a contracting company, which has submitted a bid for the construction of a bridge.

- ✓ There may be a variety of outside interest. But the conflict arises when the outside interest influence or threatens the professional judgment in serving the employer or clients.

2. Apparent Conflict of interest:

- ✓ It is explained by the following example. An Engineer is paid on a percent of the cost of the design and there is no incentive for him to cut the costs.

- ✓ In this situation, it appears that the engineer makes the design more expensive in order to get larger commission from him.

- ✓ This situation leads to doubting the engineer interest and ability for professional judgement.

3. Potential Conflict of interest:

- ✓ There are situations where the interest of an employee extends beyond the current employer and into the interest on one's spouse, relative or friend.

- ✓ The interest changes into intimacy and subsequent non-moral judgement against the interest of the employer and in favor of the outsider or even a potential competitor.

   (a) Favorable Contact:

- ✓ When an Engineer's spouse is working for a contractor or vendor, a conflict does not arise.

- ✓ But if the Engineer is to give to a sub-contract to the contractor or purchase order to the supplier, the conflict arises.

- ✓ This arises even when the engineer has partial or substantial stock holding in the business of that contractor or supplier

   (b)**Bribe and Gift**

✓ The conflict arises when accepting large gifts from the suppliers. Bribe is different from a gift. The following table shows a comparison of the nature of bribe and gift. Codes of ethics do not encourage even gifts, but employees have set forth flexible policies.

✓ Government and company policies generally ban giftsmore than a nominal value (>Rs.1000?) An additional thumb rule is that the acceptance of gift should not influence one's judgment on merit.

(*c*) Moonlighting

✓ It is a situation when a person is working as employee for two different companies in thespare time.

✓ This is against the right to pursue one's legitimate self-interest.

✓ It will lead toconflict of interests, if the person works for competitors, suppliers or customers, whileworking under an employer.

✓ Another effect of moonlighting is that it leaves the personexhausted and harms the job performance in both places.

(*d*) Insider Information

✓ Another potential conflict of interest is when using 'inside' information to establish a business venture or get an advantage for oneself or one's family or friends.

✓ The information may beeither of the parent company or its clients or its business partners, e.g., engineers mightinform the decision on the company's merger with another company or acquisition or an innovative strategy adopted.

✓ In such cases, their friends get information on stock holdingand decide on trading their stocks to sell or buy quickly, so that gain more or prevent a loss.

✓ For example, in WorldCom USA, the insider information was used to manipulate and sell a large amount of stock holding by the Director, upon knowing that the government hasdeclined to admit their product.

Differences between General and Professional conflict of interest:

Professional conflict of interest:

✓ It is the situation where the professional has an interest that, if pursued, might prevent him from meeting his obligations to his employers or clients.

✓ For example, An Electrical Engineer working in the state Electricity Board may have a financial interest ina company which supplies electrical instruments. If the Engineer decides on bid for supply of instruments a clear case of conflict of interest exists.

3

General conflict of interest:

- ✓   A student has to clear four arrears subjects in the supplementary examination. But he finds that the time available is sufficient only to study three subjects.

- ✓   This is a situation of conflicting interest where he has two or more desires that can be fulfilled under the given circumstances. But there is no moral problem involved in pursuing all subjects.

- ✓   But in case of Professional conflict of interest, there is possibility of all the conflicting interest thereby inviting a moral problem

2. **What are intellectual property rights? Explain the elements of intellectual property rights in detail and list out its benefits. (Nov/Dec 2017) (or) Explain how elements of intellectual property rights benefits people. (A/M 2022) [Nov/Dec 2022](A/M 2023) what is patent? List the types. Also list out requirements for granting patent. Nov 2023**

Intellectual Property (IP):

- ✓ It is the information and original expression that derives its original value from creative ideas and is with a commercial value.

- ✓ IP permits people to have fully independent ownership for their innovationsand creativity, like that of own physical property.

- ✓ This encourages the IP owners towards innovationand benefit to the society. It is an asset that can be bought or sold, licensed, and exchanged. It I intangible i.e., it cannot be identified by specific parameters.

- ✓ The agreements with World Trade Organization (WTO) and Trade-Related aspects of Intellectual Property System (TRIPS) have been adopted effective from January 2005.

- ✓ Besides the minimum standards set for protection of IP rights, appropriate laws framed by the member countries are expected to reduce distortions and barriers for and promote the international trade.

- ✓ The global IPR system strengthens protection, increases the incentives for innovation, and raises returns on international technology transfer. However, it could raise the costs of acquiring new technology and products, shifting the global terms of trade in favor of technology producers.

Need for Protection of IP

- ✓ IP plays an essential role to stabilize and develop the economy of a nation. This protection actually stimulates creativity, research, and innovation by ensuring freedom to individuals and organizations to benefit from their creative intellectual investments.

The IP serves many purposes, namely

4

(*a*) It prevents others using it,

(*b*) Prevent using it for financial gain,

(*c*) Prevent plagiarism

(*d*) Fulfill obligation to funding agency. ICICI Bank has advanced loan against IP as security to Shopper's Stoppe, New Delhi, and

(*e*) Provides a strategy to generate steady income.

Some of the challenges in the acquisition of IP are:

(*a*) Shortage of manpower in the industry. Educational institutions can play a vital role in providing the same.

(*b*) High cost of patenting and lengthy procedure. This was being considered by the Government and a simpler and faster procedure is expected, and

(*c*) Lack of strong enforcement mechanism.

Types and Norms

The agreements establish norms and conditions for the following instruments of intellectual properties:

1. Patents

- Patent is a contract between the individual (inventor) and the society (all others). Patents protect legally the specific products from being manufactured or sold by others, without permission of the patent holder.

- Patent holder has the legally-protected monopoly power as one's own property.

- The validity is 20 years from the date filing the application for the patent. It is a territorial right and needs registration. The Patent (Amendment) Act 2002 guarantees such provisions.

- Patent is given to a product or a process, provided it is entirely new, involving an inventive method and suitable for industrial application.

- While applying for a patent, it is essential to submit the documents in detail regarding the problem addressed, its solution, extent of novelty or innovation, typical applications, particulars of the inventor, and the resources utilized. Inventions are patentable and the discoveries are not.

2. Copyright

- The copyright is a specific and exclusive right, describing rights given to creators for their literary and artistic works.

- This protects literary material, aesthetic material, music, film, sound recording, broadcasting, software, multimedia, paintings, sculptures, and drawings including maps, diagrams, engravings or photographs.
- There is no need for registration and no need to seek lawyer's help for settlement.
- The life of the copyright protection is the life of the inventor or author plus 50 years.
- Copyright gives protection to particular expression and not for the idea.

Copyright is effective in

    (*a*) Preventing others from copying or reproducing or storing the work,

    (*b*) Publishing and selling the copies,

    (*c*) Performing the work in public, commercially

    (*d*) To make film

    (*e*) To make translation of the work and

    (*f*) To make any adaptation of the work. Copying the idea is called 'plagiarism' and it is dealt with separately.

- ✓ Can software be protected through copyright? Indian copyright Act amended in 1984 included the rights of in a computer program as literary work. Many countries protect software as a copyright.
- ✓ Some holds the view that copyright is not the right type of protection for software.
- ✓ They held that the patents and trade secrets are more appropriate forms of protecting software.
- ✓ While trade secret is the most conventional form of protection of software, in the recent years, both patents and copyrights are adopted to protect software.11 Copyright (Amendment) Act 1999, India ensures fair dealing of broadcasting through the internet.
- ✓ The concerns of Book industry, Music Industry, Film and Television Industry, Computer Industry and Database Industry are sufficiently met by this updated Act.

3. Trademark

- ✓ Trademark is a wide identity of specific good and services, permitting differences to be made among different trades. It is a territorial right, which needs registration. Registration is valid initially for 10 years, and renewable.

- ✓ The trademark or service mark may be registered in the form of a device, a heading, a label, a ticket, a letter, a word or words, a numeral or any combination of these, logos, designs, sounds, and symbols.
- ✓ Trademark should not be mistaken for a design, e.g., the shape of a bottle in which a product is marketed, cannot be registered as a trademark. Trademarks Act 1999 made in compliance with TRIPS agreement, provides further details.

There are three functions of trademark:

1. Just as we are identified by our names, good are identified by their trademarks. For example, the customer goes to the shop and asks for Lux soap. The word 'Lux' is a trade mark. In other words it shows the origin or source of the goods.

2. The trademark carries with it an inherent indication or impression on the quality of goods, which indirectly demonstrates that it receives the customer's satisfaction.

3. The trademark serves as silent sales promoter. Without a trademark, there can be no advertisement. In other words, it serves as a medium for advertising the goods.

- ✓ The marks should be distinctive i.e., it should be able to distinguish from one good to the other.
- ✓ The terms used for trademarks are usually generic, descriptive, and suggestive. Some of the term which are not distinctly distinguishing the goods or services from others, are called generic term and are eligible for protection under trademarks.
- ✓ The descriptive term should clearly indicate or convey the specific purpose, function, physical characteristic and the end use of the product. Relatively, the suggestive

3. Discuss the testing strategies' for safety with suitable examples. Mention the difficulties in assessing the personal risks. (April/May 2018) /Assessment of safety and risk is helpful in improving the workers morality, work culture and work atmosphere (A/M 2023)

Testing strategies:

The various testing strategies for safety are as follows:

1. **Scenario Analysis:** This test starts from a given event and then studies the different consequences that might develop from it.

2. **Failure Modes and Effects Analysis:** This approach systematically examines the failure modes of each component without focusing on causes or relationships among the elements of a complex system.

3. **Fault tree analysis:** This approach proposes a system failure and then traces the events back to possible causes at component level.

4. **Event tree analysis:** This is the reverse of the fault tree analysis. This analysis is very useful in identifying a potentially hazardous situation in a plant.

1. Scenario Analysis:

✓ This is the most common method of analysis. Starting from an event, different consequences are studied. This is more a qualitative method.

✓ For example, a disaster recovery plan, for an organization is discussed. When the probability and size of loss (indicating possibility and financial significance, respectively) are both high, risk exists.

✓ On the other hand, risk is not associated with very low probability of occurrence, or with losses that under any other circumstances would be considered "affordable". But there is a gray area between probability/loss combinations that are truly risky, and those that are not. This reflects the fact that the boundary between risky and non-risky events is fuzzy, not exact.

✓ To assess the risk faced by the organization, the planner matches the probability and loss characteristics of various exposures to one's intuition of risk.

✓ This exposure analysis can be most effectively carried out using 'loss scenarios'. A scenario is a synopsis of events or conditions leading to an accident and subsequent loss.

✓ Scenarios may be specified informally, in the form of narrative, or formally using diagrams and flow charts.

Steps for Risk Assessment

1. What can go wrong that could lead to an outcome of hazard exposure? (Identification and characterization of risk)

2. How likely is this to happen? (Quantification of risk, likelihood, and magnitude)

2. Failure Modes and Effects Analysis FMEA:

✓ Failure Mode and Effect Analysis (FMEA), also known as risk analysis, is a preventive measure to systematically display the causes, effects and possible actions regarding observed failures.

✓ The objective of FMEA is to anticipate failures and prevent them from occurring. FMEA prioritizes failures and attempts to eliminate their causes.

✓ FMEA is an engineering technique used to define, identify and eliminate known and/or potential failures, problems, errors which occur in the system, design, process and service before they reach the customer.

✓ FMEA is a 'before - the – event' action and is done when existing systems/products/processes are changed or redesigned.

✓ FMEA is a never-ending-process improvement tool.

Types of FMEA

The several types of FMEA include:

1. *System FMEA* –Analyze components, subsystem and main system in early stage of design.
2. *Design FMEA* –Analyze the products/parts before they are released to manufacturing.
3. *Process FMEA* –Focuses on manufacturing and assembly processes.
4. *Service FMEA* –Analyzes service industry processes before they are released to impact the customer.
5. *Equipment FMEA*
6. *Maintenance FMEA*
7. *Concept FMEA*
8. *Environmental FMEA*

However in practice, all the above types can be broadly categorized into two types. They are:

1. **Design FMEA**
   - Design FMEA involves the analysis of the potential failures of product or service due to component or subsystem unreliability.
   - Design FMEA is to establish priorities based on expected failures and severity of those failures.

