Module 2

1 What is Moral Dilemma? Explain it with examples.

Moral Dilemma refers to a situation in which an individual is faced with conflicting moral principles, making it challenging to choose the right course of action. A moral dilemma happens when you face a tough choice between two or more options, and each option goes against some moral belief you have. Whatever decision you make, you end up going against one of your moral values.

Examples: Consider a scenario where an engineer working for a construction company discovers a flaw in the design of a building that could potentially compromise its structural integrity in certain conditions. However, revealing this flaw could lead to significant financial losses for the company and potential damage to its reputation. The engineer faces an ethical dilemma: should they report the flaw and risk the negative consequences for the company, or remain silent and potentially endanger public safety? In this scenario, the ethical dilemma revolves around conflicting values such as honesty, integrity, and public safety versus loyalty to the employer and considerations of financial impact.

Now, let's consider a different scenario where an engineer is tasked with designing a new product for their company. During the design process, the engineer realizes that the product could have negative environmental impacts due to its manufacturing process or materials used. Despite meeting all legal requirements and industry standards, the engineer grapples with the moral implications of contributing to environmental degradation. Here, the moral issue lies in the broader ethical considerations beyond immediate consequences or legal obligations. The engineer must weigh the potential harm to the environment against the benefits of the product, questioning their responsibility to minimize harm and promote sustainability.

2 Moral development theories

Kohlberg's stages of moral development

Lawrence Kohlberg's moral reasoning theory was inspired by the work of Jean Piaget. This theory holds that moral reasoning, which is the basis for ethical behaviour, has six identifiable developmental stages. He followed the development of moral judgment beyond the ages originally studied by Piaget, who claimed that logic and morality develop through constructive stages. Kohlberg expanded considerably on this groundwork, determining that the process of moral development was principally concerned with justice and that its

development continued throughout the lifespan, even spawning dialogue of philosophical implications of his research. Kohlberg used stories about moral dilemmas in his studies, and was interested in how people would justify their actions if they were put in a similar moral crux. He would then categorize and classify evoked responses into one of six distinct stages. These six stages are broken into three levels: pre-conventional, conventional and post-conventional. His theory is based on constructive developmental stages; each stage and level are more adequate at responding to moral dilemmas than the last.

Kohlberg's **six stages** were grouped into **three levels**:

Before going into the theories, first we should know what is meant by convention & Conventional

Convention: - Conventions denote customs or traditions or usages which are in use since long. To be clear, these are nothing but unwritten laws. The accountants have to adopt the usage or customs, which are used as a guide in the preparation of accounting reports and statements. These conventions are also known as doctrine.

In other words, convention means a general agreement about basic principles or procedures, it can also be a principle or procedure accepted as true or correct by convention like the conventions of grammar.

Conventional: - based on or in accordance with what is generally done or believed.

Level 1 (pre-conventional)

1. Obedience and punishment orientation
2. Self-interest orientation (What's in it for me?)

Level 2 (Conventional)

3. Interpersonal accord and conformity (The good boy/good girl attitude)
4. Authority and social-order maintaining orientation (Law and order morality)

Level 3 (post-conventional)

5. Social contract orientation
6. Universal ethical principles (Principled conscience)

Level 1 Pre-Conventional

The pre-conventional level of moral reasoning is especially common in children, although adults can also exhibit this level of reasoning. Persons in the pre-conventional level judge the morality of an action by its direct consequences. The pre-conventional level consists of the first and second stages of moral development, and are purely concerned with the self in an egocentric (thinking only of oneself, without regard for the feelings or desires of others; self-centred) manner.

Stage 1- (**Obedience and punishment orientation**) In this stage individuals focus on the direct consequences that their actions will have for themselves. For example, an action is perceived as morally wrong if the person who commits it gets punished. The worse the punishment for the act is, the more 'bad' the act is perceived to be. In addition, there is no recognition that others' points of view are any different from one's own view. This stage may be viewed as a kind of authoritarianism (the enforcement or advocacy of strict obedience to authority at the expense of personal freedom.). Stage two espouses the what's in it for me position, right behaviour being defined by what is in one's own best interest.

Stage 2- (**Self-interest orientation (What's in it for me?)**. In this stage the reasoning shows a limited interest in the needs of others, but only to a point where it might further one's own interests. In stage two concern for others is not based on loyalty or intrinsic respect. Lacking a perspective of society in the preconventional level, this should not be confused with social contract (stage five), as all actions are performed to serve one's own needs or interests. For the stage two theorist, the perspective of the world is often seen as morally relative.

Level 2 Conventional

The conventional level of moral reasoning is typical of adolescents and adults. Persons who reason in a conventional way judge the morality of actions by comparing these actions to societal views and expectations. The conventional level consists of the third and fourth stages of moral development.

Stage 3- **(Interpersonal accord and conformity (The good boy/good girl attitude)**. In this stage the self enters society by filling social roles. Individuals are receptive of approval or disapproval from other people as it reflects society's accordance with the perceived role. They try to be a good boy or good girl to live up to these expectations, having learned that there is inherent value in doing so. Stage three reasoning may judge the morality of an action by evaluating its consequences in terms of a person's relationships, which now begin to include things like respect, gratitude and the 'golden rule'. Desire to maintain rules and

authority exists only to further support these stereotypical social roles. The intentions of actions play a more significant role in reasoning at this stage.

Stage 4- (Authority and social-order maintaining orientation (Law and order morality). In this stage it is important to obey laws, dictums and social conventions because of their importance in maintaining a functioning society. Moral reasoning in stage four is thus beyond the need for individual approval exhibited in stage three; society must learn to transcend individual needs. A central ideal or ideals often prescribe what is right and wrong, such as in the case of fundamentalism. If one person violates a law or laws, perhaps everyone would - thus there is an obligation and a duty to uphold laws and rules. When someone does violate a law, it is morally wrong; culpability is thus a significant factor in this stage as it separates the bad domains from the good ones.

Level 3 Post-Conventional

The post-conventional level, also known as the principled level, consists of stages five and six of moral development. Realization that individuals are separate entities from society now becomes salient. One's own perspective should be viewed before the society's. It is due to this 'nature of self before others' that the post-conventional level, especially stage six, is sometimes mistaken for pre-conventional behaviors.

Stage 5- (Social contract orientation). In this stage the individuals are viewed as holding different opinions and values, and it is paramount that they be respected and honoured impartially. Issues that are not regarded as relative like life and choice should never be withheld or inhibited. Along a similar vein, laws are regarded as social contracts rather than rigid dictums. Those that do not promote general social welfare should be changed when necessary to meet the greatest good for the greatest number of people. This is attained through majority decision, and inevitably compromise.

Stage 6- Universal ethical principles (Principled conscience)

In this stage the moral reasoning is based on abstract reasoning using universal ethical principles. Laws are valid only insofar as they are grounded in justice, and that a commitment to justice carries with it an obligation to disobey unjust laws. Rights are unnecessary as social contracts are not essential for demonic moral action. Decisions are met categorically in an absolute way rather than hypothetically in a conditional way.

Further stages

In his empirical studies of persons across their life-span, Kohlberg came to notice that some people evidently had undergone moral stage regression. He was faced with the option of either conceding that moral regression could occur, or revise his theory. Kohlberg chose the latter, postulating the existence of sub-stages wherein the emerging stage has not yet been adequately integrated into the personality. In particular Kohlberg noted of a stage 4½ or 4+, which is a transition from stage four to stage five, sharing characteristics of both. In this stage the individual has become disaffected with the arbitrary nature of law-and-order reasoning. Culpability is frequently turned from being defined by society to having society itself be culpable. This stage is often mistaken for the moral relativism of stage two as the individual views the interests of society which conflict with their own choices as relatively and morally wrong. Kohlberg noted that this was often seen in students entering college. Kohlberg further speculated that a seventh stage may exist (Transcendental Morality or Morality of Cosmic Orientation) which would link religion with moral reasoning However, because of Kohlberg's trouble providing empirical evidence for even a sixth stage, he emphasized that most of his conjecture towards a seventh stage was theoretical.

Theoretical assumptions (philosophy) Kohlberg's theory includes a view of human nature, and a certain understanding of the form and content of moral reasoning. It holds conceptions of the right and the scope of moral reasoning across societies. Furthermore, it includes the relationship between morality and the world, between morality and logical expression, and the role of reason in morality. Finally, it takes a view of the social and mental processes involved in moral reasoning. The picture of human nature which Kohlberg begins with is the view that humans are inherently communicative and capable of reason, and they possess a desire to understand others and the world around them. The stages of Kohlberg's model refer to the qualitative moral reasonings that people adopt, and thus do not translate directly into praise or blame of the actions or characters of persons. In order to argue that his theory measures moral reasoning and not particular moral conclusions, Kohlberg insists that the form and structure of moral arguments is independent of the content of the arguments, a position he calls "formalism". Kohlberg's theory revolves around the notion that justice is the essential feature of moral reasoning. By the same token, justice relies heavily upon the notion of sound reasoning upon principles Kohlberg's theory understands values as a critical component of the right. Whatever the right is, for Kohlberg, it must be universally valid across societies According to Kohlberg, a person who progresses to a higher stage of moral reasoning cannot skip stages. For example, one cannot jump from being concerned mostly with peer judgments

(stage three) to being a proponent of social contracts (stage five). However, when one encounters a moral dilemma and finds one's current level of moral reasoning unsatisfactory, one will look to the next level. Discovery of the limitations of the current stage of thinking drives moral development as each progressive stage is more adequate than the last. This process is constructive; it arises through the conscious construction of the actor, and is neither in any meaningful sense a component of the actor's innate dispositions, nor a result of past inductions. Formal elements Progress along the stages of development occurs because of the person’s increased competence in both psychologically and socially balancing conflicting value-claims. The name of "justice operation" is given to the process which resolves the dispute between conflicting claims and strikes equilibrium between them. Kohlberg identifies two of these operations in "equality" and "reciprocity", which respectively involve an impartial regard for persons (i.e., irrespective of who the individual persons are), and a regard for the role of personal merit. For Kohlberg, the most adequate result of both operations is "reversibility", where a moral or dutiful act within a particular situation is evaluated in terms of whether or not the act would be satisfactory even if particular persons were to switch roles within the situation.

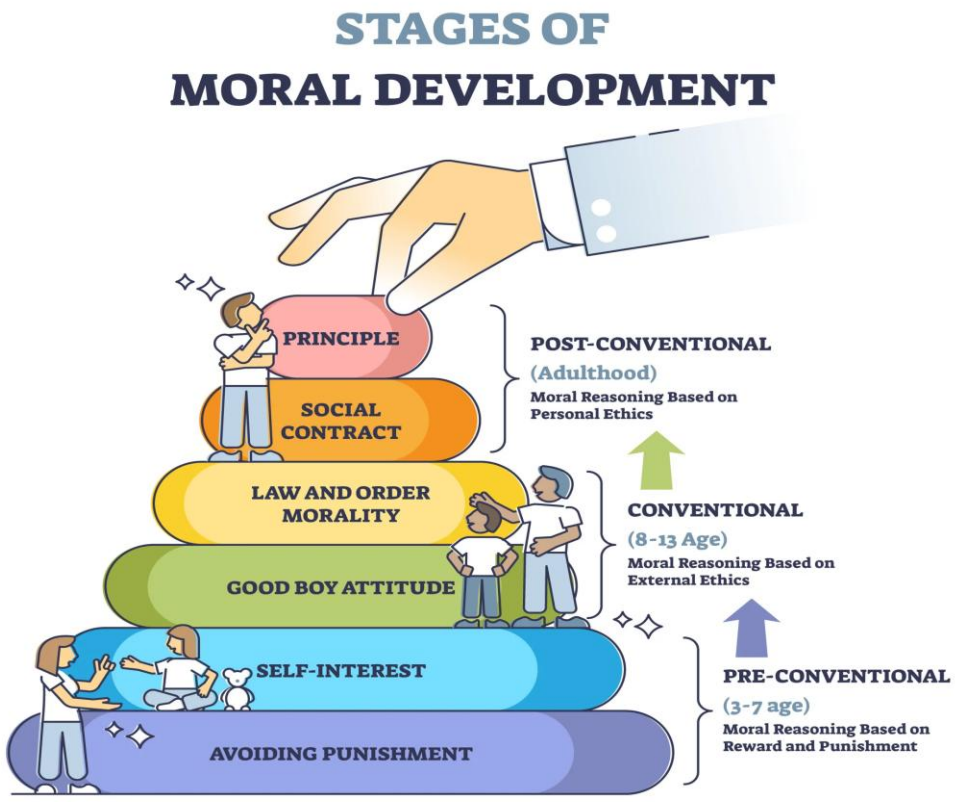


Figure: Kohlberg’s stages of moral development

Piaget Theory of Moral Development

The term "moral" is derived from the Latin word "mores" which means manners, customs and folkways. Moral development refers to the development or moral behaviour and moral concepts. Moral behaviour is a socially desired behaviour. Moral concepts start developing when the child learns what is good and what is bad, what is right and what is wrong. Piaget (1932) used the interview method – to find out the various stages of moral development of the child. According to him, there are four stages of moral development: which are as follows:

1. Anomy (Birth to years)
2. Heteronomy – authority (5 – 8 years)
3. Heteronomy Reciprocity (8 – 13 years)
4. Autonomy Adolescence (13 – 18years)

Anomy (Birth to 5 years) Piaget called the first stage anomy, the stage without the law. At this stage the behavior of child is neither moral nor immoral but is non – moral or moral. So, the child's behaviour is not guided by moral standards. The regulators of behaviour arc pain and pleasure. Example: A toddler takes a toy from another child without understanding that it's wrong. They are not yet aware of concepts like fairness or rules.