2. **Process FMEA**
   - Process FMEA involves a failure analysis of a manufacturing process.
   - The process FMEA is used primarily to identify areas of critically of control and to emphasize the design and more reliable process.
   - It may be noted that equipment, service, and environmental FMEA are slightly modified versions of process FMEA.

Benefits of FMEA

Properly used FMEA provides several benefits. FMEA is used to:

- ✓ Improve product/process reliability and quality
- ✓ Increase customer satisfaction
- ✓ Early identification and elimination of potential product/process failure modes.
- ✓ Prioritize product/process deficiencies.
- ✓ Capture engineering/organization knowledge.
- ✓ Document and track the actions taken to reduce risk.
- ✓ Provide focus for improved testing and development.
- ✓ Minimize late changes and associated cost.
- ✓ Act as catalyst for teamwork and idea exchange between functions.

Inputs for preparation of FMEA

1. **People Inputs:** The FMEA methodology is a team effort. The FMEA team should have assembly engineer, service engineer, manufacturing engineer, materials engineer, quality engineer, suppliers and the customer.

2. **Data Inputs:** The data inputs needed to prepare FMEA are product and process specifications, reliability data, customer priority data, process variability data, process descriptions and inspection data

Stages of FMEA (FMEA methodology)

The FMEA methodology has four stages. They are:

Stage 1: Specifying possibilities

(i) Functions (ii) Possible Failure modes   (iii) Root causes (iv) Effects

(v) Detection/Prevention

Stage 2: Quantifying risk

(i) Probability of cause   (ii) Severity of effect

(iii) Effectiveness of control to prevent cause (iv) Risk priority number (RPN)

Stage 3: Correcting High Risk Causes

(i) Prioritizing work   (ii) Detailing action (iii) Assigning action responsibility

(iv) Check points on completion

Stage 4: Re-evaluation of risk

(i) Recalculation of risk priority number

3. Fault-tree Analysis

✓ This is a qualitative method and was originated by Bell Telephones. It is technology-based deductive logic.

✓ The failure (undesirable event) is initially defined, and the events (causal relationships) leading to that failure are identified at different components level.

✓ This method can combine hardware failures and human failures

4. Event Tree Analysis: Features of event tree analysis [Nov/Dec 2022]

✓ This method illustrates the sequence of outcomes which may arise after the occurrence of a selected initial event. This method uses inductive logic.

✓ IT is mainly used for consequence analysis and in identifying the potential hazards existing situation in the system. It is the inverse of FTA. FTA allows one to proceed back in time from possible catastrophic accidents to examine the components of sequences with probability of failure.

✓ But ETA allows the observer to proceed forward in time from potential component failure to final accident.

Personal Risk:

✓ Assessing the involuntary personal risk is not an easy task.

✓ For example, a group residing near the cement plant is exposed to a lot of risk. If suppose a cement plant or refinery was to come up in the area where group already reside, they will object the proposal.

✓ The adequacy of compensation amount cannot be fixed reasonably. How to estimate the rupee value of an individual human being?

✓ For example, a person may be a father to his young ones, husband to his beloved wife, son to his aged parents, friends to the needy, and as well as guardian to his pet dogs.

✓ There are persons who dared to serve people in dire straits, in spite of the risky situations where their lives are in stakes.

✓ For example, Mahatma Gandhi served people during NavakaliYatra when dangers were present all over. For such saviors there was no personal risk.

✓ However any of the following methodologies may be adopted to assess quantitatively the personal risk.

  1. To assess the voluntary activities. (Life Insurance policy taken)
  2. To assess the degree of occupational hazard (dust, radiation and asbestosis) and its effect on health.
  3. To determine Loss of senses such as sight (eyes), hearing (ears) and loss of limbs (immobility by the loss/damage to organs or disfigurement of the limbs or body)
  4. To predict the loss of earning capability, especially due to physical disability and
  5. To get assistance by trained arbiters.

4. **'Safety in a commodity comes with a price.' Substantiate with explanation. Discuss how the knowledge of risk is always better for safety with suitable examples. (April/May 2018)(part –C, Nov/Dec 2018)**

   'Safety in a commodity comes with a price':

✓ Safety should never be treated as a commodity. However, it's a hard notion to avoid in a world in which commoditization runs rampant.

✓ Today, products can move from concept to creation so rapidly that even if it's the first of its kind, it won't be for long, as competitors quickly come to market with similar goods in a matter of days, if not weeks.

- ✓ The risk of commoditization is not specific to consumer goods manufacturers. It is also a very real challenge for safety product manufacturers in the oil and gas industry.
- ✓ Increasingly, safety solutions are less separated in terms of quality and performance than ever before.
- ✓ Consequently they run the risk of being treated as commodities as products flood the market and the only perceived differentiator is price. But, can you really put a price on safety?
- ✓ Absolute safety is never possible to attain and safety can be improved in an engineering product only with an increase in cost.
- ✓ On the other hand, unsafe products incur secondary costs to the producer beyond the primary (production) costs, like warranty costs loss of goodwill, loss of customers, litigation costs, downtime costs in manufacturing, etc.
- ✓ Figure indicates that P- Primary costs are high for a highly safe (low risk) product and S- Secondary costs are high for a highly risky (low safe) product.
- ✓ If we draw a curve T=P+S as shown, there is a point at which costs are minimum below which the cost cannot be reduced.
- ✓ If the risk at Minimum Total Cost Point is not acceptable, then the producer has to choose a lower acceptable risk value in which case the total cost will be higher than M and the product designed.

Knowledge of risk:

- ✓ To assess a risk, an Engineer must first identify it. To identify a risk, an Engineer must know the information about the safety of standard products.
- ✓ Though past experience and historical data provide good information about the safety of standard products, still it is insufficient to completely assess the risk of a product.
- ✓ The past experience and historical data are inadequate to access the risk, because of the following reasons:
    - The information is not freely shared among firms.
    - There are always new applications of old technology that makes the available information less useful.
- ✓ Therefore in order to assess the risk, Engineers and firms should share the information and knowledge about the safety of products freely.

5. Explain in detail about the assessment of safety and risk. (Nov/Dec 2017) List out code of ethics executed by engineer in safety risk and assessment. Nov 2023

✓ It is always a great challenge to Engineers to balance quality and safety against cost. In general, Engineer's tendency is to design and produce high-quality products, but business managers tend to keep the cost down.

✓ Therefore it is necessary to understand the relationship between safety, risk, costs and price.

The relationship between them is given below.

Both low risk and high risk products are costly because,

✓ A product cost may have two elements:

    1. Primary cost of product.

    2. Secondary cost of product

✓ The primary cost of product includes production cost and cost of safety measures involved.

✓ The secondary cost of product involves costs associated with warranty expenses, loss of customer good will, litigation, possible downtime in the manufacturing process etc.

6. Explain in detail about 'safe exit 'and 'risk benefit analysis'.

Explain the procedure in risk benefit analysis and discuss its role in reducing risk with suitable examples. (Nov/Dec 2018, 2021) (or) Explain how the risks are reduced. (A/M 2022) (or) Explain the concept of risk benefit analysis. (A/M 2022)

SAFE EXIT

In the study of safety, the 'safe exit' principles are recommended. The conditions referred to as 'safe exit' are:

		Safety	
		High	**Low**
Risk	**High**	High safety and high risk, High cost and high price Examples: Nuclear plant, Air craft and missiles	Low safety and high risk, Low cost and high price Examples: Automobile
	Low	High safety and Low risk High cost and Medium price Examples: Electrical products, safety valves	Low safety and low risk Low cost and low price Examples: Electronic goods and computers

1 The product, when it fails, should fail safely

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2 The product, when it fails, can be abandoned safely (it does not harm others by explosion or radiation)

3 The user can safely escape the product (e.g., ships need sufficient number of life boats for all passengers and crew; multi-storied buildings need usable fire escapes)

RISK-BENEFIT ANALYSIS

The major reasons for the analysis of the risk benefit are:

1 To know risks and benefits and weigh them each.

2 To decide on designs, advisability of product/project

3 To suggest and modify the design so that the risks are eliminated or reduced

There are some limitations that exist in the risk-benefit analysis. The economic and ethical limitations are presented as follows:

1. Primarily the benefits may go to one group and risks may go to another group. Is it ethically correct?

2. Is an individual or government empowered to impose a risk on someone else on behalf of supposed benefit to somebody else? Sometimes, people who are exposed to maximum risks may get only the minimum benefits. In such cases, there is even violation of rights.

3. The units for comparison are not the same, e.g., commissioning the express highways may add a few highway deaths versus faster and comfortable travel for several commuters. The benefits may be in terms of fuel, money and time saved, but lives of human being sacrificed. How do we then compare properly?

4. Both risks and benefits lie in the future. The quantitative estimation of the future benefits, using the discounted present value (which may fluctuate), may not be correct and sometime misleading.

5. Both risks and benefits may have uncertainties. The esteemed probability may differ from time to time and region to region.

The various techniques involved to reduce risks and to improve safety are as follows:

1. Application of inherent safety concepts in design.

Example: LPG cylinder is provided with frame to protect the valve while handling and facilitate cryogenic storage. A magnetic door catch provides an easy escape for children caught inside the fridge accidentally.

2. Use of redundancy principle in the instrument protection or design.

Example: Use of stand-by device and back-up for computer storage.

2. Periodical monitoring (inspection) and testing of safety system to ensure reliability, e.g., fire extinguishers, 'earth' system in electric circuits are checked periodically.

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4. Issue of operation manuals, training of the operating personnel and regular audits are adopted to ensure that the procedures are understood, followed and the systems are kept in working condition.

5. Development of well-designed emergency evacuation plan and regular rehearsal/drills to ensure preparedness, in case of emergency.

8. What are the safety lessons one can learn from 'The challenger'.

The safety lessons one can learn in the Challenger case are as follows:

1. Negligence in design efforts. The booster rocket casing recovered from earlier flights indicated the failure of filed-joint seals. No design changes were incorporated. Instead of two O-rings, three rings should have been fixed. But there was no time for testing with three rings. At least three rings could have been tried while launching.

2. Tests on O-rings should have been conducted down to the expected ambient temperature i.e., to 20^0F. No normalization of deviances should have been allowed.

3. NASA was not willing to wait for the weather to improve. The weather was not favorable on the day of launch. A strong wind shear might have caused the rupture of the weakened O-rings.

4. The final decision making of launch or no-launch should have been with the engineers and not on the managers. Engineers insisted on 'safety' but the managers went ahead with the 'schedule'.

5. Informed consent: The mission was full of dangers. The astronauts should have been informed of the probable failure of the O-rings (field joints). No informed consent was obtained, when the engineers had expressed that the specific launch was unsafe.

6. Conflict of interest (Risk Vs. Cost): There were 700 criticality-1 items, which included the field joints. A failure in any one of them would have cause the tragedy. No back-up or standby had been provided for these criticality-1 components.

7. Escape mechanism or safe exit should have been incorporated in the craft.

8. Ethical Engineers should have been given awards and encouraged to hold their discretion (moral autonomy), in risky situations and to report to appropriate agency about their views in the interest of public safety.

9. Explain the safety lesson with a case study.

Chernobyl, Near Kiev, Russia (April 1986)

✓ The RBMK (Acronym for water cooled and graphite moderated) reactors were graphite moderated and they use water tubes. A test on the turbine generator was planned to be conducted during a scheduled plant shut-down maintenance. To conduct the test, the power plant output was reduced to 700 MW. But due to a sudden and unexpected demand, the power output has to be raised.

1. To go ahead with the test, the reactor operators had already disconnected the emergency core-cooling system, ignoring the raise in demand situation.