Heteronomy – Authority (5 to 8 years) (Morality of Constraint) This stage of moral development may be called the discipline of artificial consequences imposed by adults. Moral development controlled by external authority. Rewards and punishment regulate moral development.

- Children in this stage view rules and authority as fixed and unchangeable. They believe that rules are determined by adults or authorities and cannot be altered.
- They also believe that consequences are more important than intentions. If a rule is broken, they focus on the outcome rather than the intention behind the action.
- They have a sense of moral realism, where they believe that rules are absolute and universally applicable.

Example: A child follows the rule of not drawing on the walls because their parents said it's wrong, and they don't want to get punished.

Heteronomy – Reciprocity (8 to 13 years) At this stage, there is the morality of cooperation with peers or equals. This stage is regulated by reciprocity which implies that conformity with the group becomes necessary at this stage. Example:

A child agrees to share their lunch with a friend because they expect the friend to share something in return in the future. They view this as a fair exchange.

Autonomy – Adolescence (13 to 18 years) Piaget calls the stage as equity stage. Children of this stage demand equality in moral action. The individual at this stage is fully responsible for his behaviour. In this stage, children begin to develop a more mature understanding of morality. They recognize that rules can be created and changed through agreement among people. Rules are seen as social agreements rather than rigid authorities.

- Children become more concerned with intentions behind actions rather than just the consequences. They start to consider motives and circumstances when evaluating the morality of an action.
- They develop a sense of moral relativism, understanding that rules can vary across cultures and situations.
- Fairness and reciprocity become important concepts. They start to apply principles of equality and mutual benefit in their judgments of right and wrong

Example: A teenager might challenge a school rule they find unfair, like a dress code that discriminates against certain students, because they believe in equal treatment for all.

3 Ethical theories

- **Utilitarian Approach/ Theory:** Some thinkers emphasised that the ethical action is the one that's provide the most good and does less harm. It is related with the science of ends known as "Teleological Philosophy". This Philosophy emphasised on consequences of action and if outcome is right than action is considered right. So, it decides quality of human action on the basis of result rather than the action itself.

  Example: In engineering ethics, a utilitarian approach might involve maximizing overall societal benefit, even if it means sacrificing the interests of a few. For example, in designing infrastructure, engineers might prioritize projects that provide the greatest good for the greatest number of people, even if it means displacing a small community or altering the environment. The focus is on achieving the greatest net positive outcome for society as a whole, weighing the costs and benefits of various actions.

- **Rights Approach/Theory:** Some philosophers suggest that the ethical action is the one that best protects and respects the rights of those affected. This approach starts from the belief that human being has dignity and

human being has an ability to choose freely that what to do with their life. Also, it is often said that rights imply responsibility in particular and also the duty to respect others right.

Example: In engineering ethics, a rights approach emphasizes the importance of respecting and protecting the fundamental rights of individuals and communities affected by engineering projects. For example, when designing a new transportation system, engineers must ensure that the rights of nearby residents, such as the right to clean air and minimal noise pollution, are upheld. Similarly, in developing new technologies, engineers must consider the rights to privacy and autonomy of users. This approach requires engineers to carefully consider the impact of their decisions on the rights of all stakeholders involved and to prioritize actions that uphold and promote those rights.

- **Justice Approach/ Theory:** Aristotle and other Greek philosopher had given the idea that all equals should be treated equally.

  A justice approach advocates for fair and equitable treatment of all individuals and communities affected by engineering decisions. For instance, when constructing a new infrastructure project like a bridge, engineers must ensure that the benefits and burdens are distributed fairly among different socioeconomic groups. This might involve conducting thorough assessments of potential environmental and social impacts, consulting with diverse stakeholders, and implementing measures to mitigate any disproportionate harm to marginalized communities. Today we use this idea to say that ethical action treats all human being equally. If unequally than fairly based on some standards that are defendable. We pay people more or less based on their contribution in the organisation.

- **Common good approach/ Theory:** Aristotle and other Greek philosopher had given the idea that all equals should be treated equally. A justice approach advocates for fair and equitable treatment of all individuals and communities affected by engineering decisions. For instance, when constructing a new infrastructure project like a bridge, engineers must ensure that the benefits and burdens are distributed fairly among different socioeconomic groups. This might involve conducting thorough assessments of potential environmental and social impacts, consulting with diverse stakeholders, and implementing measures to mitigate any disproportionate harm to marginalized communities.

- **Virtue Approach/ Theory:** If an action of an individual generates good values within himself than it is considered to be ethical or moral. However, if an action generates negative values in an individual irrespective of the motive or circumstances, it is said to be wrong or unethical. It is a very ancient approach to ethics under it, it is believed that ethical actions ought to be consistent with certain ideal virtues that provide for the full development of humanity. Mahatma Gandhi believed in Virtue approach.
- **Casuist Approach/Theory:** The casuist theory suggests that the best way to solve a current ethical problem is to compare it with similar problems from the past and their outcomes. For instance, if faced with a decision regarding the safety of a new construction material, engineers might consult precedents from similar projects to assess potential risks and ethical considerations. By examining the specifics of past cases and their outcomes, engineers can develop nuanced solutions that account for relevant contextual factors and ethical principles. This approach helps engineers navigate complex ethical challenges by drawing on historical analogies to inform their decision-making and ensure consistency in ethical standards.
- **Moral Absolutism Approach/ Theory**: Moral absolutism is a term that denotes the view held by some people who firmly believe that there is only one right perspective and that is the one held by them. Moral absolutism can be seen in many religious codes of conduct, which have to be observed without anybody raising any questions. In engineering ethics, a moral absolutist stance could be seen in the principle of safety. An engineer adhering to moral absolutism would assert that ensuring the safety of users and the public is an inviolable moral duty. For example, even if cutting corners or using subpar materials could save time or money, a moral absolutist engineer would refuse to compromise on safety standards, believing that protecting human lives outweighs any other considerations.
- **Moral Relativism Approach/Theory:** Moral Relativism is a philosophy that asserts that no action can be called absolutely moral. Actions need to be judged against the cultural and individual contexts. For instance, when designing infrastructure projects, engineers might face differing ethical views regarding environmental preservation. A moral relativist engineer might prioritize the preferences and values of the local community where the project is situated, adapting environmental standards to align with the community's cultural beliefs. This approach acknowledges that ethical

considerations can vary based on cultural context, leading to a more flexible approach in decision-making within engineering ethics.

- **Moral Pluralism Approach/Theory:** Moral, ethical pluralism is the idea that there are many human values, which are equally good but can come into conflict with each other in a given situation. An example could be designing a new energy-efficient product: engineers must consider not only the safety of the product for users but also its environmental impact in terms of resource consumption and waste generation, as well as its affordability for consumers. Moral pluralism allows engineers to navigate complex ethical dilemmas by weighing and integrating various moral principles to make well-rounded decisions.
- **Ethical Egoism Approach/ Theory:** This theory deals with self-interest. One's actions are ethical if they promote the interest of the person who acts.

  For instance, if an engineer is presented with a choice between two projects—one that offers substantial personal financial gain but involves cutting corners on safety standards, and another that prioritizes safety but offers less financial reward—an engineer adhering to ethical egoism might choose the former to maximize their own benefit, disregarding potential harm to others. This approach prioritizes self-interest over the well-being of others, which contradicts many ethical principles commonly upheld in engineering ethics, such as prioritizing public safety and welfare.
- **Feminist Consequentialism Approach/ Theory:** Evaluating consequences should take care of those aspects that affects women. They argue that the existing utilitarianism often tends to neglect this aspect, and is biased against and insensitive to women.

4 Case studies

A) Aisha, a resident of Newtown, Kolkata, has been working as a freelance graphic designer for the past few years, juggling multiple small projects to make ends meet. She has a close friend, Rohan, who works as a project manager at a local advertising agency. Rohan has recently offered Aisha a full-time position at the agency, which would provide a stable income and better benefits. However, Aisha had previously agreed to help a small, local startup, "Eco-Prints," with their branding and marketing materials, promising to complete the project by the end of March. Eco-Prints is a small business focused on sustainable products, and Aisha is passionate about their mission.

What is the dilemma in the case? Explain

Ans: Aisha is now faced with a difficult choice: take the full-time job at the advertising agency, which would allow her to secure her financial future, or honor her promise to Eco-Prints, potentially jeopardizing her own livelihood. If she takes the full-time job, she won't be able to complete the Eco-Prints project on time, potentially damaging her reputation and the startup's prospects. If she stays with Eco-Prints, she risks being financially unstable, and she may have to decline the more secure job offer.

What is the moral consideration in the situation.

Ans: The moral considerations in the situation are:

- Loyalty and Trust:

Aisha must consider the importance of upholding her word and the potential damage to her reputation if she breaks her promise to Eco-Prints.

- Financial Stability:

Aisha must weigh the importance of securing a stable income against the moral implications of potentially abandoning her commitment to Eco-Prints.

- Personal Values:

Aisha must consider her own values and priorities, deciding whether financial security or upholding her word is more important.

Mention the possible courses of action in the situation

Ans: Possible Courses of Action:

- Option 1: Take the Job and Break the Promise:

Aisha could take the full-time job and inform Eco-Prints that she can no longer fulfill her commitment. This would secure her financial future but could damage her reputation and potentially harm Eco-Prints.

- Option 2: Decline the Job and Honor the Promise:

Aisha could decline the job offer and focus on completing the Eco-Prints project. This would allow her to uphold her promise but could jeopardize her financial stability.

- Option 3: Negotiate a Solution:

Aisha could try to negotiate with both parties, potentially finding a way to complete the Eco-Prints project while also exploring part-time work at the advertising agency or finding a way to complete the Eco-Prints project after securing the full-time position.

5 Case Study

Industrial chemicals are produced on a big scale by a conglomerate. It suggested establishing a second unit. Due to its negative impact on the environment, many states rejected this proposal. But one state government acceded to the request and permitted the unit close to a city, brushing aside all opposition. Further, the unit was set up 10 years ago and was in full swing till recently. The pollution caused by the industrial effluents was affecting the land, water, and crops in the area. It was also causing serious health problems to human beings and animals. This gave rise to a series of agitations demanding the closure of the plant. In a recent agitation, thousands of people took part, creating a law-and-order problem necessitating stern police action. Following the public outcry, the State government ordered the closure of the factory. The closure of the factory resulted in the unemployment of not only those workers who were engaged in the factory but also those who were working in the ancillary units. It also very badly affected those industries which depended on the chemicals manufactured by it.