2. Further, a control device was not properly reprogrammed to maintain power at 700-100 MW level.

3. The test was conducted at 200 MW power out-put which is very low for the test. They should have shut down the reactor.

4. The operators blocked all emergency signals and automatic shut-down controls, thus all safety systems were disconnected.

5. The operators raised control rods to increase power output and tried to continue the test. This made the reactor unsafe. The temperature of RBMK reactor increased and the fission rate increased.

6. The test should have been postponed but continued. The reactor core melted and due to the Hydrogen accumulation, the reactor caught fire and the radioactive waste began to spread out in USSR and also Europe.

The people living around were informed after a few hours and were evacuated 12 hours after the explosion. More than 30 workers in the complex lost their lives, while 200 workers sustained burns. About 8000 people lost their lives. The agricultural products were affected due to contaminated radioactive water, for several years.

10. Explain in detail about Human rights.

HUMAN RIGHTS

✓ Human rights are defined as moral entitlements that place obligations on other people to treat one with dignity and respect.

✓ Organizations and engineers are to be familiar with the minimum provisions under the human rights, so that the engineers and organizations for a firm base for understanding and productivity.

Provisions under 'human rights' are as follows:

1. Right to pursue legitimate personal interest
2. Right to make a living
3. Right to privacy
4. Right to property
5. Right of non-discrimination
6. No sexual harassment

Under professional rights, the following provisions are protected:

1. *Right to form and express professional judgment***:**

- ✓ It is also called the *right of professional conscience*.
- ✓ In pursuing professional responsibilities, this empowers one to form and exercisethe professional judgment.
- ✓ Both technical and moral judgments are included. This right isbound by the responsibilities to employers and colleagues.

2. *Right to refuse to participate in unethical activities***:**

- ✓ It is also called the *right of conscientious refusal*.
- ✓ It is the right to refuse to engage in unethical actions and to refuse to do so solelybecause one views that as unethical.
- ✓ The employer cannot force or threaten the employee todo something that is considered by that employee as unethical or unacceptable.
- ✓ Medical practitioners have a right not to participate in abortions. Similarly, theengineers must have a right to refuse assignments that violate their personal conscience, suchas when there exists a threat to human life or moral disagreement among reasonable people.
- ✓ For example,Unethical al and illegal activities that can be refused are: falsifying data, forging documents,altering test results, lying, giving or taking bribe etc. There may be situations, when there isa disagreement or no shared agreement among reasonable people over whether an act isunethical.

3. *Right to fair recognition and to receive remuneration for professional services***:**

- ✓ Engineershave a right to professional recognition for their work and achievements. This includes fairmonetary and non-monetary forms of recognition. It is related to morality as well as self interest.
- ✓ They motivate them to concentrate their energy on jobs and to update their knowledgeand skills through continuing education.
- ✓ This will prevent the engineers from diversion suchas moonlighting or bother on money matters.Many times, the engineers who have laboredto get patents on the organizations are not adequately remunerated.
- ✓ Based on the resourcesof the organization and the bargaining power of the engineers, the reasonable salary or remuneration for patent discovery can be worked out

11. Discuss the faithful agent argument and public service argument of collective with suitable examples.

(Nov/Dec 2018, 2021) What does conflict bargaining arises? Nov 2023

Collective bargaining:

- ✓ Collective bargaining is the bargain by the trade union for improving the economic interests of the worker members. The process includes negotiation, threatening verbally, and declaration of 'strike'. It is impossible to endorse fully the collective bargaining of unions or to condemn. There exist always conflicting views between the professionalism and unionism.

Faithful Agent Argument:

- ✓ Professional societies such as NSPE and IEI refuse to accept the 'collective coercive action' of unionism, holding the principles of professional integrity as right, e.g., as per NSPE code III, i.e., engineers shall not promote their own interest at the expense of the dignity and integrity of the profession.

- ✓ The faithful agent or trustee means executing the assigned task and safeguarding the property and it does not mean to sacrifice the monetary self- interest.

- ✓ The Engineers are said to exhibit a higher standard than self interest, and they are expected to perform an ethical duty to their employers as faithful agent or trustee.

- ✓ The actions of unions are usually against the interests of the employers and they use coercion and force against the employers. These actions are interpreted as unprofessional and disloyal.

- ✓ But Engineers do take part in strikes passively.

- ✓ It does not nullify the right to negotiate for safe, hygienic work conditions and economic benefits collectively.

- ✓ The codes insist that the paramount obligation is to the society as compared to their employers. The duty to the employers is also limited by considerations such as work safety and the right to disobey illegal or unethical activities. After all the employees are also parts of the society.

Public Service Argument:

- ✓ The paramount duty of an Engineer is to serve the public.

- ✓ An union in promoting the self-interest of its members should not go against the interest of the public.

- ✓ **For example,** Government employee's strike, bank associations strike etc.

- ✓ Thus based on the situations, the collective bargaining and its tactic may become unethical.

- ✓ Professional societies can play a great role in promotion and establishment of principles and practices towards fair employment and exploitation. But they cannot function as collective bargaining agents.

- ✓ The collective bargaining cannot be judged as unethical unless we study the cases individually and decide.
- ✓ The collective bargaining is acceptable, but the means should be constructive, persuasive, firm based on mutual understanding, and not destructive, disruptive, and not harming the persons or property.

Collegiality

Define collegiality? What the central elements of collegiality. Nov 2023

- ✓ Collegiality is the relationship between colleagues.

Elements

- ✓ Respect
- ✓ Commitment
- ✓ Connectedness
- ✓ Cooperation

GLOBAL ISSUES

Multinational Corporations–Environmental Ethics–Computer Ethics–Weapons Development– Engineers as Managers–Consulting Engineers–Engineers as Expert Witnesses and Advisors– Moral Leadership–Code of Conduct–Corporate Social Responsibility

ENVIRINMENTAL ETHICS

01. Explain the significance of environmental ethics for an engineer by giving an examples of environmental issue. (Nov / Dec 2021) OR Brief on the importance of Environmental ethics. (A/M 2022)

➢ Most of us are aware of the importance of the environment for our own well-being. Much of our life is spent coping with it, enjoying it, or escaping from it.

➢ Until recently, most of us have not bothered about the impact of our behaviour on the environment.

➢ It seems that we have been content to assume that the environment could and would look after itself.

➢ Therefore the negative impact of our lifestyles on the world around us could be safely ignored or escaped by simply moving on.

➢ The short listed character of this approach is now becoming inescapably obvious.

➢ Acid rain is beginning to have a devastating impact on forests, agriculture, and water resources.

➢ The Great Lakes basin has become a repository for many of the deadliest chemicals source of unlimited, inexpensive energy, has become a source of serious concern on a number counts: the threats of leaks accidents, the as-yet-unsolved problem of storing nuclear wastes, the long-term hazards of uranium mine tailings, and so on.

➢ Our forests and soils, loo, are being severely depleted.

➢ Many species of animal life are extinct or endangered, and our treatment of animals generally has come under increasing critical scrutiny. The list can be extended in definitely

What is meant by Environmental Ethics?

➢ Literally, environmental ethics means conscious efforts to protect an environment and lo maintain its stability from the hazardous pollutants.

➢ Environmental ethic is the study to explore the ethical roots of the environmental movement and to understand what ethics tells us about our responsibility to the environment.

➢ What can environmental ethics can do for us?

➢ Whatever ethics can do for us when applied to non-environmental concerns, environmental ethics can do you when applied to environmental concerns.

Write short notes on Sentient – Centered Ethics, Bio – Centric Ethics, Ecocentric Ethics and Human – Centered Environmental Ethics. Sentient – Centered Ethics

✓ Sentient animals are those which feel pain and pleasure.

✓ This version of Nature entered ethics is advanced by some utilitarians, notably Peter Singer, who says that right action maximizing good for all should include sentient animals as well as humans.

✓ Failure to do so leads discrimination like racism, which is known as "Speciesism".

✓ There is always a dispute as to whether the inherent worth of animals can be equated to human beings or not.

Bio – Centric Ethics

✓ This regards all living organisms as having inherent worth. We should live with the virtue of "reverence to life", as set forth by Albert Schweitzer (1875-1965).

✓ This will enable us to take decisions about when life can be sacrificed.

Eco-centric Ethics

✓ This locates inherent worth in Ecological systems and this approach is different from the other two, as it is not individualistic. This is voiced by Aldo Leopold (1887-1948).

✓ There is another view that eco-centric ethic does not replace socially generated human-oriented duties to family, neighbours and humanity

Human – Centered Environmental Ethics

✓ This is an extension of ethical theories to combat threats to human beings presented by the destruction of nature.

COMPUTER ETHICS:

02. What is meant by computer ethics? State and explain the categories of ethical problems and unethical acts computer as an instrument of unethical behaviour. What is meant by hacking?(Nov/Dec 2017, 2021) or Discuss the ethical issues related to computer ethics. (Nov/Dec 2021)(or) Enumerate on the moral and ethical issues involved in use of computers. (A/M 2022) (A/M 2023)

✓ Computer ethics is defined as (a) study and analysis of nature and social impact of computer technology, (b) formulation and justification of policies, for ethical use of computers.

✓ This subject has become relevant to the professionals such as designers of computers, programmers, system analysts, system managers, and operators.

✓ The uses of computers have raised a host of moral concerns such as free speech, privacy, intellectual property right, and physical as well as mental harm.

✓ There appears to be no conceptual framework available on ethics, to study and understand and resolve the problems in computer technology.

Types of Issues

Different types of problems that are found in computer ethics are as follows:

1. Computer as the Instrument of Unethical Acts

(a) The usage of computer replaces the job positions. This has been overcome to a large extent by readjusting work assignments, and training everyone on computer applications such as word processing, editing, and graphics.

(b) Breaking privacy. Information or data of the individuals accessed or erased or the ownership changed.

(c) Defraud a bank or a client, by accessing and withdrawing money from other's bank account.

2. Computer as the Object of Unethical Act

The data are accessed and deleted or changed.

(a) Hacking: The software is stolen or information is accessed from other computers. This may cause financial loss to the business or violation of privacy rights of the individuals or business. In case of defence information being hacked, this may endanger the security of the nation.

(b) Spreading virus: Through mail or otherwise, other computers are accessed and the files are erased or contents changed altogether. =Trojan horses are implanted to distort the messages and files beyond recovery. This again causes financial loss or mental torture to the individuals. Some hackers feel that they have justified their right of free information or they do it for fun. However, these acts are certainly unethical.

(c) Health hazard: The computers pose threat during their use as well as during disposal.

3. Problems Related to the Autonomous Nature of Computer

(a) **Security risk:** Recently the Tokyo Stock Exchange faced a major embarrassment. A seemingly casual mistake by a junior trader of a large security house led to huge losses including that of reputation. The order through the exchange's trading system was to sell one share for 600,000Yen. Instead the trader keyed in a sale order for 600,000 shares at the rate of one Yen each. Naturally the shares on offer at the ridiculously low price were lapped up. And only a few buyers agreed to reverse the deal! The loss to the securities firm was said to be huge, running into several hundredthousand. More important to note, such an obvious mistake could not be corrected by some of the advanced technology available. For advanced countries like Japan who have imbibed the latest technology, this would be a new kind of learning experience.

(b) **Loss of human lives:** Risk and loss of human lives lost by computer, in the operational control of military weapons. There is a dangerous instability in automated defence system. An unexpected error in the software or hardware or a conflict during interfacing between the two,

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may trigger a serious attack and cause irreparable human loss before the error is traced. The Chinese embassy was bombed by U.S. military in Iraq a few years back, but enquiries revealed that the building was shown in a previous map as the building where insurgents stayed.

(c) In flexible manufacturing systems, the autonomous computer is beneficial in obtaining continuous monitoring and automatic control. Various issues related to computer ethics are discussed as follows:

Computers in Workplace

The ethical problems initiated by computers in the workplace are:

- ✓ Elimination of routine and manual jobs: This leads to unemployment, but the creation of skilled and IT-enabled service jobs are more advantageous for the people.
- ✓ Initially this may require some up gradation of their skills and knowledge, but a formal training will set this problem right. For example, in place of a typist, we have a programmer or an accountant. .
- ✓ Health and safety: The ill-effects due to electromagnetic radiation, especially on women and pregnant employees, mental stress, wrist problem known as Carpel Tunnel Syndrome, and back pain due to poor ergonomic seating designs, and eye strain due to poor lighting and flickers in the display and long exposure, have been reported worldwide.
- ✓ Over a period of long exposure, these are expected to affect the health and safety of the people.
- ✓ The computer designers should take care of these aspects and management should monitor the health and safety of the computer personnel. .
- ✓ Computer failure: Failure in computers may be due to errors in the hardware or software. Hardware errors are rare and they can be solved easily and quickly. But software errors are very serious as they can stop the entire network.
- ✓ Testing and quality systems for software have gained relevance and importance in the recent past, to avoid or minimize these errors.

Property Issues

The property issues concerned with the computers are:

1. Computers have been used to extort money through anonymous telephone calls.
2. Computers are used to cheat and steal by current as well as previous employees.
3. Cheating of and stealing from the customers and clients.
4. Violation of contracts on computer sales and services.
5. Conspiracy as a group, especially with the internet, to defraud the gullible, stealing the identity and to forge documents.

6. Violation of property rights: Is the software a property? The software could be either a Program (an algorithm, indicating the steps in solving a problem) or a Source code (the algorithm in a general computer language such as FORTAN, C and COBOL or an Object code (to translate the source code into the machine language). How do we apply the concept of property here? This demands a framework for ethical judgments.

✓ Property is what the laws permits and defines as can be owned, exchanged, and used. The computer hardware (product) is protected by patents.

✓ The software (idea, expression) is protected by copyrights and trade secrets. But algorithms cannot be copyrighted, because the mathematical formulas can be discovered but not owned.

✓ The object codes which are not intelligible to human beings cannot be copyrighted.

✓ Thus, we see that reproducing multiple copies from one copy of (licensed) software and distribution or sales are crimes.

✓ The open source concepts have, to a great extent, liberalized and promoted the use of computer programs for the betterment of society.

Computer Crime

The ethical features involved in computer crime are:

1. Physical Security

✓ The computers are to be protected against theft, fire, and physical damage. This can be achieved by proper insurance on the assets.

2. Logical security

The aspects related are

✓ (a) The privacy of the individuals or organizations,

✓ (b) Confidentiality

✓ (c) Integrity, to ensure that the modifications of data or program are done only by the authorized persons

✓ (d) Uninterrupted service. This is achieved by installing appropriate uninterrupted power supply or back-up provisions and

✓ (e)Protection against hacking that causes dislocation or distortion. Licensed anti-virus packages and firewalls are used by all computer users to ensure this protection. Passwords and data encryption have been incorporated in the computer software as security measures. But these have also been attacked and bye-passed. But this problem is not been solved completely.

Major weaknesses in this direction are:

✓ (a) The difficulty in tracing the evidence involved and

✓ (b) Absence of stringent punishment against the crime.

The origin of a threat to the Central Government posted from an obscure browsing center, remained unsolved for quite a long time. Many times, such crimes have been traced, but there are no clear cyber laws to punish and deter the criminals.

Privacy and Anonymity

- ✓ The data transmission and accessibility have improved tremendously by using the computers, but the right to privacy has been threatened to a great extent. Some issues concerned with the privacy are listed hereunder:

1. Records of Evidence

- ✓ Service records or criminal records and the details of people can be stored and accessed to prove the innocence or guilt. Records on psychiatric treatment by medical practitioners or hospital, or records of membership of organizations may sometime embarrass the persons in later years.

2. Hacking

- ✓ There are computer enthusiasts who wilfully or for fun, plant virus or .Trojan horses that may fill the disc space, falsify information, erase files, and even harm the hardware.
- ✓ They breakdown the functioning of computers and can be treated as violation of property rights.
- ✓ Some hackers opine that the information should be freely available for everybody. It is prudent that the right to individual privacy in limiting the access to the information on oneself should not be violated.
- ✓ Further any unauthorized use of personal information (which is a property), is to be considered as theft. Besides the individual privacy, the national security, and freedom within the economy are to be respected.

- ✓ The proprietary information and data of the organizations are to be protected so that they can pursue the goals without hindrance.

3. Legal Response

- ✓ In the Indian scene, the Right to Information Act 2005 provides the right to the citizens to secure access to information under the control of public authorities, including the departments of the central government, state governments, government bodies, public sector companies and public sector banks, to promote transparency and accountability of public authorities.
- ✓ Right to information: Under the Act, section 2 (j), the right to information includes the right to

(1) Inspect works, documents, records,

(2) To take notes, extracts or certified copies of documents or records,

(3) Take certified samples of material and

(4) To obtain information in the form of printouts, diskettes, floppies, tapes, video cassettes or in any other electronic mode.

WHAT IS NOT OPEN TO DISCLOSURE?

The following are exempt from disclosure:

1. Information, disclosure of which would prejudicially affect the sovereignty and integrity of India, the security, strategic, scientific or economic interests of the state, relation with, foreign state or lead to incitement of an offence.

2. Information which has been expressly forbidden to be published by any court of law or tribunal or the disclosure of which may constitute contempt of court.

3. Information, the disclosure of which would cause a breach of privilege of Parliament or the State Legislature.

4. Information including commercial confidence, trade secrets or intellectual property, the disclosure of which would harm the Competitive position of a third party, unless the competent authority is satisfied that larger public interest warrants the disclosure of such information.

5. Information available to a person in his fiduciary relationship, unless the competent authority is satisfied that the larger public interest warrants the disclosure of such information.

6. Information received in confidence from foreign government.

7. Information, the disclosure of which would endanger the life or physical safety of any person or identify the source of information or assistance given in confidence for law enforcement or security purposes.

8. Information which would impede the process of investigation or apprehension or prosecution of offenders.

9. Information which relates to personal information the disclosure of which has no relationship to any public activity or interest, or which would cause unwarranted invasion of the privacy of the individual.

10. Notwithstanding anything in the Official Secrets Act 1923 nor any of the exemptions listed above, a public authority may allow access to information, if public interest in disclosure outweighs the harm to the protected interests.

11. Where the Information Officer, intends to disclose any information or record, on a request, which relates to or has been supplied by a third party and has been treated as confidential by that third party, the officer shall give a written notice to such third party of the request and of the fact that the officer intends to disclose the information, and invites the third party to make a submission in writing or orally, regarding whether the information should be disclosed, and such submission of the third party shall be kept in view while taking a decision about disclosure of information: provided that except in the case of trade or commercial secrets

protected by law, disclosure may be allowed if the public interest in disclosure outweighs in importance any possible harm or injury to the interests of such third party. Laws to regulate the access to information are very expensive to enforce and inconvenient to genuine users such as accessing records of people for medical research.

4. Anonymity

✓ Anonymity in the computer communication has some merits as well as demerits. While seeking medical or psychological counselling or discussion (chat) on topics, such as AIDS, abortion, gay rights, the anonymity offers protection (against revealing their identity). But frequently, anonymity is misused by some people for money laundering, drug trafficking and preying upon the vulnerable.

5. Professional Responsibility

✓ The computer professionals should be aware of different conflicts of interests as they transact with other at different levels. The IEEE and Association for Computing Machinery (ACM) have established the codes of ethics to manage such responsibilities.

The Big Net

✓ Almost all the countries are now connected by the internet. But there are no international laws to regulate the issues of freedom of speech, intellectual property rights, privacy rights etc. Another development in this direction is, the universities offering degrees-on-line. Third World is certainly gaining knowledge and education. Even Google.com has announced plans to publish research papers through the World Wide Web. Knowledge is power.

ENVIRONMENTAL ETHICS:

03. State the types of concern for environment by the Engineers. Discuss the approaches to resolve environmental problems. What do professional codes of ethics say about environment?(Nov/Dec 2017)[Nov/Dec 2022](A/M 2023)

✓ Environmental ethics is the study of (a) moral issues concerning the environment, and (b) moral perspectives, beliefs, or attitudes concerning those issues.

✓ Engineers in the past are known for their negligence of environment, in their activities. It has become important now that engineers design eco-friendly tools, machines, sustainable products, processes, and projects.

These are essential now to

(a) To ensure protection (safety) of environment

(b) To prevent the degradation of environment and

(c) To slow down the exploitation of the natural resources, so that the future generation can survive.

- The American Society of Civil Engineers (ASCE) code of ethics, has specifically requires that .engineers shall hold paramount the safety, health, and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of professional duties.
- The term sustainable development emphasizes on the investment, orientation of technology, development and functioning of organizations to meet the present needs of people and at the same time ensuring the future generations to meet their needs.
- Compaq Computer Corporation (now merged with HP) was the leader, who exhibited their commitment to environmental health, through implementation of the concept of Design for environment on their products, unified standards all over the world units, and giving priority to vendors with a record of environmental concern.

Engineers as experimenters have certain duties towards environmental ethics, namely:

- **Environmental impact assessment**: One major but sure and unintended effect of technology is wastage and the resulting pollution of land, water, air and even space. Study how the industry and technology affects the environment.
- **Establish standards:** Study and to fix the tolerable and actual pollution levels.
- **Counter measures**: Study what the protective or eliminating measures are available for immediate implementation
- **Environmental awareness**: Study on how to educate the people on environmental practices, issues, and possible remedies.

Disasters

1. Plastic Waste Disposal

- In our country, several crores of plastic bottles are used as containers for water and oil, and plastic bags are used to pack different materials ranging from vegetables to gold ornaments.
- Hardly any of these are recycled. They end up in gutters, roadsides, and agricultural fields. In all these destinations, they created havoc.
- The worse still is the burning of plastic materials in streets and camphor along with plastic cover in temples, since they release toxic fumes and threaten seriously the air quality.
- Cities and local administration have to act on this, collect and arrange for recycling through industries.

2. e-Waste Disposal

- The parts of computers and electronic devices which have served its useful life present a major environmental issue for all the developing countries including India. This scrap contains highly toxic elements such as lead, cadmium, and mercury.

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- ✓ Even the radioactive waste will lose 89% of its toxicity after 200 years, by which time it will be no more toxic than some natural minerals in the ground.
- ✓ It will lose 99% of its remaining toxicity over the next 30,000 years. The toxic chemical agents such as mercury, arsenic, and cadmium retain toxicity undiminished forever.
- ✓ But these scraps are illegally imported by unscrupulous agencies to salvage some commercially-valuable inputs.
- ✓ Instead of spending and managing on the scrap, unethical organizations sell them to countries such as India.
- ✓ This is strictly in violation of the Basel Convention of the United Nations Environment Program, which has banned the movement of hazardous waste.
- ✓ A recent report of the British Environment Agency has revealed that the discarded computers, television sets, refrigerators, mobile phones, and electrical equipments have been dispatched to India and Pakistan in large quantity, for ultimate disposal in environmentally-unacceptable ways and at great risk to the health of the labour.
- ✓ Even in the West, the electronic junk has been posing problems.
- ✓ Strong regulation including (a) pressure on industries to set up disassembling facilities, (b) ban on disposal in landfill sites, (c) legislation for recycling requirements for these junk and (d) policy incentives for eco-friendly design are essential for our country.
- ✓ The European Union through the Waste Electrical and Electronic Equipment (WEEE) directive has curbed the e-waste dumping by member countries and require manufacturers to implement methods to recover and recycle the components.
- ✓ Indian Government expressed its concern through a technical guide on environmental management for IT Industry in December, 2004.
- ✓ It is yet to ratify the ban on movement of hazardous waste according to the Basel Convention. A foreign news agency exposed a few years back, the existence of a thriving e-waste disposal hub in a suburb of New Delhi, operating in appallingly dangerous conditions.
- ✓ Our country needs regulations to define waste, measures to stop illegal imports, and institutional structures to handle safe disposal of domestic industrial scrap.