As a senior officer entrusted with the responsibility of handling these issues, how are you going to address it? Discuss the course of action

Answer: My course of action:

- My plan would be to look for solution that will keep the factory running under better environmental conditions as well as keep the jobs of the people.
- I would firstly visit the factory to analyze what were the issues that led to the factory closure. I would try to see if the factory could be modified with advance equipment that does not harm the nearby environment.
- If the conditions are good for modification, I would request for a special group of experts who can look for solutions for developing the factory under acceptable conditions.
- When the plans of modification worked well and environmental degradation is reduced, then I would need to convince the people for

their approval for this project to go ahead. I would then provide them with proof so that they trust the administration.

- The factory administration would need to make the changes according to the environmental standards. If the factory does not have any funds, I would consider providing them with necessary resources in short term as a loan so that they can go ahead with the approved plan.
- In a scenario where no modification can be undertaken, then I would brainstorm alternative plans, so that people do not suffer. This can be done through setting up of another industry that is less polluting.
- If no such industry is set up, I would have to take steps that can allow the job losers to attain financial security. This can be done through transferring them to other industries as per their requirements and further, supporting them with self-employment opportunities by providing them with loans to set up small cooperative industries or small business.
- I would be conducting an investigation to find out whether environmental rules were flouted while giving permission to set up factory ten years back or there are any loopholes in the state's Environmental Impact Assessment norms which were used by company. At the same time the inspection should be done to find out that other companies are not flouting norms and polluting the environment.
- Alternatively, I may order the shutdown of the industrial unit due to public outcry, then it would be short sighted solution as, it would shift the problem to some other place and consequently putting the health of people there at risk rather than providing a sustainable solution for the existing problem.

Write down the stakeholders involved in this case study

Answer: Stakeholders involved in the case are as under:

- Me as a senior officer who is responsible to solve this case,
- People living in the area,
- Employee of the closed factory, Ancillary units,
- State government which gave permission to set up industrial unit,
- MLA/MP of the area

What human attribute for an officer is important in this case to solve the issue?

- **Emotional Intelligence**: It would help senior officer in handling the difficult situation arising from the above case.
- **Empathy**: It is an awareness of the needs and feelings of others both individually and in groups and being able to see things from the point of view of others.

6 Discuss the type of Inquiry in Engineering ethics?

Answer: Inquiry means an investigation: - Engineering ethics involves investigations into values, meaning and facts.

Normative Inquiries: These are about „what ought to be" and "what is good". These questions identify and also justify the morally desirable norms or standards.

Some of the questions are:

A. How far engineers are obligated to protect public safety in given situations?

B. When should engineers start whistle blowing on dangerous practices of their employers?

C. Whose values are primary in taking a moral decision, employee, public or govt?

D. Why are engineers obligated to protect public safety?

E. When is govt justified in interfering on such issues and why?

Conceptual Inquiries: These are meant for describing the meaning of concepts, principles, and issues related to Engineering Ethics.

Examples are:

A. What is SAFETY and how is it related to RISK

B. Protect the safety, health and welfare of public-What does this statement mean?

C. What is a bribe?

D. What is a profession and who are professionals?

Factual or Descriptive Inquiries: These help to provide facts for understanding and finding solutions to value-based issues. These are inquiries used to uncover information using scientific techniques. These inquiries get to information about business realities, history of engineering profession, procedures used in assessment of risks and engineers' psychology.

7. What is profession. Describe the key characteristics of profession. Explain the model of professional roles.

Answer: A profession is characterized by a body of knowledge acquired through education and training, requiring specialized skills and expertise. Professionals are expected to uphold ethical standards and act in the best interests of the public or their clients. Examples of professions include medicine, law, engineering, teaching, and social work.

Key Characteristics of a Profession:

Specialized Knowledge and Skills: Professionals possess in-depth knowledge and skills in their field, acquired through formal education and training.

Ethical Standards: Professions have a code of ethics that guides their conduct and ensures accountability.

Public Service: Professionals are expected to serve the public interest and prioritize the needs of their clients or patients.

Autonomy and Independence: Professionals often have a degree of autonomy in their work, allowing them to make decisions based on their expertise.

Professional Organizations: Many professions have professional bodies or associations that set standards, provide continuing education, and advocate for the profession.

Models of Professional Roles:

Savior: This model views professionals as having the power to save or fix problems, often seen in fields like medicine or social work.

Guardian: Professionals in this model act as protectors of the public or their clients, ensuring their well-being and safety.

Bureaucratic Servant: This model emphasizes following rules and procedures, often seen in fields like government or law enforcement.

Social Enabler: Professionals in this model work to create positive social change and empower individuals or communities.

Game Player: This model views professionals as strategic actors who navigate complex systems and situations to achieve their goals.

8. What is Emotional Intelligence. Discuss the theories related to Emotional Intelligence.

Answer: Emotional intelligence refers to the ability to identify and manage one's own emotions, as well as the emotions of others. Emotional intelligence is generally said to include a few skills: namely emotional awareness, or the ability to identify and name one's own emotions; the ability to harness those emotions and apply them to tasks like thinking and problem solving; and the ability to manage emotions, which includes both regulating one's own emotions when necessary and helping others to do the same.

Daniel Goleman's Theory of Emotional Intelligence

Daniel Goleman popularized the concept of Emotional Intelligence (EI) in the 1990s, especially through his book *Emotional Intelligence: Why It Can Matter More Than IQ* (1995).
According to Goleman, Emotional Intelligence is a key factor for success in life and at work — sometimes even more important than IQ.

He breaks EI into five core components:

1. **Self-Awareness**
    - Recognizing your own emotions and how they affect your thoughts and behavior.
    - Knowing your strengths and weaknesses.
    - Having self-confidence.
2. **Self-Regulation**
    - Managing your emotions in healthy ways.
    - Controlling impulsive feelings and behaviors.
    - Being adaptable, keeping your cool under pressure.
    - Showing trustworthiness and integrity.
3. **Motivation**
    - Being driven to achieve for the sake of achievement.
    - Commitment to personal and organizational goals.
    - Optimism, even in the face of challenges.
4. **Empathy**
    - Recognizing, understanding, and considering other people's feelings, especially when making decisions.

- Crucial for leading and managing teams.
- Helps with developing others and managing diversity.

5. **Social Skills**
    - Building good relationships.
    - Managing conflict effectively.
    - Inspiring and influencing others.
    - Working well in teams.

Salovey Mayer Theory of Emotional Intelligence

Salovey and Mayer define Emotional Intelligence as:

"The ability to perceive emotions, to access and generate emotions so as to assist thought, to understand emotions and emotional meanings, and to regulate emotions reflectively to promote emotional and intellectual growth."

They view EI as part of intelligence — something you can develop over time. They proposed a **four-branch model**, which focuses on how we process emotional information.

The Four Branches of Salovey and Mayer's EI Model:

1. **Perceiving Emotions**
    - Recognizing emotions in yourself and others.
    - Reading emotional cues like facial expressions, tone of voice, and body language.
    - The foundation of EI: if you can't recognize emotions, you can't manage them.
2. **Using Emotions to Facilitate Thinking**
    - Harnessing emotions to prioritize what we pay attention to.
    - Using emotions to guide decision-making and problem-solving.
    - Emotions help us to think more creatively and flexibly.
3. **Understanding Emotions**
    - Comprehending emotional language and the signals emotions convey.

- Understanding complex feelings (like feeling both happy and sad about something).
- Recognizing how emotions evolve over time and predict emotional outcomes.

4. **Managing Emotions**
    - Regulating emotions in yourself and others.
    - Staying open to feelings but also managing emotional responses in a productive way.
    - Helps with emotional recovery and maintaining emotional balance.

UNIT –III

ENGINEERING AS SOCIAL EXPERIMENTATION

Syllabus: Engineering as experimentation - engineers as responsible experimenters - codes of ethics – Industrial Standards

ENGINEERING AS EXPERIMENTATION

What is Experimentation?

Experiment- means a scientific test done carefully to study what happens and to gain new knowledge.

Experimentation refers to activity, process or practice of making experiments.

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.

ENGINEERING EXPERIMENTS WITH STANDARD EXPERIMENTS:

There are many similarities and differences between engineering experiments and other standard experiments.

Similarities to Standard Experiments

There are many aspects of engineering that make it appropriate to view engineering projects as experiments. The three important aspects are as follows:

1. Engineering projects, like the standard experiments, are carried out in **partial uncertainties**. The uncertainties may include in the,
   ✓ Design calculation
   ✓ Exact properties of raw materials used
   ✓ Constancies of material processing and fabrication
   ✓ Nature of working of final products
2. The final outcomes of engineering projects are also generally **uncertain** like those of other experiments for example, a nuclear reactor may reveal unexpected problems that endangered the surrounding people.
3. Similar to standard experiments, engineering experiments also requires **thorough knowledge** about the products at the pre-production and post-production stages. Thus engineering, like any other experimentation, requires constant monitoring, alertness, and vigil on the part of the engineers at every stage of the project.

   Contrast with standard experiments: The study of knowing differences between engineering and other standard experiments is helpful to the engineers to realize their special and moral responsibility.

Some aspects of these differences are given below:

1. Experimental control: Experimental control is the most important difference between engineering and other standard experiments.

✓ 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 another group are not given that special treatment. Even both the groups are subjected to same environment; the group that was not given the special treatment is called "**control group**".

✓ While, in engineering experiments, usually there is no control group. Sometimes the control group is used only when the project is limited to laboratory experiments. Because the engineering experiments involve human beings are 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 users are out of experimenter's control. In this type, it is not possible to select the member from various group randomly. Instead, the engineers should work with the available historical and fair data about various groups randomly. Instead, the engineering should work the available historical and fair data about various groups that uses the end product.

The above discussion also justifies the view of engineering as a social experimentation.

2. Informed consent: It is well known that there is always a strong human interface in the use of the engineering experiments' result; and also, the beneficiaries are invariably humans. Therefore, engineering experiments are also viewed at par the medical experiments. When a medicine or an engineering product is to be tested on a person, then the moral and legal rights is to get "informed consent" for him.

   Informed consent consists of two main elements:

   A. **Knowledge**: The human subjects should be given all the information to make a reasonable decision.
   B. **Voluntariness**: The human subjects should show their willingness to be a human model voluntarily. The person should not be forced, deceived, fraud, etc. Moreover, the manufacturer should give all the information about the potential risks and benefits of their products to their customers and users.

      The characteristics of a "valid consent" (The informed consent is called as _valid consent 'when the following three conditions are met):

      I. The consent should be given voluntarily and not by force.
      II. The consent should be based on all information needed for the rational person to make reasonable decision.
      III. The consentient should be physically and mentally fit; then he should be major i.e., above 18 years.

Learning from the past

It has been expected that the engineers have to learn not only form their own design and the production system but also the results of others. Due to lack of communication, prejudiced in not asking for clarification, fear of law and also mere negligence, these things can happen to the continuation of past mistakes.

The following are some of the examples:

1. The tragedy of „Titanic" happened because of the insufficient number of life boats. The same disaster took place in the steamship "the Arctic" some years before, because of the same problem.

2. The fall down of "the Sunshine Skyline Bridge" in the bay of Thamba at Sweden in 1980, on a moving ship due to improper matching of horizontal impact forces in mind. This could have been avoided of the engineers had known about the striking of the ships with the Maracaibo Bridge at Venezuela in 1964 and the Tasman Bridge of Australia in 1975.

3. The nuclear reactor accident at Three Mile Island on March 1979, was due to malfunctioning of the valves. Valves though minute items, are being among the least reliable components of hydraulic systems. It was a pressure relief valve and lack of information about its opening or closing state contributed to a nuclear reactor accident at Three Mile Island. This malfunction was already happened because of the same reasons at other locations.