3. Industrial Waste Disposal

- ✓ There have been a lot of complaints through the media, on
- ✓ (a) Against the Sterlite Copper Smelting Plant in Tuticorin (1997) against its pollution, and
- ✓ (b) When Indian companies imported the discarded French Warship Clemenceau for disposal, the poisonous asbestos compounds were expected to pollute the atmosphere besides exposing the labor to a great risk, during the disposal. The government did not act immediately. Fortunately for Indians, the French Government intervened and withdrew the ship, and the serious threat was averted!

4. Depletion of Ozone Layer

- ✓ The ozone layer protects the entire planet from the ill-effects of ultraviolet radiation and is vital for all living organisms in this world.

- ✓ But it is eaten away by the Chloro-Fluro-Carbons (CFC) such as Freon emanating from the refrigerators, air conditioners, and aerosol can spray.

- ✓ This has caused also skin cancer to sun-bathers in the Western countries. Further NO and NO_2 gases were also found to react with the ozone.

- ✓ Apart from engineers, the organizations, laws of the country and local administration and market mechanisms are required to take up concerted efforts to protect the environment.

5. Global Warming

- ✓ Over the past 30 years, the Earth has warmed by 0.6 °C. Over the last 100 years, it has warmed by 0.8°C. It is likely to push up temperature by 3^0 C by 2100, according to NASA's studies.

- ✓ The U.S. administration has accepted the reality of global climate change, which has been associated with stronger hurricanes, severe droughts, intense heat waves and the melting of polar ice.

- ✓ Greenhouse gases, notably carbon dioxide emitted by motor vehicles and coal-fired power plants, trap heat like the glass walls of a greenhouse, cause the Earth to warm up.

- ✓ Delegates from the six countries — Australia, China, India, Japan, South Korea and US met in California in April 2006 for the first working session of the Asia-Pacific Partnership on Clean Development and Climate.

- ✓ These six countries account for about half of the world's emissions of climate-heating greenhouse gases. Only one of the six, Japan, is committed to reducing greenhouse gas emissions by at least 5.2 per cent below 1990 levels by 2012 under the Kyoto Agreement.

- ✓ About 190 nations met in Germany in the middle of May 2006 and tried to bridge vast policy gaps between the United States and its main allies over how to combat climate change amid growing evidence that the world is warming that could wreak havoc by stoking more droughts, heat waves, floods, more powerful storms and raise global sea levels by almost a meter by 2100.

6. Acid Rain

- ✓ Large emissions of sulphur oxides and nitrous oxides are being released in to the air from the thermal power stations using the fossil fuels, and several processing industries.

- ✓ These gases form compounds with water in the air and precipitates as rain or snow on to the earth. The acid rain in some parts of the world has caused sufficient damage to the fertility of the land and to the human beings.

Human-Centered Environmental Ethics

- ✓ This approach assumes that only human beings have inherent moral worth duly to be taken care of. Other living being and ecosystems are only instrumental in nature.

- Utilitarianism aims to maximize good consequences for human beings. Most of the goods are engineered products made out of natural resources.

  Human beings have also

  (a) Recreational interests (enjoy leisure through mountaineering, sports, and pastimes),

  (b) Aesthetic interests (enjoy nature as from seeing waterfalls and snow-clad mountains),

  (c) Scientific interests to explore into nature or processes,

  (d) A basic interest to survive, by preservation as well as conservation of nature and natural resources

- Rights ethicists favour the basic rights to live and right to liberty, to realise the right to a live in a supportive environment.

- Further, virtue ethics stresses importance of prudence, humility, appreciation of natural beauty, and gratitude to the Mother Nature that provides everything.

- However, the nature-centered ethics, which ensures the worth of all living beings and organisms, seems to be more appropriate in the present-day context.

- Many Asian religions stress the unity with nature, rather than domination and exploitation. The Zen Buddhism calls for a simple life with compassion towards humans and other animals.

- Hinduism enshrines the ideal of oneness (advaitha) in and principle of ahimsa to all living beings. It identifies all the human beings, animals, and plants as divine.

- The eco-balance is the need of the hour and the engineers are the right experimenters to achieve this.

WEAPONS DEVELOPMENT

04. How much is being spent in Defence expenditure and how Arms Trade gets promoted by private manufacturers of arms?

- Hundreds of billions of dollars, annually, throughout the world, are being spent for military operations.

- 25% of this is spent on just procurement of weapons.

- 17% of these are spent in transactions across countries.

1. Promotion of Arms Deals:

- Krupp, a family of successful arms merchants and manufacturers Armies and navies invested in Krupp's nickel steel armour

- Then Krupp made chrome steel shells that can pierce nickel leading to further investment by military.

- Then they made a high-carbon armour plate that can resist the new shells resulting in more orders

- Then Krupp again produces, "capped shot" with explosive noses which can pierce through the high-carbon armoured plate also Arms deals continued to flourish

2. Vickers and Schneider-another arms manufacturer

- ✓ Supplying arms to Chinese, Japanese and Russians
- ✓ Pointing out the growth of the Japanese navy to Chinese
- ✓ Pointing out the growth of the Chinese to their rivals, Russians
- ✓ Russia – Japanese war in 1905 was useful for the cause of arms manufacturers. Russians lost the war, hence ordered fresh arms for rehabilitation
- ✓ Japanese won the war, but were upset since terrible bloodbath was caused by Russians machine guns on land.

05. Describe the destructive nature and power of weapons and their development?

- ✓ Towards the end of World War II, night raids sometimes on civilian areas were very common
- ✓ The deaths caused by Atom bombs on Hiroshima, Nagasaki were not more than the deaths caused by single air raids in World War II
- ✓ But they were horrible because of their power in rapid delivery of destructive power in immense concentration
- ✓ Hiroshima Bomb – equivalent to 20000T of TNT powder carried on 267 bogies of railroad (2 miles long) for one bomb – again equivalent to 740-B52 bombers to carry this load.
- ✓ USSR exploded Hydrogen bombs in 1960 – 50 & 60 mega ton range for tests with capabilities such as:
- ✓ 2000 to 3000 times powerful than Hiroshima bomb
- ✓ 4000 to 6000 miles long train required to carry an equivalent amount of TNT powder which will take 100 hours to pass any point
- ✓ Will require one and a half million planes +(bombers) to carry the powder Towards the end of cold war
- ✓ USSR had 5800 megatons (9500 warheads on 2700 launchers) and
- ✓ USA had 3300 megatons (10800 warheads on 2000 launchers)

06. Illustrate the involvement of engineers in Weapons Development with examples.

- ✓ 1. Bob is employed by firm manufacturing anti-personnel bombs. These bombs tie up much of the enemy's resources in treating the wounded who survive its explosion (by showering its fragments on to the victims). Though he does not like to be involved in bomb mfr., he justifies himself that someone would have to mfr., them. If he does not, then someone else will. Of course, his family also needs a steady income.
- ✓ 2. A chemical engineer, Mary, got into napalm mfg., when she was promoted. She does not like wars, but she feels that govt. knows better about international dangers. She also knows that

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if she continues doing well in her job, she will again be promoted to work on a commercial product.

- ✓ 3. Ron is a specialist in missile control and guidance. He knows that he was one of the engineers instrumental in keeping any potential enemy in check through his work. At least, there is enough mutual deterrence for a third world war.
- ✓ 4. Joanne is an electronics engineer working also on avionics for fighter planes that are sold abroad. She does not want these planes to be sold to hostile countries. Since she does not have any say on who should be their customers, she even alerts occasionally her journalist friends with information about her work which she feels all public should have. Anyone who is involved in weapons development should be very clear as to his/her motives for being in the industry.

07. Explain the problems of defence industry with examples.

- ✓ **1. Large military build-ups:** $2 billion cost overrun on the development of C5-A cargo plane reported to the public by Ernest Fitzgerald due to poor operating efficiencies in defence industry. He pointed out how large suppliers felt secure in not complying with cost-cutting plans but small contractors were willing. 25% firms hold 50% of all defence contracts and 8 firms conduct 45% of defence research.

- ✓ **2. Technology creep:** The arms are not only growing in size, it is also becoming better. The development of a new missile or one that can target more accurately, by one country, can upset or destabilize a diplomatic negotiation. Sometimes this fad for modernization leads to undesirably consequences. The F15 fighter planes were supposed to be fastest and most manoeuvrable of its kind but most were not available for service due to repairs, defects and lack of spares. Engineers should be bewaring of such pitfalls.

- ✓ **3. Impact of secrecy:** Secrecy poses problems to engineers. Engineers should be aware of the answers to the following questions: Should discoveries of significance to military be informed to govt.? Can they be shared with other researchers, in other countries? Should they be withheld from the scientific and public community? Will the secrecy in weapons development will also serve to hide corruption or their mistakes in defence establishments? Can secrecy help the promotion of weapons systems without criticism or interference from outsiders?

- ✓ **4. Effect on economy:** Every dollar spent on defence produces fewer jobs than what could be provided for by using the resource on other neglected sectors such as education and road development. May be a changeover by training defence engineers to use their designs, processes and techniques to bring about better, competitive civilian products is what would be the most appropriate thing to do now.

08. What are the difficulties in Decommissioning Weapons?

- ✓ Even now, shells (duds or live) which landed about 90 years back during World War I are found by farmers during ploughing. Special bomb disposal squads are being kept busy with hundreds of calls.

- ✓ There are, still more, unexploded and hidden bombs allover the world that fell during World War II

- ✓ Severed limbs and dead bodies are being discovered in lands filled with mines in Cambodia and Vietnam in 1960s and70s.

- ✓ Anti-personnel weapons are found in Afghanistan, Angola, Bosnia, Mozambique, Nicaragua and Somalia.

- ✓ These weapons are easily spread by air but are very difficult and dangerous to detect and remove.

- ✓ About 100 million landmines remain still scattered in the above countries as per estimates by U.S.State dept.

- ✓ Landmines present a serious ethical dilemma to leaders who want to be ethical in wars also

- ✓ Design, mfr., deployment and eventually their disposal is a huge experiment.

- ✓ Widespread ignorance on radiation amongst the public

- ✓ Gas warfare experiments, Anthrax carriers, nuclear weapons all cause both known and unknown problems

- ✓ Engineers dealing with dangerous material should consider both the intended use and also the unintended consequences and also their disposal.

09. Which studies are more useful to 'engineer managers' than even engineering?

- ✓ Richard L.Meehan, a civil Engg. graduate from MIT, was retained by General Electric as a consultant to testify before Nuclear Regulatory Commission about the capability of GE"s nuclear plant in California, U.S.A. to withstand earthquakes. He found, while trying to understand the effect of earthquakes on nuclear plants, that

- His basic study of physics is more useful in studying this area compared to the more advanced studies in Engg.

- His understanding of risk analysis was based not only on probability theory but also on value judgement about safety.

- But more interesting was that understanding people was more important than anything else.

- Person oriented skills are as important to engineers as technical skills.

ENGINEERS AS MANAGERS

10. Why managements prefer to make engineers as managers than non-engineers? / Why engineers find management positions attractive? [Nov/Dec 2022]

- ✓ Engineers undergo the most intensive technical training amongst professionals. But still, many of them move to managerial positions early in their career for which they received no training.
- ✓ Organisations find it easier to teach the business side to engineers than teaching engineering to non-engineers.
- ✓ They also value the quantitative analysis, strong work-ethics, and confidence in problem solving exhibited by engineers.
- ✓ Engineers also prefer the management attractive, since career in management offers better recognition than technical track.