4. The disaster of Tettron Dam in Los Angles was due to rapid flow of water and sudden break down. The builder didn't consider the case of the Fontenelle Dam, which was also collapsed due to the same problem. So, to say that engineers should not fully depend on handbooks and they should have some review of the past cases relating to their current task.

Comparisons with standard Experiments

Engineering is entirely different from standard experiments in few aspects. Those differences are very much helpful to find out the special responsibilities of engineers and also help them in knowing about the moral irresponsibilities which are involved in engineering.

Experimental Control

Members for two groups should be selected in a standard experimental control, i.e. Group A and Group B. The members of the group "A" should be given the special experimental treatment. The group "B" does not receive the same though they are in the same environment. This group is called the ***'control group'***.

Though it is not possible in engineering but for the projects which are confirmed to laboratory experiments. Because, in engineering the experimental subjects are human beings who are out of the control of the experimenters. In engineering, the consumers have more control as they are the selecting authority of a project. Therefore, in this field it is impossible to follow a random selection. An engineer has to work only with the past data available with various groups who use the products.

Consequently, engineering can be viewed as a natural experiment which uses human subjects. But today, most of the engineers do not care for the above said Experimental Control.

Informed Consent

Engineering is closely related to the medical testing of new drugs and techniques on human beings as it also concerned with human beings.

When new medicines have been tested, it should be informed to the persons who undergo the test. They have moral and legal rights to know about the fact which is based on "informed consent" before take part in the experiment. Engineering must also recognize these rights. When a producer sells a new product to a firm which has its own engineering staff, generally there will be an agreement regarding the risks and benefits form that testing.

Informed consent has two main principles such as knowledge and voluntariness.

First, the persons who are put under the experiment has to be given all the needed information to make an appropriate decision.

Second, they must enter into the experiment without any force, fraud and deception. The experimenter has also to consider the fundamental rights of the minorities and the compensation for the harmful effects of that experiment.

In both medicine and engineering there may be a large gap between the experimenter and his knowledge on the difficulties of an experiment. This gap can be filled only when it is possible to give all the relevant information needed for drawing a responsible decision on whether to participate in the experiment or not.

In medicine, before prescribing a medicine to the patient, a responsible physician must search for relevant information on the side effects of the drug. The hospital management must allow him to undergo different treatments to different patients and finally the patient must be ready to receive that information from the physician. Similarly, it is possible for an engineer to give relevant information about a product only when there is a better co-operation by the management and quick acceptance from the customers.

The following conditions are essential for a valid informed consent

A. The consent must be given voluntarily and not by any force.
B. The consent must be based on the relevant information needed by a rational person and should be presented in a clear and easily understandable form.
C. The consenter must be capable of processing the information and to make rational decisions in a quick manner.
D. The information needed by a rational person must be stated in a form to understand without any difficulty and has to be spread widely.
E. The experimenter's consent has to be offered in absentia of the experimenter by a group which represents many experiments.

Knowledge Gained

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

ENGINEERS AS RESPONSIBLE EXPERIMENTERS

The engineers have so many responsibilities for serving the society.

1. A primary duty is the safety of human beings and respect their right of consent. [A *conscientious commitment* to live by moral values].

2. Having a clear awareness of the experimental nature of any project, thoughtful forecasting of its possible side effects, and an effort to monitor them reasonably. [A comprehensive perspective or *relative information*].

3. Unrestricted free personal involvement in all the steps of a project. [*Autonomy*]

4. Being accountable for the results of a project [*Accountability*]

5. Exhibiting their technical competence and other characteristics of professionalism.

Conscientiousness

Conscientiousness implies consciousness (sense of awareness). As holding the responsible profession with maintaining full range moral ethics and values which are relevant to the situation. In order to understand the given situation, its implications, know- how, person who is involved or affected, Engineers should have open eyes, open ears and open mind.

The present working environment of engineers, narrow down their moral vision fully with the obligations accompanied with the status of the employee. More number of engineers are only salaried employees, so, they have to work within large bureaucracies under great pressure to work smoothly within the company. They have to give importance only to the obligations of their employers. Gradually, the small negative duties such as not altering data by fraud, not violating patent right and not breaking confidentiality, may be viewed as the full extent of moral desire.

As mentioned, engineering as social experimentation brings into light not only to the person concerned but also to the public engineers as guardians of the public interest i.e., to safeguard the welfare and safety of those affected by the engineering projects. This view helps to ensure that this safety and welfare will not be affected by the search for new knowledge, the hurry to get profits, a small and narrow follow up of rules or a concern over benefits for the many and ignoring the harm to the few.

The social experimentation that involved in engineering should be restricted by the participants consent.

Relevant Information

Without relevant factual information, conscientious is not possible. For showing moral concern there should be an obligation to obtain and assess properly all the available information related to the fulfilment of one's moral obligations. This can be explained as:

1) To understand and grasp the circumstance of a person's work, it is necessary to know about how that work has a moral importance. For example, A person is trying to design a good heat exchanger. There is nothing wrong in that. But at the same time, if he forgets the fact that the heat exchanger will be used in the manufacture of an illegal product, then he is said to be

showing a lack of moral concern. So, a person must be aware of the wider implication of his work that makes participation in a project.

2) Blurring the circumstance of a person's work derived from his specialization and division of labour is to put the responsibilities on someone else in the organization. For example, if a company produces items which are out of fashion or the items which promotes unnecessary energy wastage, then it is easy to blame sales department.

The above said means, neglecting the importance of a person's works also makes it difficult in acquiring a full perspective along a second feature of factual information i.e., consequence of what one does.

So, while giving regard to engineering as social experimentation, points out the importance of circumstances of a work and also encourage the engineers to view his specialized activities in a project as a part of a large social impact.

Moral Autonomy

This refers to the personal involvement in one's activities. People are morally autonomous only when their moral conduct and principles of actions are their own i.e., genuine in one's commitment to moral values.

Moral beliefs and attitudes must be integrated into an individuals' personality which leads to a committed action. They cannot be agreed formally and adhered to merely verbally. So, the individual principles are not passively absorbed from others. When he is morally autonomous and also his actions are not separated from himself.

When engineering has seen as a social experimentation, it helps to keep a sense of autonomous participation in a person's work. An engineer, as an experimenter, is undergoing training which helps to form his identity as a professional. It also results in unexpected consequence which helps to inspire a critical and questioning attitude about the current economic and safety standards. This also motivates a greater sense of personal involvement in a person's work.

Accountability

The people those who feel their responsibility, always accept moral responsibilities for their actions. It is known as accountable. In short, „accountable" means being culpable and hold responsible for faults. In general, and to be proper, it means the general tendency of being willing to consider one's actions to moral examinations and be open and respond to the assessment of others. It comprises a desire to present morally convincing reasons for one's conduct when called upon in specific circumstances.

The separation of causal influence and moral accountability is more common in all business and professions and also in engineering. These differences arising from several features of modern engineering practices are as follows:

1. Large – scale engineering projects always involve division of work. For each and every piece of work, every person contributes a small portion of their work towards the completion of the project. The final output us transmitted from one's immediate work place to another causing a decrease in personal accountability.

2. Due to the fragmentation of work, the accountability will spread widely within an organization. The personal accountability will spread over on the basis of hierarchies of authority.

3. There is always a pressure to move on to a different project before finishing the current one. This always leads to a sense of being accountable only for fulfilling the schedules.

4. There is always a weaker pre-occupation with legalities. In other words, this refers to a way a moral involvement beyond the laid down institutional role. To conclude, engineers are being always blamed for all the harmful side effects of their projects. Engineers cannot separate themselves from personal responsibilities for their work.

CODES OF ETHICS

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

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

Roles of codes and its functions

1) Inspiration and Guidance

Codes give a convinced motivation for ethical conduct and provide a helpful guidance for achieving the obligations of engineers in their work. Codes contribute mostly general guidance as they have to be brief. Specific directions may also be given to apply the code in morally good ways.

The following engineering societies have published codes of ethics.

AAES - American Association of Engineering Societies

ABET - Accreditation Board for Engineering and Technology (USA)

NSPE - National Society of Professional Engineer (USA)

IEEE - Institute of Electrical and Electronics Engineering (USA)

AICTE - All India Council for Technical Education (India)

Most of the technological companies have established their own codes such as pentagon (USA), Microsoft etc. These codes are very much helpful to strengthen the moral issues on the work of an engineer.

2) Support

Codes always support an engineer who follows the ethical principles. Codes give engineers a positive, a possible good support for standing on moral issues. Codes also serve as a legal support for engineers.

3) *Deterrence and Discipline*

Codes act as a deterrent because they never encourage to act immorally. They also provide discipline among the Engineers to act morally on the basis of codes does not overrule the rights of those being investigated.

4) *Education and Mutual Understanding*

Codes have to be circulated and approved officially by the professionals, the public and government organizations which concern with the moral responsibilities of engineers and organizations.

5) *Contributing to the profession's Public Image*

Codes help to create a good image to the public of an ethically committed profession. It helps the engineers in an effective manner to serve the public. They also give self-regulation for the profession itself.

6) *Protecting the Status Quo*

Codes determine ethical conventions which help to create an agreed upon minimum level of ethical conduct. But they can also suppress the disagreement within the profession.

7) *Promoting Business Interests*

Codes help to improve the business interests. They help to moralize the business dealings to benefit those within the profession.

Limitations of Codes

1. Codes are restricted to general and vague wordings. Due to this limitation, they cannot be applicable to all situations directly. It is also impossible to analyze fully and predict the full range of moral problems that arises in a complex profession.

2. Engineering codes often have internal conflicts. So, they can't give a solution or method for resolving the conflict.

3. They cannot be treated as the final moral authority for any professional conduct. Codes represent a compromise between differing judgments and also developed among heated committee disagreements.

4. Only a few practicing engineers are the members of Professional Societies and so they cannot be compelled to abide by their codes.

5. Many engineers who are the members of Professional Societies are not aware of the existence of the codes of their societies and they never go through it.

6. Codes can be reproduced in a very rapid manner.

7. Codes are said to be coercive i.e., implemented by threat or force.

A BALANCED OUTLOOK ON LAW

A balanced outlook on laws stresses the necessity of laws and regulations and their limitations in directing engineering practice.

In order to live, work and play together in harmony as a society, there must be a balance between individual needs and desires against collective needs and desires. Only ethical conduct can provide such a balance. This ethical conduct can be applied only with the help of laws. Laws are important as the people are not fully responsible and because of the competitive nature of the free enterprise system which does not encourage moral initiative.

The model of engineering as social experimentation allows for the importance of clear laws to be effectively enforced.

Engineers, ought to play an effective role in promoting or changing enforceable rules of engineering as well as in enforcing them. So, the codes must be enforced with the help of laws. The following are the two best examples.

1. Babylon's Building Code: (1758 B.C.)

This code was made by Hammurabi, king of Babylon. He formed a code for builders of his time and all the builders were forced to follow the code by law. He ordered

"If a builder has built a house for a man and has not made his work sound, and the house which he has built was fallen down and so caused the death of the householder, that builder shall be put to death. If it causes the death of the house holder's son, they shall put that builder's son to death. If it causes the death of the house holder's slave, he shall give slave to the householder. If it destroys property, he shall replace anything it has destroyed; and because he has not made the house sound which he has built and it has fallen down, he shall rebuild the house which has fallen down from his own property. If a builder has built a house for a man and does not make his work perfect and the wall bulges, that builder shall put that wall in to sound condition at his own cost".

The above portion of Babylon‟s building code was respected duly. But the aspects find only little approval today. This code gives a powerful incentive for self-regulation.

2. The United States Steamboat Code: [1852 A.D]

Steam engines in the past were very large and heavy. James Watt, Oliver Evans and Richard Trevethik modified the old steam engines by removing condensers and made them compact. Beyond careful calculations and guidelines, explosions of boiler happened on steam boats, because of the high speed of the boats. The safety valves were unable to keep steam pressure up causing explosion. During that period in 18 th century, more than 2500 people were killed and 2000 people were injured because of the explosion of boilers in steam boats.