1. **'Managers' responsibility is to conduct business to increase profits'. Discuss.**

- ✓ Nobel laureate Milton Friedman said „The social responsibility of business is to increase its profit. The responsibility of managers is to conduct business in accordance with their stockholders" desires, which generally will be to make as much money as possible while conforming to the basic rules of society, both those embodied in law and those embodied in ethical custom"
- ✓ The ethical custom referred by Friedman means only „refraining from fraud, deception and corruption.
- ✓ But Martin and Schinzinger say that Friedman is not correct in saying that managers" ethics reduce to only responsibility to maximize profits for stockholders.
- ✓ The primary responsibility of managers is to produce product or service while maintaining respect for persons, including customers, employees and public.
- ✓ Ethically, personnel and safety comes first before profits.
- ✓ By definition, compared to charitable institutions, religions, organizations, etc organizations and corporate operate only for profits.
- ✓ But the ultimate goal of managers should be to make valuable products that are also profitable since profit making is one of the conditions to be in business.
- ✓ Good business and sound ethics go together. Hence the moral roles of managers and engineers are complementary and not opposed.
- ✓ Engineer managers have two major responsibilities – promoting and ethical climate and resolving conflicts.

11. Explain how Ethical Climate is promoted in organizations through examples.

There are highly ethical organizations, examples of some of which are given below:

- ✓ Marilyn Hamilton founded Quickie Designs in 1980, who was a teacher and athlete who were paralyzed in hang-gliding accident. A highly mobile and versatile wheel chair was designed weighing 26 pounds, half the weight of chairs that were currently produced. The company grew up within a decade to $65 million in sales. It had a policy of customer sponsored sports events for young people in wheelchairs. It is relatively small (500 strong) and exceptionally committed.

- ✓ Martin Mariette Corp began an ethics program in 1985 emphasizing basic value like honesty and fairness and responsibility for environment and high product quality. They drafted a code of conduct, conducted and ethics workshop for managers and created effective procedures for employees to express their ethical concerns.

- ✓ Texas Instruments (TI) is an example of an ethical large corporation emphasizing on trust, respect for other persons, etc. TI appointed a full time Ethics Director, Carl Skooglund. He surveyed to know the ethical concerns of employees and their awareness. He conducted workshops on ethics, wrote brochures and was directly to all employees through a confidential phone line. Even though they made it clear that unprofessional conduct would not be tolerated, the focus was on supporting ethical conduct than punishing wrong doers.

- ✓ A large defence contractor started an ethics program that was not successful. Higher management viewed the program as a success but the professional employees considered it as a sham/farce for public relations and window dressing. The primary difficulty was the gap between the intentions of top management and the unchanged behaviour of the senior managers.

What steps can be taken to improve the ethical climate by managers?

1. Ethical values and their full complexity are widely acknowledged and appreciated by managers and engineers. Neither profits nor promoting the interests of the organization is neglected but the moral limits on profit-seeking go beyond simply obeying the law and avoiding fraud.

2. The sincere use of ethical language is recognized as a legitimate part of corporate dialogue. This is done either by formulating corporate code of ethics or by including ethical responsibilities in job descriptions at all levels.

3. Top management must set a moral tone, in words, in policies and by personal example. Everyone should be confident that management is serious about ethics.

4. There must be procedures for conflict resolution. Managers should be trained to resolve conflicts and on the other hand, a person should be exclusively made to have confidential discussions about moral concerns.

12. Discuss the ethical role of Engineers in weapon development with suitable examples.

(April/May 2018) (Nov/Dec 2018)

- ✓ Military activities including the world wars have stimulated the growth of technology. The growth of Internet amply illustrates this fact.
- ✓ The development of warfare and the involvement of engineers bring out many ethical issues concerned with engineers, such as the issue of integrity in experiments as well as expenditure in defense research and development, issue of personal commitment and conscience, and the issues of social justice and social health.

Engineers involve in weapons development because of the following reasons:

1. It gives one job with high salary.

2. One takes pride and honor in participating in the activities towards the defense of the nation (patriotic fervor).

3. One believes the he fights a war on terrorism and thereby contribute to peace and stability of the country. Ironically, the wars have never won peace, only peace can win peace!

4. By research and development, the engineer is reducing or eliminating the risk from enemy weapons, and saving one's country from disaster.

5. by building-up arsenals and show of force, a country can force the rogue country, towards regulation. Engineers can participate effectively in arms control negotiations for surrender or peace, e.g., bombing of Nagasaki and Hiroshima led to surrender by the Japanese in 1945.

Examples:

1. Bob is employed by firm manufacturing anti-personnel bombs. These bombs tie up much of the enemy's resources in treating the wounded who survive its explosion (by showering its fragments on to the victims). Though he does not like to be involved in bomb mfr., he justifies himself that someone would have to mfr., them. If he does not, then someone else will. Of course, his family also needs a steady income.

2. A chemical engineer, Mary, got into napalm mfg., when she was promoted. She does not like wars, but she feels that govt. knows better about international dangers. She also knows that if she continues doing well in her job, she will again be promoted to work on a commercial product.

3. Ron is a specialist in missile control and guidance. He knows that he was one of the engineers instrumental in keeping any potential enemy in check through his work. At least, there is enough mutual deterrence for a third world war.

4. Joanne is an electronics engineer working also on avionics for fighter planes that are sold abroad. She does not want these planes to be sold to hostile countries. Since she does not have any say on who should be their customers, she even alerts occasionally her journalist friends with information about her work which she feels all public should have. Anyone who is involved in weapons development should be very clear as to his/her motives for being in the industry.

ENGINEERS AS A CONSULTING ENGINEER

13. Discuss the ethical role of Engineers as a consulting Engineer with suitable examples. (April/May 2018) (Nov/Dec 2018) or Discuss the following in detail of Engineers as consultants (Nov/Dec 2021) Point out any six responsibilities of consulting engineering? Nov 2023

Consulting engineers, in the fulfilment of their professional duties, shall:

1. Hold paramount the safety, health and welfare of the public in the performance of their professional duties.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act in professional matters for each client as faithful agents or trustees.
5. Avoid improper solicitation of professional assignments.

II. Rules of Practice

1. **Consulting engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.**
   a. Consulting engineers shall at all times recognize that their primary obligation is to protect the safety, health, property and welfare of the public. If their professional judgment is overruled under circumstances where the safety, health, property or welfare of the public are endangered, they shall notify their client and such other authority as may be appropriate.
   b. Consulting engineers shall approve only engineering work which, to the best of their knowledge and belief, is safe for public health, property and welfare and in conformity with accepted standards.
   c. Consulting engineers shall not reveal facts, data or information obtained in a professional capacity without the prior consent of the client except as authorized or required by law or these Guidelines.
   d. Consulting engineers shall not permit the use of their name or firm nor associate in business ventures with any person or firm which they have reason to believe is engaging in fraudulent or dishonest business or professional practices.
   e. Consulting engineers having knowledge of any alleged violation of these Guidelines shall cooperate with the proper authorities in furnishing such information or assistance as may be required.
2. **Consulting engineers shall perform services only in the areas of their competence.**

a. Consulting engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.

b. Consulting engineers shall not affix their signatures to any plans or documents dealing with subject matter in which they lack competence nor to any plan or document not prepared under their direction and control.

c. Consulting engineers may accept an assignment outside of their fields of competence to the extent that their services are restricted to those phases of the project in which they are qualified and to the extent that they are satisfied that all other phases of such project will be performed by registered or otherwise qualified associates, consultants or employees, in which case they may then sign the documents for the total project.

3. **Consulting engineers shall issue public statements only in an objective and truthful manner.**

   a. Consulting engineers shall be objective and truthful in professional reports, statements or testimony. They shall include all relevant and pertinent information in such reports, statements or testimony.

   b. Consulting engineers may express publicly a professional opinion on technical subjects only when that opinion is founded upon adequate knowledge of the facts and competence in the subject matter.

   c. Consulting engineers shall issue no statements, criticisms, or arguments on technical matters which are inspired or paid for by interested parties, unless they have prefaced their comments by explicitly identifying the interested parties on whose behalf they are speaking and by revealing the existence of any interest they may have in the matters.

4. **Consulting engineers shall act in professional matters for each client as faithful agents or trustees.**

   a. Consulting engineers shall disclose all known or potential conflicts of interest to their clients by promptly informing them of any business association, interest or other circumstances which could influence or appear to influence their judgment of the quality of their services.

   b. Consulting engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed to, and agreed to, by all interested parties.

   c. Consulting engineers in public service as members of a governmental body or department shall not participate in decisions with respect to professional services solicited or provided by them or their organizations in private engineering practices.

   d. Consulting engineers shall not solicit or accept a professional contract from a governmental body on which a principal or officer of their organization serves as a member.

5. **Consulting engineers shall avoid improper solicitation of professional assignments.**

a. Consulting engineers shall not falsify or permit misrepresentation of their or their associates', academic or professional qualifications. They shall not misrepresent or exaggerate their degree of responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of assignments shall not misrepresent pertinent facts concerning employees, associates, joint ventures or past accomplishments with the intent and purpose of enhancing their qualifications and their work.

b. Consulting engineers shall not offer, give, solicit or receive, either directly or indirectly, any political contribution in an amount intended to influence the award of a contract by public authority, or which may be reasonably construed by the public of having the effect or intent to influence the award of the contract.

ENGINEERS AS EXPERT WITNESSES

14. Discuss the role of Engineers as expert witnesses with suitable examples (Nov/Dec 2018)orDiscuss the following in detail of Engineers as expert witness and advisors. (Nov/Dec 2021) (or) Justify engineers as expert witness and advisors with suitable examples. (A/M 2022) [Nov/Dec 2022]

List out various issues and requirements for engineers who act as advisors. Nov 2023

✓ Frequently engineers are required to act as consultants and provide expert opinion and views in many legal cases of the past events.

✓ They are required to explain the causes of accidents, malfunctions and other technological behaviour of structures, machines, and instruments, e.g., personal injury while using an instrument, defective product, traffic accident, structure or building collapses, and damage to the property, are some of the cases where testimonies are needed.

✓ The focus is on the past.

✓ The functions of eye-witness and expert-witness are different as presented in the Table.

Eye Witness	Expert Witness
1. Eye-witness gives evidence on only what has been seen or heard actually (perceived facts)	1. Gives expert view on the facts in their area of their expertise
	2. Interprets the facts, in term of the cause and effect relationship
	3. Comments on the view of the opposite side
	4. Reports on the professional standards, especially on the precautions when the

	product is made or the service is provided

The engineers, who act as expert-witnesses, are likely to abuse their positions in the following manners:

1. Hired Guns

- ✓ Mostly lawyers hire engineers to serve the interest of their clients. Lawyers are permitted and required to project the case in a way favourable to their clients. But the engineers have obligations to thoroughly examine the events and demonstrate their professional integrity to testify only the truth in the court.
- ✓ They do not serve the clients of the lawyers directly. The hired guns forward white lies and distortions, as demanded by the lawyers. They even withhold the information or shade the fact, to favor their clients.

2. Money Bias

- ✓ Consultants may be influenced or prejudiced for monitory considerations, gain reputation and make a fortune.

3. Ego Bias

- ✓ The assumption that the own side is innocent and the other side is guilty, is responsible for this behaviour.
- ✓ An inordinate desire to serve one's client and get name and fame is another reason for this bias.

4. Sympathy Bias

- ✓ Sympathy for the victim on the opposite side may upset the testimony. The integrity of the consultants will keep these biases away from the justice. The court also must obtain the balanced view of both sides, by examining the expert witnesses of lawyers on both sides, to remove a probable bias.

ENGINEERS AND THE ENVIRONMENT

16. Discuss various approaches to resolve environmental problems. Mention any four professional code of ethics concerning to environment. Nov 2023

- ➢ It is evident that engineers are usually creators of technology that contributes to environmental degradation as well as environmental improvement, therefore they should have a professional obligation to protect the environment. Also as agents of change and experimenters, engineers have a vital role to play in protecting the environment.

Types of Concern for Environment

There are two types of concern for the environment. They are:

1. Health-related concern: Engineers can be concerned for the environment when environmental pollution poses a direct and clear threat to human health. This is called as a health-related concern for the environment.

2. Non-health-related concern: Engineers can also be concerned for the environment even when human wealth is not directly affected. This concern is termed as non-health-related concern for the environment.

Engineers' Concern for Environment

> ➤ While choosing a career or when taking up a new assignment / job, every engineers should ask himself the following ethical questions associated with the environment:
> ➤ How does and to what extent a particular industry affect the environment?
> ➤ How far such ill effects can be controlled physically and or politically?
> ➤ What is the reasonable protective measures available for immediate implementation?
> ➤ In what way, I can be effective as an engineer in ensuring safe and clean environment?
> ➤ Should preserving the environment and ts non-human inhabitants be regarded as of value for its ewn sake?
> ➤ Do i have obligations for the future?
> ➤ How are my obligations to the future to be balanced against my obligation to the present?

What Does Professional Codes Of Ethics Say About The Environment?

Some of the professional codes of ethics regarding the environment are given below:

1. The codes of the American Society of Civil Engineers (ASCE) states: "Engineers should be committed to improving the environment by adherence to the principles of sustainable development so as to enhance the quality of life of the general public".

2. The codes of the Institute of Electrical and Electronics Engineers (IEEE) states: "Engineers have to accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly factors that might endanger the public or the environment".

3. The codes of the American Society of Mechanical Engineers (ASME) states: "Engineers shall consider environmental impact in the performance of their professional duties".

APPROACHES TO RESOLVE ENVIRONMENTAL PROBLEMS

The two important approaches that can be applied to resolve environmental problems are:

1. Cost oblivious approach
2. Approach based on cost benefit analysis

Cost-oblivious Approach

> ➤ In this approach, priority is given to the protection of environment than the cost of the products designed by the engineers.
> ➤ This approach does not accept / tolerate any environmental degradation.
> ➤ Also this approach satisfies the concept of eights and duty ethics.
> ➤ **Drawback:** This approach is difficult to sustain and enforce in a modem urbanized society.

Approach based on cost benefit analysis

- In this approach, the problem is analyzed in terms of the benefits derived by reducing the pollution and the costs required to solve the problem. In fact, this approach is derived from the concept of utilitarianism.
- In other words, the objective is not to achieve a completely clean environment. But to achieve an economically beneficial balance of pollution with health or environmental considerations.
- **Drawbacks:** it is very difficult to determine the true cost of a human life or the loss of a species; and also it is very difficult accurately assess costs and benefits.

INTERNALIZING COSTS OF ENVIRONMENTAL DEGRADATION

- As we know, the cost of any product usually includes direct labour cost, direct materials cost, direct expenses, factory expenses, administrative expenses, and selling and distribution expenses.
- Here, other costs incurred due to numerous indirect factors such as the effects of pollution, the depletion of energy and raw materials, and social costs are not considered.
- Along with the economists, the scientists, the lawyers, and the politicians, engineers have to play an important role in finding acceptable mechanisms for pricing and releasing products. It should be realized that the good engineering design process can provide the answers to protect the environment without any addition of real cost.

TECHNOLOGY ASSESSMENT

- Technology assessment refers to the studies on the social and environmental effects of technology in various areas. The areas include nuclear war, health care. Cashless trading via bank-card, and pollution.
- In this view of the economist Robert Theobald, engineers sometimes tend to find the right answers to the wrong questions. He also emphasized that the university curriculum should be based on the finding right answers to the right questions.
- When the engineers and scientists conduct experiments, they should distil the information collected through normative, conceptual, and factual inquiries, as depicted in Fig.
- As shown in Fig, engineers should use the funnel for distilling and applying knowledge to design and build the engineering projects.
- The difficulty in technology assessment is to explore the extent of the effects and to prioritize the possible adverse effects.
- Thus it should be noted that engineers as social experimenters should do continuous monitoring even after implementing the project so that to ensure safe and clean environment.

PHILOSOPHICAL VIEWS OF NATURE

Though there are various views on environment, now we shall brief four important views of it

1. Sentient-Centered Ethics

- This view acknowledges the inherent worth of all sentient animals. Sentient animals are those that feel pain and pleasure and have desires.
- Peter Singer, in his book Animal Liberation, emphasizes that moral judgments must take into account the effects of our actions on sentient animals. For example while constructing a dam or a plant engineers should consider the impact on animals living there.
- According to Tom Regan, conscious creatures have inherent worth not only because they can feel pleasure and pain, but also because they are subjects of experiences who form beliefs, memories, inventories, preferences, and can act purposefully.
- Both Singer and Regan teit that the sentient animals need not to be treated in the identical way we treat humans, but their interest should be weighed equally with human interests in making decisions.

2. Bio centric Ethics

- This life-centered ethics recognizes that all living organisms as having inherent worth.
- According to Albert Schweitzer, all organisms have the reverence for life' to survive and to develop.

3. Eco centric Ethics

- In contrast to the individualistic approaches of sentient-centered and bio centered ethics, eco centered ethics emphasizes inherent value in ecological systems.
- According to the naturalist Aldo Léopold, a thing is right when t tends to preserve the integrity, stability, and beauty of the biotic community.

4. Human-Centered Environmental Ethics

- Human-centered ethics environmental ethics extends traditional ethical theories in the aspect of the threats to human beings presented by the destruction of nature.
- 'Virtue ethics' draws attention to humility, appreciation of beauty, love, and affection and gratitude towards the world of nature.
- Right ethics' stresses that the fundamental right to life enforces a night for livable environment in a particular period of time, when pollution and depletion of resources has reached a dangerous proportion.
- Duty ethics urges that the respect for human life implies more concern for nature than has been traditionally recognized.
- Utilitarianism' stresses that human pleasures and self-interests are linked to nature in so many ways apart from the stage the engineering products are produced from natural resources.

17. Explain the Bhopal Gas Tragedy. Discuss the violation of moral, ethical and professional codes of standard in it. Write a conclusion to avoid such strategy in future. (April/May 2018)

[Nov/Dec 2022]

- The Union Carbide had 51% and the Indian subsidiary UC India Ltd. had 49% of stock. In 1983, there were 14 plants in India manufacturing chemicals, pesticides, and other hazardous products.

- The Bhopal plant had a license to make Methyl isocyanate-based pesticides. In November 1984, they had decided to close down the plant. For quite some years before the production rate was going down.

- In the history of chemical plants disasters, three other wake-up calls were reported. Flixborough accident in 1974 in U.K. when certain modifications carried out in the plant led to the leakage and explosion of cyclohexane, which killed 28 people.

- The Piper Alpha offshore oil platform disaster in 1988, near Scotland, killed 167 people and resulted in $ 2 billion losses. The third occurred in Toulouse, France in 2001, killing 29 people, and injuring thousands.

- A warehouse holding 300 tonnes of ammonium nitrate fertilizer exploded and damaged 10000 buildings, including schools, a university, and a hospital. But we have not learnt from the past.

- The cumulative effects of the following factors caused the tragedy in Bhopal on December 3, 1984, maintenance was neglected and the trained maintenance personnel were reduced as economy measure.

- Need for quick diagnosis aggravates the situation by causing considerable psychological stress on the plant personnel.

- Training activities for the supervisory personnel were stopped. This led to inadequate training of the personnel to handle emergencies.

- Periodical Safety Inspection teams from U.S. which visited previously were also stopped. From the initial U.S. Standards, the safety procedures were reduced to low level Indian standards.

- The procedures had been deteriorating at these sites for weeks or months, prior to the accident. There was clear lack of management systems and procedures to ensure safety.

- Vital spares for equipments and machineries were not available.

- Absence of capital replacement led to the stagnant economy of the plant.

- The high turnover of the experienced engineers and technicians, who were demoralized by the lack of development, Lack of experienced personnel to operate and control the vital installations.

- They have not conducted a thorough process hazards analysis that would have exposed the serious hazards which resulted in disaster later. . No emergency plan was put in practice, during the shutdown and maintenance.

- Above all, the commitment of top-level management to safety was lacking. They have been paying only lip service to safety of people of the host country.

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Technologically, the tragedy was caused by a series of events listed:

1. The safety manual of Union Carbide prescribed that the MIC tanks were to be filled only up to 60% of the capacity. But the tanks were reported to have been filled up to 75%.

2. The safety policy prescribed that an empty tank should be available as a stand-bye in case of emergency. But the emergency tank was also filled with to its full capacity. These facts confirmed that the MNC had not followed and implemented appropriate safety standards of the home country in the host country. Can this be called as an example of misappropriate technology'?

3. The storage tanks should be refrigerated to make the chemical less reactive. But here the refrigeration system was shut down as an economy measure. This raised the temperature of the gas stored.

4. The plant was shut down for maintenance two months earlier. The worker who cleaned the pipes and filters connected to the tanks and closed the valves, was not trained properly. He did not insert the safety disks to prevent any possible leakage of the gas. This led to the build-up of temperature and pressure in the storage tanks.

5. When the gas started leaking out, the operators tried to use the vent gas-scrubber that was designed to reduce the exhausting gas. But that scrubber was also shut down.

6. There was a flare tower that was designed to burn-off the gas escaping from the scrubber. That was not also in working condition.

7. The workers finally tried to spray water up to 100 feet to quench the gas (which is water soluble). But the gas was escaping from the chimney of 120-feet high.

8. The workers were not trained on safety drills or emergency drills or any evacuation plans.

The gas escaped into the air and spread over 40 sq. km. About 600 people died and left 7000 injured and the health of about 2 million people was affected adversely. Even after 22 years, influence of the Central Government and the courts, the compensation had not reached all the affected people.

Ethical Balance

✓ Should an organization adopt the rules and practices of the host country fully and face dangers and other serious consequences or adopt strictly their own country's standards and practices in the host country? There is a saying, When in Rome do as Romans do. Can this be applied in the case of MNCs? This is called ethical relativism.

✓ The actions of corporation and individuals that are accepted by law, custom and other values of a society can be morally right in that society.

✓ It is morally false, if it is illogical. It means, the corporation (and the engineers) functioning in other countries must understand their law, customs, and beliefs and act in line with those prevailing in that country.

✓ This will lead to disaster if the country is a developing one where the safety standards are given a go-bye. Laws and conventions are not morally self-sustaining.

- In an overpopulated country, the loss of human lives may not physically affect them, but the tragedy cast shadow for over decades, as it happened in Bhopal in 1984.
- This will be criticized from the points of view of human rights, public welfare, and respect to people.
- On the other hand, the organizations may practice laws of the home country, without adjustments to the host culture. This stand is called ethical absolutism.
- This is again false, since the moral principles in a different culture come into conflicts, and implementation in the hostile culture is almost impossible.
- Hence, MNCs may adopt ethical relationalism (contextualism) as a compromise. Moral judgments are made in relation to the factors prevailing locally, without framing rigid rules.
- The judgments should be contextual and in line with the customs of other cultures. The ethical pluralism which views more than one justifiable moral solution is also adaptable. This principle accepts cultural diversity and respects the legitimate cultural differences among individuals and groups, of the host country.
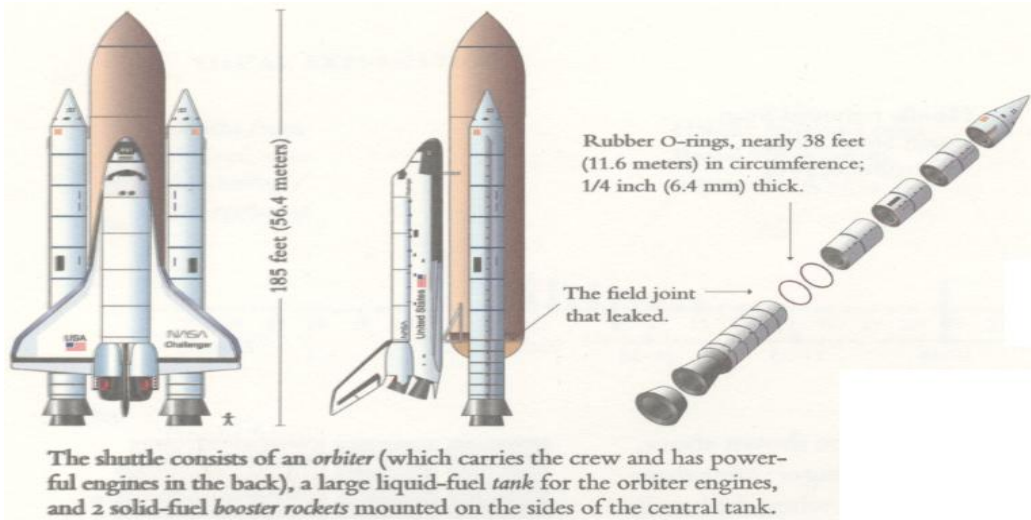
18. Explain the Challenger space shuttle disaster. Discuss the violation of moral, ethical and professional codes of standard in it. Write a conclusion to avoid such strategy in future. (April/May 2018)

- 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.