Due to this, the ruling congress in USA passed a law which provided for inspection of the safety aspects of ships and their boilers and engines. But his law turned out to be ineffective due to the corruptions of the inspectors and also their inadequate training regarding the safety checking. Then Alfred Guthiro, an engineer of Illinoise had inspected about 200 steam boats on his own cost and found out the reasons for the boiler explosions and made a report. His recommendations were published by a Senator Shields of Illinoise and incorporated in senate documents. With the help of this, another law was passed. Now it is in the hands of the

American Society of Mechanical Engineers who formulated the standards for producing steam boats.

THE CHALLENGER CASE STUDY

The world has known about many numbers of accidents. Among them the explosion of the space shuttle „Challenger" is the very familiar one. In those days this case had been reviewed vigorously by media coverage, government reports and transcripts of hearings. This case deals with many ethical issues which engineers faced. It poses many questions before us. What is the exact role of the engineer when safety issues are concern? Who should have the ultimate authority for decision making to order for a launch? Whether the ordering of a launch be an engineering or a managerial decision?

Challenger space shuttle was designed to be a reusable one. The shuttle mainly consisted of an orbiter, two solid propellant boosters and a single liquid-propeller booster. All the boosters were ignited and the orbiter was lifted out the earth. The solid rocket booster was of reusable type. The liquid propellant booster was used to finish the lifting of the shuttle in to the orbit. This was only a part of the shuttle which has been reused.

The accident took place on 28th January 1986, due to the failure of one of the solid boosters. In the design of the space shuttle, the main parts which needed careful design of the fields joints where the individual cylinders were placed together. The assembly mainly consists of tang and clevis joints which are sealed by two O-rings made up of synthetic rubber only, not specifically hat resistant. The function of the O-rings is to prevent the combustion gases of the solid propellant from escaping. The O-rings were eroded by hot gases, but this was not a serious problem, as the solid rocket boosters were only for reuse initially for the few minutes of the flight. If the erosion of the O-rings could be in a controlled manner, and they would not completely burn through, then the design of the joint would be acceptable, however the design of the O-rings in this shuttle was not so.

In the post flight experiment in 1985, the Thiokol engineers noticed black soot and grease on the outside of the boosters due to leak of hot gases blown through the O-rings. This raised a doubt on the resiliency of the materials used for the O-rings. Thiokol engineers redesigned the rings with steel billets to withstand the hot gases. But unfortunately, this new design was not ready by that time of flight in 1986.

Before launching, it was necessary to discuss the political environment under which NASA was operating at that time. Because the budget of NASA has decided by Congress. These factors played the main cause for unavoidable delay in the decision to be taken for the shuttle performance, the pressures placed for urgency in launching in 1986 itself, before the launch of RUSSIAN probe to prove to the congress that the program was on processing. The launching date had already been postponed for the availability of vice president GEORGE BUSH, the space NASA supporter. Later further delayed due to a problem in micro switch in the hatch-locking mechanism. The cold weather problem and long discussions went on among the engineers. The number of tele-conferences further delayed the previous testing in 1985 itself. The lowest temperature was 53-degree Fahrenheit but O-ring temperature during the proposed launch period happened to be only 29-degree Fahrenheit, which was far below the environment temperature at which NASA had the previous trail. Somehow, the major factor that made the revised final decision was that previous trial. Somehow, the major factor that made the revised

final decision was that with the available data at that time there seemed to be no correlation between the temperature and the degree at which O-rings had eroded by the blow-by gas in the previous launch. Assuming a safety concern due to cold weather, though the data were not concluded satisfactorily, a decision was taken not to delay further for so many reasons, and the launch was finally recommended.

But unexpectedly the overnight temperature at the time of launch was 8-degree Fahrenheit colder than ever experienced. It was estimated that the temperature of the right-hand booster would be only at 28-degree Fahrenheit. The camera noticed a puff of smoke coming out from the field joints as soon as the boosters were ignited. But the O-rings were not positioned properly on their seats due to extreme cold temperature. The putty used as heat resistant material was also too cold that it failed to protect the O-rings. All these effects made the hot gases to burn past both the O rings, leading to a blow-by over an arc around the O-rings. Though immediately further sealing was made by the by-products of combustion in the rocket propulsion, a glassy oxide formed on the joints. The oxides which were temporarily sealing the field joints at high temperature, later were shattered by the stresses caused by the wind. Again, the joints were opened and the hot gases escaped from the solid boosters. But the boosters were attached to the large liquid fuel boosters as per the design. This made the flames due to blow-by from the solid fuel boosters quickly to burn through the external tank. This led to the ignition of the liquid propellant making the shuttle exploded.

Later the accident was reviewed and investigations were carried out by the number of committees involved and by various government bodies. President Regan appointed a commission called Rogers Commission which constituted many distinguished scientists and engineers. The eminent scientists in the commission after thorough examination and investigations gave a report on the flexibility of the material and proved that the resiliency of the material was not sufficient and drastically reduced during the cold launch.

As the result of commission hearings, a lot of controversial arguments went on among the Thiokol engineers. Thiokol and NASA investigated possible causes of the explosion. Mr.Boisjoly, the main member in the investigation team, accused Thiokol and NASA of intentionally downplaying the problems with the O-rings while looking for the other causes of the accidents. The hot discussions hurt the feelings and status of the headed engineers like Mr.Boisjoly, Mr.Curtis and Mr.Mellicam. Finally, the management's atmosphere also became intolerable. This event shows the responsibility, functions, morality, duties of the engineers leading to ethical problems.

INDUSTRIAL STANDARDS

A set of criteria within an industry relating to the standard functioning and carrying out of operations in their respective fields of production. In other words, it is the generally accepted requirements followed by the members of an industry. It provides an orderly and systematic formulation, adoption, or application of standards used in a particular industry or sector of the economy. Industry standards vary from one industry to another. Industry standards facilitate global as well as domestic competitiveness. It is a crucial tool for developing and meeting industry goals. For example, in the automotive industry, tire sizes and durability must fall within a standardized range. Standardization serves as a quality check for any industry.

Purpose of various types of standards:

• Accuracy in measurement, inter changeability, ease of handling.

• Prevention of injury, death and loss of income or property.

• Fair value of price.

• Competence in carrying out tasks.

• Sound design, ease of communications.

• Freedom from interference.

UNIT- IV

Safety, Responsibilities and Rights

***Syllabus*:** Safety Definition, Safety and Risk, Risk Analysis, Assessment of Safety and Risk, Conflict of Interests, Occupational Crime, Human Rights, Employee Rights, Whistle Blowing, Intellectual Property Rights

Definition of Safety: The condition of being protected from or unlikely to cause danger, risk, or injury.

Definition of Risk: Risk is the likelihood of an undesirable outcome or the potential for harm.

Safety and Risk: There is an interconnection between safety and risk. In fact, both the concepts are relational. Risk is the possibility of harm or loss, while safety is the freedom from risk or exposure to danger. Essentially, safety aims to mitigate or eliminate risks.

Safety measures involve implementing procedures, practices, and technologies to reduce the likelihood and impact of potential risks. For example, Wearing sterilized hand gloves during surgeries or wound caring reduces the risk of possible infection. Wearing a seatbelt while driving is a safety measure that reduces the risk of injury in an accident.

Risks can be classified based on their severity, likelihood, and the nature of the threat (e.g., environmental, financial, health & safety). It can arise from various factors, both internal and external, controllable and uncontrollable. For example, the risk of a traffic accident includes the potential for injury or property damage.

So far if we think of the relationship between the two, we find that safety and risk have an inverse relationship; as one increases, the other decreases.

Since, risk shows the probability of the outcome/consequence, hence effective risk management is crucial for improving safety by identifying, assessing, and mitigating potential hazards. Therefore, a healthy balance between taking risks and ensuring safety is important in various contexts, including investment, business, and professional & personal decisions.

Summarizing the above, we can say safety is the result of proactive measures taken to address and minimize risks, aiming to create a protected and secure environment.

Categories of Risks

Voluntary and involuntary risk: Voluntary risk is a situation wherein the people choose willingly and involve in risk Whereas Involuntary risk is taken by people unwillingly or by compulsion.

Many consider something safer if they knowingly take on the risk, but would find it unsafe if forced to do so. If the property values are low enough, some people will be tempted to buy a house near a plant that emits low levels of a toxic waste into the air. They are willing to assume the risk for the benefit of cheap housing. However, if a person already living near a plant finds that toxic fumes are emitted by the plant and he wasn't informed, the risk will appear to be larger, since it was not voluntarily assumed.

Short term and long-term consequences: Something that might cause a short-lived illness or disability seems safer than something that will result in permanent disability. An activity for which there is a risk of getting a fractured leg will appear much less risky than an activity with a risk of a spinal fracture, since a broken leg will be painful and disabling for a few months, but generally full recovery is the norm. Spinal fractures, however, can lead to permanent disability.

Reversible effects: Something will seem less risky if the bad effects are ultimately reversible. This concept is similar to long term and short-term risk.

Expected Probability: Many might find a one-in-a-million chance of a severe injury to be an acceptable risk, whereas a 50: 50 chances of a fairly minor injury might be unacceptable.

Threshold level of risk: Something that is risky only at fairly high exposure will seem safer than something with a uniform exposure to risk. Studies have shown that low levels of nuclear radiation actually have beneficial effects on human health, while only at higher levels of exposure are there severe health problems or death. If there is a threshold for the effects, generally there will be a greater tolerance for risk.

Delayed Risk and Immediate Risk: The activity that will cause harm in future seems less risky and is called delayed risk. Example: Mobile radiation, Fast food and alcohol. Any activity that results is immediate harm or risk is immediate risk. Example: fall due to slippery floor, electric shock, fall from ladder and explosion will put risk for engineers immediately.

Analysis and Assessment of Risk and Safety

Discuss analytical methods adopted in testing for safety of a product/project or Risk analysis?

Scenario Analysis

It is a technique used in risk management to understand how different future events could affect an organization's objectives. It provides insight into potential risks and opportunities that may arise from uncertain situations, allowing companies to make informed decisions. This method involves considering different scenarios or hypothetical situations that may occur and assessing the potential outcomes of each scenario. The scenarios can be based on various factors such as economic conditions, regulatory changes, natural disasters, or industry developments.

Steps for Risk Assessment

- What can go wrong that could lead to an outcome of hazard exposure? **(Identification and characterization of risk**)
- How likely is this to happen? (**Quantification of risk, likelihood, and magnitude**)
- If it happens, what are the consequences? Scenarios are constructed and the **ways and means of facing the consequences are designed.**

Example: Consider three loss scenarios facing the company which is transporting various cargoes, some hazardous. The three scenarios involve the legal liability arising from use of company vehicles on public roads.

- **Scenario A:** It has a probability of occurrences of 0.001 and a loss potential of 50 million. It is deemed sufficiently "possible" and significant so as to be unequivocally classified as "risky".
- **Scenario B**: It represents the company's liability for an accident involving bodily injury and property damage from relatively "ordinary" road hazards. No spill or disruption of cargo is involved.
- Finally, **Scenario C** identifies a situation involving multiple simultaneous catastrophes to the company fleet.

Scenario A has probability of occurrence of 0.001 and a loss potential of 50 million. It is deemed sufficiently "possible" and significant so as to be unequivocally classified as "risky".

Scenario B, on the other hand, while more probable than A, involves losses that this firm considers "affordable". As such, it is rated not risky with confidence.

Not so easy to classify scenario C. while the probability of multiple catastrophes is not strictly zero, it is rare (10^{-6}, or chance in a million). So, while the loss potential is great, the chance of occurrence is "virtually impossible". Scenario C, nonetheless, resides in that gray area of risk that result in considerable anxiety over its classification.

Methods of Assessment of Safety and Risk

Failure Mode and Effect Analysis (*FEMA*)

Failure Mode and Effects Analysis (FMEA) is a structured approach to discovering potential failures that may exist within the design of a product or process. Failure modes are the ways in which a process can fail. Effects are the ways that these failures can lead to waste, defects or harmful outcomes for the customer. Failure Mode and Effects Analysis is designed to identify, prioritize and limit these failure modes.