Fig. 3.2 a Challenger
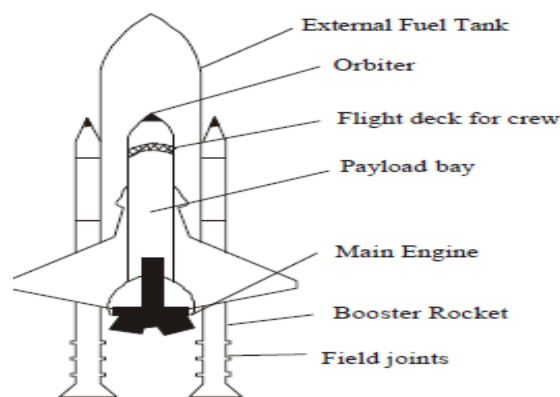
- The casing of each booster rocket is about 150 feet long and 12 feet in diameter. This consists of cylindrical segments that are assembled at the launch site. There are four-field joints and they use seals

consisting of pairs of O-rings made of vulcanized rubber. The O-rings work with a putty barrier made of zinc chromate.

The shuttle consists of an *orbiter* (which carries the crew and has power-ful engines in the back), a large liquid-fuel *tank* for the orbiter engines, and 2 solid-fuel *booster rockets* mounted on the sides of the central tank.

1. Orbiter:

✓ The primary component: A reusable, winged craft containing the crew and payload that actually travels into space and returns to land on a runway.

✓ It is of Length 37.2m, Height 17.25m and Mass 68.5tonnes with Payload:32,000kg and Crew: 7 max
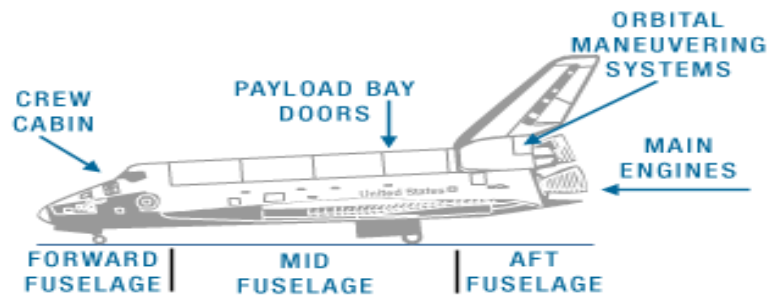
2. **Solid Rocket Boosters:**

✓ Without the SRBs, the shuttle cannot produce enough thrust to overcome the earth's gravitational pull.

✓ An SRB is attached to each side of the external fuel tank.

✓ Each booster is 149 feet long (45m) and 12 feet (3.6m) in diameter.

✓ Before ignition, each booster weighs 2 million pounds (900 tonnes, 150 elephants), 80% of the total vehicle mass, 83% of total thrust.

About the disaster:

✓ Roger Boisjoly, a Thiokol engineer had gone on record the night before the launch.

✓ In a teleconference with NASA he stated: "If we launch tomorrow we will kill those seven astronauts", but he was ignored.

✓ Chart by Rogers Commission Showing all launches

Figure 7
Plot of flights with and without incidents of O-ring thermal distress
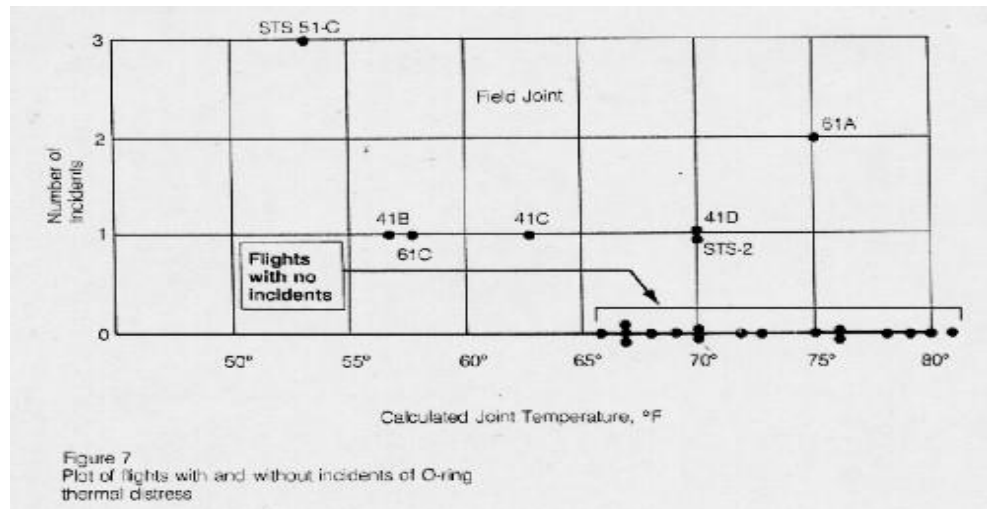
Pressure to launch:

✓ NASA managers were anxious to launch the Challenger for several reasons, including economic considerations, political pressures, and scheduling backlogs.

✓ Unforeseen competition from the European Space Agency put NASA in a position in which it would have to fly the shuttle dependably on a very ambitious schedule to prove the Space Transportation System's cost effectiveness and potential for commercialization.

✓ This prompted NASA to schedule a record number of missions in 1986 to make a case for its budget requests.

Key Dates:

1974 - Morton-Thiokol awarded contract to build solid rocket boosters.

1976 - NASA accepts Morton-Thiokol's booster design.

1977 - Morton-Thiokol discovers joint rotation problem.

**November 1981** - O-ring erosion discovered after second shuttle flight.

January 24, 1985 - shuttle flight that exhibited the worst O-ring blowby.

July 1985 - Thiokol orders new steel billets for new field joint design.

August 19, 1985 - NASA Level I management briefed on booster problem.

January 27, 1986 - night teleconference to discuss effects of cold temperature on booster performance.

January 28, 1986 - *Challenger* explodes 72 seconds after liftoff

Pressurized Joint Deflection

Pressurized Joint (Exaggerated)

Unpressurized Joint
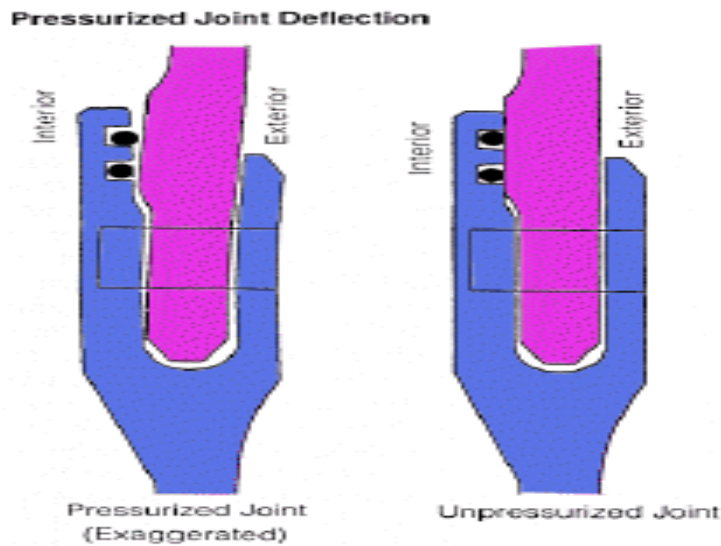
Moral/Normative Issues

1. The crew had no escape mechanism. Douglas, the engineer, designed an abort module to allow the separation of the orbiter, triggered by a field-joint leak. But such a 'safe exit' was rejected as too expensive, and because of an accompanying reduction in payload.

2. The crew was not informed of the problems existing in the field joints. The principle of informed consent was not followed.

3. Engineers gave warning signals on safety. But the management group prevailed over and ignored the warning.

Conceptual Issues

1. NASA counted that the probability of failure of the craft was one in one Lakh launches. But it was expected that only the 100000th launch will fail.

2. There were 700 criticality-1 items, which included the field joints. A failure in any one of them would have caused the tragedy. No back-up or stand-bye had been provided for these criticality-1 components.

Factual/Descriptive Issues

1. Field joints gave way in earlier flights. But the authorities felt the risk is not high.

2. NASA has disregarded warnings about the bad weather, at the time of launch, because they wanted to complete the project, prove their supremacy, get the funding from Government continued and get an applaud from the President of USA.

3. The inability of the Rockwell Engineers (manufacturer) to prove that the lift-off was unsafe. This was interpreted by the NASA, as an approval by Rockwell to launch.

Field Joint Leakage:

- 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.
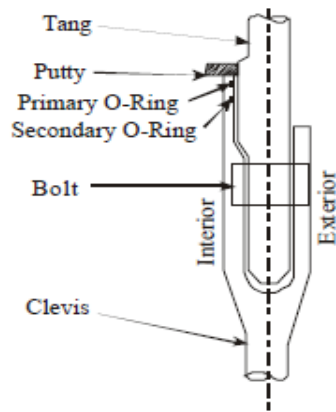- But these data were not deliberated at that conference as the launch time was fast approaching.
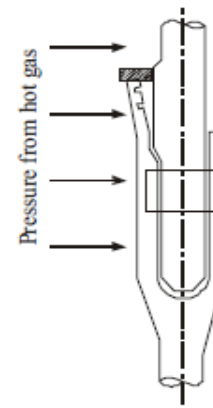

Fig. 3.2 b Field joint before ignition   **Fig. 3.2 c Field joint after ignition**

What really happened?

- 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.

19. What shifts are caused in power relationships by Computers?

Power relationship caused by Computers:

1. Job Elimination:

- Computers still continue to lead to elimination of jobs.
- While employees cannot be paid when there is no work, all attempts are to be made by employers to readjust work assignments and retain employees.
- The absence of this practice creates an employee or public backlash against introduction of Computers.

2. Customer Relations:

- It is very easy for a customer to notice an error in a computer printout, of the price difference between what is shown at the shelf and what is shown in cash receipt register.
- Here moral sense and long term business requirement requires that the policies should be made favourable to consumers.

3. Biased Software:

- A group of people with known convictions may tend to produce software which favours their views rather than views from all angles to let the user decide finally.

4. Stock Trading:

- Automatic, hands-off trading of stocks and currency can be performed, benefiting the trading community but it will harm the intended purposes.

5. Unrealistic Expectations:

- Sales personnel have a tendency to oversell systems that are too large for customers" requirements; sometimes even those which are not ready for delivery.

6. Political Power:

- By obtaining information about different groups of people regarding their attitudes and values, the computers can be made to help politicians to make speeches, send mails, etc. which would be appealing selectively to these groups.

7. Military Weapons:

- Computerised military weapons, even if perfected, will only make opposing countries to develop their striking or responding capability which is not healthy for the world.

20. How the problem of embezzlement takes place through computers and why?

- The speed and geographic coverage of the computer system and the difficulty of tracing the transactions through computers makes catching the thieves troublesome;
- Computers are abused in i) stealing by employees at work, ii) stealing by nonemployees or former employees, iii) stealing from or cheating clients and consumers, iv) violating contracts for computer sales or service and v) conspiring to use computer networks to engage in widespread fraud.
- Penalties for computer crime are mild compared to conventional crimes.
- Passwords and more recently, data encryptions are used for security with limited effectiveness.