Types of FMEAs

- Design
    - Analyzes product design before release to production, with a focus on product function
    - Analyzes systems and subsystems in early concept and design stages
- Process
    - Used to analyze manufacturing and assembly processes after they are implemented

When to Conduct an FMEA

- Early in the process improvement investigation
- When new systems, products, and processes are being designed
- When existing designs or processes are being changed
- When carry-over designs are used in new applications

- After system, product, or process functions are defined, but before specific hardware is selected or released to manufacturing

FMEA Procedure

1. For each process input (start with high value inputs), determine the ways in which the input can go wrong (failure mode)
2. For each failure mode, determine effects
    - Select a severity level for each effect
3. Identify potential causes of each failure mode
    - Select an occurrence level for each cause
4. List current controls for each cause
    - Select a detection level for each cause
5. Calculate the Risk Priority Number (RPN)
6. Develop recommended actions, assign responsible persons, and take actions
    - Give priority to high RPNs
    - MUST look at severities rated a 10
7. Assign the predicted severity, occurrence, and detection levels and compare RPNs

What is Severity, Occurrence, and Detection in FMEA

- Severity: Importance of the effect on customer requirements
- Occurrence: Frequency with which a given cause occurs and creates failure modes (obtain from past data if possible)
- Detection: The ability of the current control scheme to detect (then prevent) a given cause (may be difficult to estimate early in process operations).

Rating Scales

- Severity: 1 = Not Severe, 10 = Very Severe
- Occurrence: 1 = Not Likely, 10 = Very Likely
- Detection: 1 = Easy to Detect, 10 = Not easy to Detect

Risk Priority Number (RPN)

RPN is the product of the severity, occurrence, and detection scores.

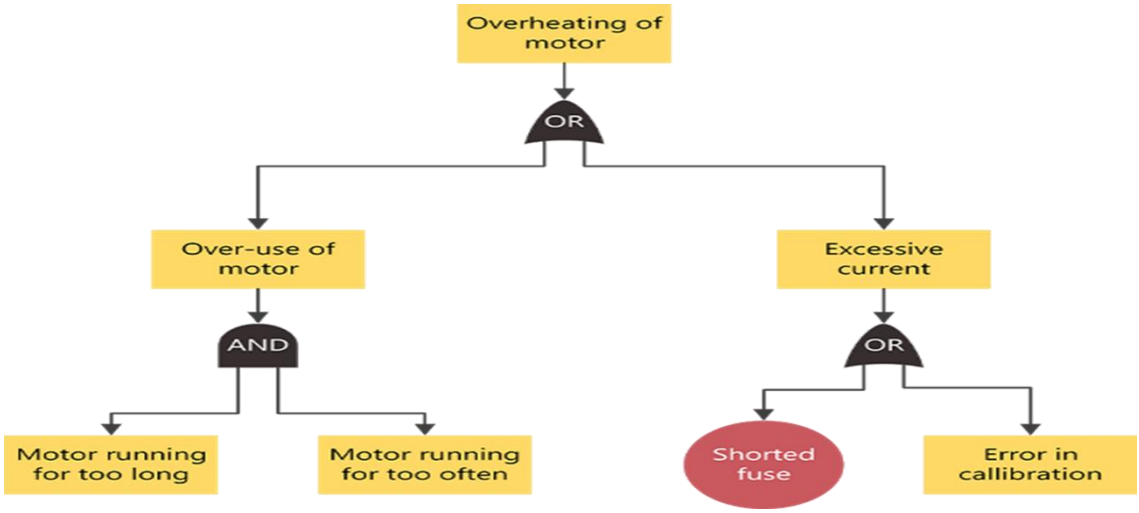
Severity x Occurrence x Detection = RPN

Example of FMEA for Manufacturing Process

Process Step	Potential Failure Mode	Potential Effects of Failure	Severity (S)	Occurrence (O)	Detection (D)	Risk Priority Number (RPN)	Actions Taken
Material Inspection	Incorrect material received	Assembled products may fail to meet specifications	8	3	5	120	Improved supplier communication, additional inspection checks
Cutting Process	Machine blade wear	Inconsistent part dimensions	6	4	6	144	Regular maintenance schedule, blade replacement protocol
Welding Operation	Inadequate weld strength	Structural failure of components	9	2	4	72	Stricter quality checks, regular equipment maintenance
Assembly	Incorrect assembly sequence	Product malfunctions, safety risks	7	3	7	147	Enhanced training for assembly line workers, visual aids
Quality Inspection	Incomplete inspection	Defective products shipped to customers	7	3	7	147	Training and certification for quality inspectors, process audit
Packaging	Incorrect labeling	Misidentification of products	5	4	8	160	Automated labeling systems, additional visual

Fault Tree Analysis (FTA)

FTA focuses on identifying potential failures or faults within a system that could lead to an undesired event or outcome. It starts with the top event, which is the undesired outcome, and then systematically breaks down the event into its component parts, such as system failures, human errors, equipment malfunctions, or external events. Example:



Breakdown of the Fault Tree Analysis:

1. *Top Event (Primary Failure):*
    - The **Overheating of Motor** is the top-level failure event that needs to be analyzed.
2. *Contributing Factors (Intermediate Events):*
    - The overheating of the motor can be caused by **Overuse of the motor** or **Excessive current** (connected via an OR gate).
3. *Basic Causes (Root Causes):*
    - *Overuse of the Motor*:
        - This happens when both **Motor running for too long** and **Motor running too often** occur together (AND gate).
    - *Excessive Current:*
        - This can be caused by either **Shorted fuse** or **Error in calibration** (OR gate).

Logical Analysis:

- If **either** excessive current or overuse of the motor occurs, overheating can happen.
- For overuse of the motor to occur, **both** conditions (motor running for too long and too often) must be met.
- Excessive current can occur due to **either** a shorted fuse or an error in calibration.

Application in Risk Assessment:

- FTA helps in **identifying critical failure points** and their dependencies.
- It allows engineers to **prioritize risk mitigation strategies** by addressing root causes.

- By analyzing the logic gates, one can determine the **probability of system failure** and implement preventive measures.

Event Tree Analysis (ETA)

ETA, on the other hand, focuses on analyzing the possible sequences of events that may occur following an initiating event, leading to various outcomes or consequences. It begins with an initiating event, such as an accident or failure, and then models the potential subsequent events and their probabilities, often branching out into different scenarios based on different conditions or responses. Example:

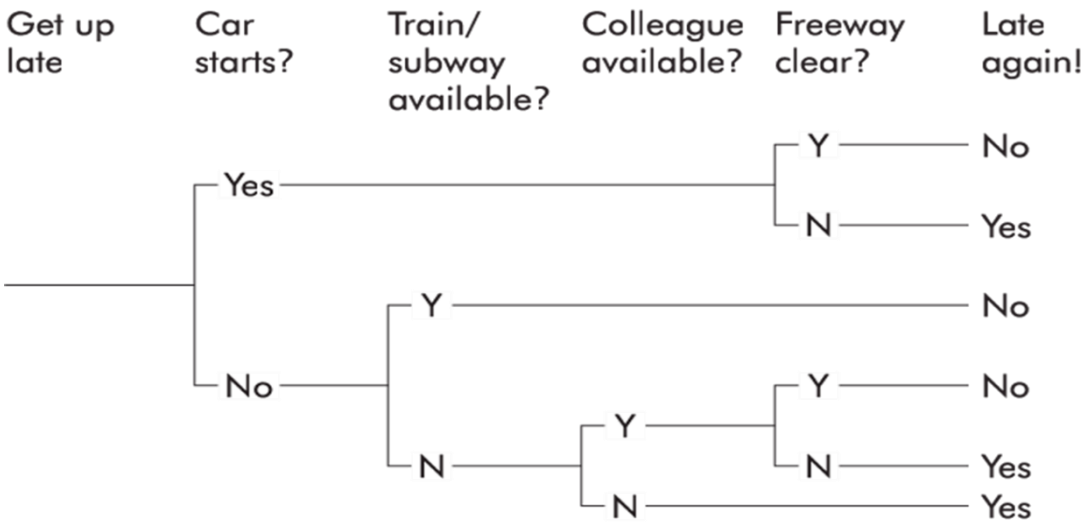


Figure: Event Tree Analysis

Whistleblowing

Whistle-blowing refers to the phenomenon when someone comes out with the information that something unethical has happened or is happening. Whistle-blowing in general has the following five attributes:

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

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

Mode: when a person discloses information of some unethical acts, he/she does not follow the approved or regular channels to convey information. There can be

many reasons for this: the person is under pressure from the organization not to disclose such information; or the person finds that the immediate supervisors who form the normal channels of communication do not listen to what he/she considers legitimate complaints.

Motive: the motive of the whistleblower is important. He / she would reveal information that the organization considers confidential, with a noble motive to bring to the public notice or authorities, something unethical going on, that could significantly affect public safety or morality.

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

Types of Whistleblowing

- **External whistle-blowing**: This occurs when an employee gives out information about unethical acts to agencies outside the organization, he/she works for.
- **Internal whistle- blowing**: This is when the employee discloses the information within the organization to a superior entity bypassing the normal channels of communication.
- **Open Whistle-blowing**: this is when the person disclosing the information does not hide his/her identity.
- **Anonymous whistle-blowing**: This is when the person disclosing the information does not disclose his/her identity. Anonymous whistle-blowing is generally not taken seriously.

Intellectual Property rights

Intellectual property may be defined as the information and original expression that derives its original value from creative ideas, and is with a commercial value. I.P rights permit people to have fully independent ownership for their innovations and creativity, like that of own physical property. This encourages the IP owners towards innovation and benefit to the society. It is an asset that can be bought or sold, licensed, and exchanged.

Types and norms 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. 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.

Types of patents:

a. **Utility Patents**: The utility patent is granted to anyone who invents or discovers any new and useful process, machine, manufacture or chemical composition of any manner or any new and useful improvement thereof. The utility time is 20 years.

b. **Industrial Design Patents**: The industrial design patent is an idea or conception regarding features of shape, configuration, pattern, ornamental with lines or colours applied to any article, two or three dimensional, made by any industrial process and is judged by the eye or a product. For example, the design of a tea cup must have a hollow receptacle for holding tea and a handle to hold the cup. These are functional features that cannot be registered. But a fancy shape or ornamentation on it would be registerable. The design patent has a term of 14 years from the date of filing the application. It is covered under Design Act 2000.

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. The life of the copyright protection is the life of the inventor or author plus 60 years. Copyrights give 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 translation of the work and (e) to make any adaptation of the work.
3. **Trademark**: Trademark is a wide identity of specific goods 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.
4. **Trade Secret**: A trade secret is the information which is kept confidential as a secret. This information is not accessed by any other(competitor) than the owner and this gives a commercial advantage over the competitors. The trade secrets are not registered but only kept confidential. These are given limited legal protection, against abuse by the employee or contractor, by keeping confidentiality and trust. The trade secrets may be formulae, or methods, or programs, or processes or test results or data collected, analysed, and synthesized.

Occupational Crimes

A. An Industrial Espionage:

The term industrial espionage refers to the illegal and unethical theft of business trade secrets for use by a competitor to achieve a competitive advantage. This activity is a covert practice often done by an insider or an employee who gains employment for the express purpose of spying and stealing information for a competitor. Industrial espionage is conducted by companies for commercial purposes rather than by governments for national security purposes.

Types of industrial espionage

Industrial espionage and corporate spying are conducted through a variety of channels and for various purposes. Some espionage is conducted through legal channels and some is conducted illegally. The following are examples of some common types of industrial espionage.

IP theft. This type of espionage comes in many different forms. For example, it can be a theft of engineering designs from an automobile or aerospace company; a formula for a new drug from a pharmaceutical company; a recipe from a food and beverage or vitamin supplement company; new robotic manufacturing processes from a high-tech manufacturer; or even pricing sheets and customer lists. These items may be stolen by outsider perpetrators or foreign governments, or by employee insiders who are disgruntled or see a way to get hired or compensated by a competitor for the theft.

Property trespass. Breaking into physical premises or files to obtain company information is another form of industrial espionage. A surprising number of critical corporate assets are still in physical form and may be obtained by insider employees or by outsiders who gain access to the premises.

Hiring away employees. Competitors frequently try to hire away employees from companies to gain access to information the employees have acquired on the job. Most of the time, the knowledge employees obtain on the job is part of the trade and is legitimately transferrable, but there also are times when employees leave with valuable trade secrets and formulas in their heads that they can put to work for their new companies.

Wiretapping or eavesdropping on a competitor. Those desiring information from a company can set up portable devices that listen in or record certain conversations, such as a confidential board meeting. In some cases, this wiretapping may be legal and authorized, but in others, it is illegal listening for the purpose of economic or strategic gain.

Cyber-attacks and malware. Whether it is through a distributed denial-of-service attack or an infusion of malware that corrupts a company's network, companies, governments and organizations also seek to disrupt each other by sabotaging daily operations and disabling their ability to work.

B. Bootlegging

Bootlegging, as an occupational crime, refers to the illegal manufacturing, transportation, distribution, or sale of prohibited goods, particularly alcohol during Prohibition, or the illegal reproduction and distribution of copyrighted material today.

What is Bootlegging?

- *Historical Context*:

During the Prohibition era (1920-1933) in the United States, bootlegging involved the illegal production, smuggling, and distribution of alcoholic beverages, which was forbidden under the 18th Amendment to the U.S. Constitution.

- *Modern Usage*:

The term "bootlegging" can also refer to the illegal copying and distribution of copyrighted materials, such as movies, music, or software.

- *Origin of the Term*:

The term "bootlegging" originated from the practice of concealing flasks of illicit liquor in the leg of a high boot.

Examples of Bootlegging as an Occupational Crime

- During Prohibition:
    - Manufacturing Illegal Alcohol: Bootleggers would set up illegal distilleries (like moonshine stills) to produce alcohol, often in rural areas or hidden locations.
    - Smuggling Alcohol: They would smuggle alcohol across state lines or international borders, using various methods to evade law enforcement, like using speedboats to outrun Coast Guard patrols.
    - Supplying Speakeasies: Bootleggers would supply illegal bars (speakeasies) with alcohol, which became social hubs during the Prohibition era.
- Modern Examples:
    - Pirated Movies and Music: Bootlegging can involve the illegal recording and distribution of movies or music, often through unauthorized online platforms.
    - Software Piracy: The illegal copying and distribution of software is another form of modern bootlegging.
    - Counterfeit Goods: Bootlegging can also involve the production and distribution of counterfeit goods, like clothing or electronics.

C. *Grease Payments*

A grease payment is a small payment or favour offered to a minor official or functionary to expedite a routine service or process that the recipient is already obligated to perform by law or regulation.

Grease Payment vs. Bribe

The key difference between a grease payment and a bribe lies in the intent and the outcome. A grease payment aims to expedite a routine process, not necessarily change the outcome. A bribe, on the other hand, is intended to influence a decision in the giver's favor, potentially involving something they are not entitled to by law. The legality of grease payments can be a grey area. In some jurisdictions, they might be considered a minor offense, while others might view them as a form of bribery.

D. *Moonlighting*

Moonlighting is a practice in which the employees take up another job or do freelance work in addition to their regular full-time job during off hours.

Different cultures have different outlooks on moonlighting. For instance, in India, this is usually not encouraged by companies as this leads to many issues like a decrease in productivity, conflict of interest, and even breach of employment contracts. However, it is normalized in western economies. In fact, the percentage of U.S. workers who hold more than one job has been increasing during the past 20 years.

There are four different kinds of moonlighting, based on the nature of motivation and circumstances

1. **Quarter Moonlighting:** In this, employees undertake part-time jobs to supplement the poor pay that they receive. For example, the workers might undertake freelancing as a supplement for their inadequately remunerated principal source of income.
2. **Half Moonlighting:** Employees devote half of their time to a side hustle to build a future financial reserve or support a luxurious life. For example, a marketing professional might run an online retail business during their free hours.
3. **Full Moonlighting:** This happens when employees take up a second job or start a business that requires substantial time and effort, often compromising with their full-time role. An example could be an engineer launching a startup while working full-time at an IT firm.
4. **Blue Moonlighting:** Blue Moonlighting occurs when employees take on a second job despite financial satisfaction, driven by dissatisfaction in their primary role. For example, a financial analyst freelancing as a graphic designer to explore a new career option.

E. Occupational Hazards

An "occupational hazard" is a risk or danger inherent in a specific job or workplace environment that can lead to injury, illness, or death.

- **Definition:**

An occupational hazard is any condition or situation in a workplace that has the potential to cause harm to employees.

- **Examples:**

These hazards can include physical, chemical, biological, or psychological factors, such as exposure to toxic substances, loud noises, repetitive motions, or workplace stress.

- **Categories:**

Occupational hazards can be broadly categorized as:

- **Physical hazards:** These include things like noise, temperature extremes, radiation, and vibration.
- **Chemical hazards:** These involve exposure to chemicals, gases, and vapors.
- **Biological hazards:** These include risks from bacteria, viruses, and other biological agents.
- **Psychosocial hazards:** These involve workplace stress, bullying, and other factors that can negatively impact mental health.
- **Ergonomic hazards:** These relate to how a job is designed and can cause musculoskeletal injuries.

F. Price Fixing

Price fixing is an agreement between competitors or businesses in a market to set the price of goods and services. This agreement involves direct or indirect communication, resulting in prices being set at levels higher than competitive market conditions would otherwise dictate. One example is if two companies who are major producers of a particular product collude to raise the price of their product above what competitive market forces would otherwise dictate.

Example of Price Fixing

In a small town, there are only two gas stations. The two gas stations are engaged in a tough competition with each other, undercutting prices to attract the most customers.

One day, the manager at one of the gas stations decides to schedule a meeting with the manager at the other gas station. He says: “Over the past few months, our profits have declined because we have been decreasing our prices to drive traffic away from each other – why don’t we both agree on a price to charge customers so we can extract more profits from them?”

The other manager agrees, and the gas stations collectively decide to raise prices from $100 to $200. Given no other options, consumers are forced to pump gas at $200.

G. What is an example of paternalism?

Paternalism refers to a person or institution of authority restricting the freedom of choice of a person or persons because they believe it is in their best interest. An example might be a doctor ordering surgery for a patient without informing them of other available options.

Paternalism Definition

Autonomy is the right of a person to make decisions on their own. When a person or institution of authority limits the autonomy of a person or a group of people, supposedly for their own good, the practice is referred to as paternalism. A paternalistic system acts on the premise that certain people are not capable of acting in their own interests and require the supervision of

those in authority. The word paternalism is from the Latin word for fatherly and suggests a parent-child relationship.

The undesired effects of paternalism include the denial of freedom to make decisions for oneself and being in a position of perceived inferiority. Groups that are likely to experience paternalism include the elderly, disabled, or terminally ill.

H. Insider Information

Insider trading, which involves using non-public information for financial gain, is a form of occupational crime, often categorized as white-collar crime, where individuals misuse their position for personal benefit.

- **Insider Trading as an Example:**

Insider trading, where someone trades securities based on non-public, material information, is a classic example of occupational crime.

- **Who is Involved?**

Individuals with access to sensitive, non-public information, such as company employees, directors, or service providers, can be involved in insider trading.

- **Why it's Illegal:**

Trading on insider information creates an unfair advantage in the market, potentially harming other investors and undermining market integrity.

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Globalization

Introduction: Globalization is a complex and multifaceted phenomenon that describes the increasing interconnectedness and interdependence of countries through the exchange of goods, services, information, and people. It transcends national borders, impacting economic, social, cultural, and political spheres. While the roots of global interaction can be traced back centuries, the pace and intensity of globalization have accelerated dramatically in recent decades, driven by technological advancements, policy changes, and the rise of multinational corporations.

Key Dimensions of Globalization:

1. **Economic Globalization:** This dimension involves the increasing integration of national economies through cross-border trade, investment flows (both foreign direct investment and portfolio investment), and the movement of labour. Key aspects include:

    Trade Liberalization: Reduction of tariffs and other barriers to international trade, leading to increased flow of goods and services.

    Financial Globalization: Integration of financial markets, facilitating the movement of capital across borders.

    Global Supply Chains: Fragmentation of production processes across different countries to leverage cost efficiencies.

2. **Social Globalization:** This refers to the increasing interconnectedness of people across the globe through the spread of information, ideas, and cultural norms. Key aspects include:

    Information Flows: Rapid dissemination of information through the internet, social media, and global media outlets.

    Cultural Exchange: Increased interaction between different cultures, leading to both homogenization and hybridization.

    Migration: Movement of people across borders for work, education, or other reasons.

3. **Political Globalization:** This involves the increasing cooperation and interdependence among countries at the political level. Key aspects include:

    International Organizations: The role of bodies like the United Nations (UN), World Trade Organization (WTO), and International Monetary Fund (IMF).

    Regional Blocs: Formation of economic and political alliances such as the European Union (EU) and ASEAN.

Global Governance: Emergence of norms, laws, and institutions that address transnational issues.

4. **Technological Globalization:** This is a major driver of globalization, characterized by the rapid development and diffusion of technologies such as the internet, mobile communications, and transportation.

Drivers of Globalization:

Technological Advancements: Innovations in communication, transportation, and information technology have significantly reduced the costs and time associated with cross-border interactions.

Policy Changes: Liberalization of trade and investment regimes by many countries has facilitated greater economic integration.

Market Forces: The desire of businesses to expand into new markets, access cheaper resources, and improve efficiency drives global economic activity.

Impacts of Globalization:

Globalization has profound and often debated impacts across various domains:

Economic Impacts:

Increased Trade and Investment: Leading to economic growth in many countries.

Job Creation (and Potential Job Displacement): While new jobs can be created through foreign investment and trade, some domestic industries may face competition leading to job losses.

Poverty Reduction (in some regions): Increased economic activity can lift people out of poverty, although the distribution of benefits is often uneven.

Increased Competition: Businesses face greater competition, which can lead to lower prices and better quality for consumers.

Financial Crises: Increased interconnectedness can also lead to the rapid spread of financial crises.

Social Impacts:

Cultural Exchange and Hybridization: Exposure to different cultures can enrich societies but may also lead to concerns about the erosion of local cultures.

Increased Awareness of Global Issues: Easier access to information can raise awareness about issues like climate change, human rights, and poverty.

Migration and Multiculturalism: Increased migration can lead to more diverse societies but also present challenges related to integration.

Political Impacts:

Rise of International Norms and Laws: Globalization has fostered the development of international legal frameworks.

Challenges to National Sovereignty: Increased influence of international organizations and global markets can pose challenges to the autonomy of nation-states.

Transnational Issues: Globalization necessitates international cooperation to address issues like terrorism, pandemics, and environmental degradation.

Challenges of Globalization:

Inequality: The benefits of globalization are not always evenly distributed, leading to widening gaps between rich and poor, both within and between countries.

Environmental Degradation: Increased economic activity and transportation associated with globalization can exacerbate environmental problems.

Loss of Local Industries and Jobs: Some domestic industries may struggle to compete with foreign producers.

Cultural Homogenization: Concerns that dominant cultures may overshadow and erode local cultural identities.

Conclusion: Globalization is an ongoing and transformative process with significant implications for the world. It presents both opportunities and challenges, requiring careful management and international cooperation to ensure that its benefits are widely shared and its negative consequences are mitigated. Understanding the various dimensions, drivers, and impacts of globalization is crucial for navigating the complexities of the 21st century.

Multinational Corporations (MNCs)

Introduction: A Multinational Corporation (MNC), also known as a transnational corporation (TNC), is a company that operates in two or more countries. This typically involves having its headquarters in one country (the home country) and conducting business operations (such as production, sales, research and development) in other countries (host countries) through subsidiaries, branches, or joint ventures. MNCs play a significant role in the global economy, influencing trade, investment, technology transfer, and employment worldwide.

Key Characteristics of MNCs:

1. **Global Presence:** Operating in multiple countries is the defining characteristic. This allows MNCs to access diverse markets, resources, and labor pools.

2. **Centralized Management:** While operations are dispersed, strategic decision-making often remains centralized at the headquarters in the home country.
3. **Coordination Across Borders:** MNCs need sophisticated systems to coordinate activities across different geographical locations, taking into account varying legal, cultural, and economic environments.
4. **Potential for Global Strategies:** MNCs can adopt global strategies that leverage their worldwide presence to achieve efficiency and competitive advantage.

Reasons for the Rise and Growth of MNCs:

Globalization: The increasing interconnectedness of economies has created opportunities and facilitated the expansion of businesses across borders.

Technological Advancements: Improvements in communication, transportation, and information technology have made it easier and more cost-effective to manage operations in different countries.

Trade Liberalization: The reduction of trade barriers has encouraged companies to engage in international trade and investment.

Market Seeking: MNCs expand to access new and larger markets for their products and services.

Resource Seeking: They may establish operations in countries where raw materials, natural resources, or specific skills are available.

Efficiency Seeking: MNCs may locate different parts of their production process in countries where costs are lower (e.g., labor costs).

Impacts of MNCs:

MNCs have significant impacts on both home and host countries, which can be positive and negative:

Impacts on Host Countries:

Economic Growth: MNCs can bring in foreign direct investment (FDI), create jobs, and contribute to the host country's GDP.

Technology Transfer: They often introduce new technologies, management practices, and skills.

Increased Competition: MNC entry can increase competition in local markets, potentially leading to lower prices and better quality for consumers.

Infrastructure Development: MNCs may invest in infrastructure such as roads, ports, and communication networks.

Potential Negative Impacts:

Exploitation of Labor and Resources: Concerns about low wages, poor working conditions, and unsustainable resource extraction.

Environmental Degradation: Less stringent environmental regulations in some host countries might lead to pollution.

Market Dominance: Large MNCs can sometimes dominate local markets, hindering the growth of domestic firms.

Repatriation of Profits: Profits earned by MNCs may be sent back to the home country, rather than being reinvested in the host country.

Political Influence: The economic power of MNCs can sometimes translate into undue political influence.

Impacts on Home Countries:

Increased Profits and Shareholder Value: Successful international operations can boost the profitability of the parent company.

Access to New Knowledge and Innovation: Operating in diverse environments can expose MNCs to new ideas and technologies.

Potential Negative Impacts:

- **Job Losses:** Some jobs may be shifted to host countries with lower labor costs.
- **Economic Dependence:** Over-reliance on foreign markets and production can create vulnerabilities.

Ethical Considerations for MNCs:

Given their global reach and influence, MNCs face numerous ethical challenges, including:

- **Labor Standards:** Ensuring fair wages, safe working conditions, and the right to organize for workers in all their operations.
- **Environmental Responsibility:** Adhering to high environmental standards, regardless of local regulations.
- **Human Rights:** Respecting human rights throughout their value chain.
- **Bribery and Corruption:** Avoiding corrupt practices in all their dealings.
- **Tax Avoidance:** Operating transparently and paying their fair share of taxes in the countries where they operate.

Conclusion: Multinational corporations are powerful actors in the global landscape, driving economic integration and shaping societies worldwide. They offer potential benefits in terms of economic growth, technology transfer, and job creation. However, they also pose ethical and practical challenges related to labour practices, environmental sustainability, and their impact on local economies and politics. Effective regulation, corporate social responsibility, and stakeholder engagement are crucial for ensuring that MNCs contribute positively to global development.

Environmental Ethics

Introduction: Environmental ethics is the philosophical discipline that studies the moral relationship of human beings to the environment and its non-human contents. It explores questions about our obligations towards the natural world, the values we should ascribe to it, and the moral principles that should guide our interactions with it. As human activities increasingly impact the planet, from climate change and biodiversity loss to pollution and resource depletion, environmental ethics has become a crucial field for understanding and addressing these challenges.

Key Questions in Environmental Ethics:

- Do non-human entities (animals, plants, ecosystems) have intrinsic value, or is their value merely instrumental to human needs and interests?
- What moral obligations do we have towards future generations regarding the environment?
- How should we balance environmental protection with other human concerns like economic development and social justice?
- What principles should guide our use of natural resources?

Different Ethical Perspectives:

Several philosophical perspectives offer frameworks for environmental ethics:

1. **Anthropocentrism (Human-Centered Ethics):** This view holds that only human beings have intrinsic value, and the natural world has value only insofar as it benefits humans. Environmental protection is thus justified primarily for human well-being (e.g., clean air and water, resource availability for future generations).
    - **Weak Anthropocentrism:** Acknowledges that human interests can include appreciating nature and avoiding harm to the environment that indirectly affects humans.
    - **Strong Anthropocentrism:** Prioritizes direct and immediate human interests over environmental concerns.
2. **Non-Anthropocentrism (Beyond Human-Centered Ethics):** These perspectives argue that non-human entities have intrinsic value, independent of their usefulness to humans.
    - **Zoocentrism (Animal-Centered Ethics):** Focuses on the moral status of animals, arguing that sentient beings (those capable of feeling pleasure and pain) have a right to moral consideration. Thinkers like Peter Singer and Tom Regan are prominent in this area.
    - **Biocentrism (Life-Centered Ethics):** Extends moral consideration to all living organisms, asserting that each individual life has inherent worth. Albert Schweitzer's "reverence for life" is an example.
    - **Ecocentrism (Ecosystem-Centered Ethics):** Places value on whole ecological systems, including living and non-living components, and ecological processes. Deep ecology and the land ethic (articulated by Aldo Leopold) fall under this category. Leopold's land ethic famously states that something is right when it tends to preserve the integrity, stability, and beauty of the biotic community.

Major Issues in Environmental Ethics:

- **Climate Change:** The ethical implications of greenhouse gas emissions, the responsibility of industrialized nations, and the fair distribution of burdens and benefits in addressing climate change.
- **Biodiversity Loss:** The moral significance of species extinction and the destruction of habitats. Do we have a duty to protect endangered species and ecosystems?
- **Pollution:** The ethical issues related to air, water, and soil pollution and the responsibility of corporations and individuals to minimize their environmental impact.
- **Resource Depletion:** Questions about the sustainable use of natural resources and our obligations to future generations to leave them with sufficient resources.
- **Animal Rights:** The moral status of animals and the ethical treatment of animals in agriculture, research, and other human activities.

Practical Applications of Environmental Ethics:

Environmental ethics is not just an academic pursuit; it has significant implications for policy-making, business practices, and individual behaviour. It informs:

- **Environmental Law and Regulation:** Guiding the development of laws and regulations aimed at protecting the environment.
- **Corporate Sustainability:** Encouraging businesses to adopt environmentally responsible practices.
- **Individual Choices:** Influencing consumer behaviour and lifestyle choices.
- **Conservation Efforts:** Providing a moral basis for the protection of natural areas and wildlife.

Challenges in Environmental Ethics:

- **Determining Intrinsic Value:** It can be challenging to definitively prove or agree upon what has intrinsic value and to what extent.
- **Balancing Competing Values:** Environmental protection often needs to be balanced with economic development, social justice, and other human values.
- **Global Cooperation:** Many environmental problems are global in scale, requiring international cooperation, which can be difficult to achieve.

Conclusion: Environmental ethics provides a critical lens through which to examine our relationship with the natural world. By exploring different ethical perspectives and grappling with complex environmental issues, it helps us to develop more responsible and sustainable ways of living and interacting with the planet. Recognizing the moral significance of the environment and its inhabitants is essential for addressing the environmental challenges of our time and ensuring a healthy planet for future generations.

Computer Ethics

Introduction: Computer ethics is a branch of applied ethics that examines ethical issues arising from the use and development of computer technology. As computers and the internet have become deeply integrated into almost every aspect of modern life, a unique set of ethical dilemmas has emerged. Computer ethics seeks to provide frameworks for understanding and

addressing these issues, guiding individuals, organizations, and societies in their interactions with digital technologies.

Key Areas of Computer Ethics:

1. **Privacy:** The ethical implications of collecting, storing, and sharing personal information in digital environments. This includes issues related to data surveillance, data breaches, and the right to control one's own information.
2. **Intellectual Property:** Ethical considerations surrounding the creation, ownership, and distribution of digital content, including software, music, videos, and text. This involves issues of copyright, patents, and plagiarism in the digital age.
3. **Computer Crime:** The ethical and legal aspects of activities such as hacking, malware creation and distribution, and online fraud.
4. **Professional Responsibility:** The ethical obligations of computer professionals, including software engineers, system administrators, and data scientists, in the design, development, and deployment of technology. This includes issues of reliability, safety, and user trust.
5. **Social Impact:** The broader societal consequences of computer technology, such as the digital divide, the impact on employment, and the potential for bias in algorithms.

Core Principles in Computer Ethics:

Several ethical principles are often applied to issues in computer ethics:

- **Respect for Privacy:** Recognizing and protecting individuals' rights to control their personal information.
- **Honesty and Integrity:** Being truthful and maintaining high standards of conduct in the development and use of computer technology.
- **Non-Maleficence:** Avoiding the creation of harmful technologies or the use of technology in harmful ways.
- **Beneficence:** Using computer technology to benefit society.
- **Justice:** Ensuring fair and equitable access to and use of computer technology, and avoiding the creation or perpetuation of inequalities.

Detailed Look at Key Areas:

- **Privacy:**

  The ease with which digital data can be collected and analyzed raises concerns about surveillance and the potential for misuse of personal information.

  Ethical questions arise regarding what information should be collected, how it should be stored and secured, who should have access to it, and for what purposes it can be used.

  The balance between security needs (e.g., government surveillance for counter-terrorism) and individual privacy rights is a central ethical challenge.

- **Intellectual Property:**

Digital technologies make it easy to copy and distribute copyrighted material, leading to debates about the rights of creators and the public's access to information and culture.

Ethical considerations include respecting copyright laws, avoiding software piracy, and properly attributing sources in academic and professional work.

The concept of "fair use" and the balance between protecting intellectual property and fostering innovation are important ethical considerations.

- **Computer Crime:**

  Activities like hacking, creating viruses, and engaging in online fraud cause harm to individuals, organizations, and society as a whole.

  Computer ethics condemns such actions as morally wrong and often illegal.

  The development of cybersecurity measures and the ethical responsibilities of individuals and organizations to protect their systems and data are crucial aspects of addressing computer crime.

- **Professional Responsibility:**

  Computer professionals have a responsibility to develop reliable and safe systems, to be aware of the potential risks of their work, and to act ethically in their professional roles.

  This includes issues like ensuring software quality, protecting user data, and being transparent about the limitations and potential biases of the technologies they create.

  Professional codes of ethics, such as those developed by the ACM (Association for Computing Machinery) and IEEE (Institute of Electrical and Electronics Engineers), provide guidance for ethical conduct in the field.

- **Social Impact:**

  The widespread adoption of computer technology has significant social consequences, some positive (e.g., increased access to information and communication) and some potentially negative (e.g., job displacement due to automation, the spread of misinformation).

  Ethical considerations include addressing the digital divide, ensuring equitable access to technology, and mitigating the negative social impacts of technological change.

  The ethical implications of artificial intelligence, including issues of bias in algorithms and the potential impact on employment, are increasingly important areas of focus.

Challenges in Computer Ethics:

- **Rapid Technological Change:** Technology evolves quickly, constantly creating new ethical dilemmas that may not be adequately addressed by existing frameworks.
- **Global Nature of Technology:** The internet and digital technologies transcend national borders, making it challenging to establish and enforce consistent ethical and legal standards.
- **Novelty of Issues:** Many ethical issues in computing are relatively new, requiring ongoing discussion and the development of new ethical frameworks.

Conclusion: Computer ethics is a vital field that helps us navigate the moral landscape of our increasingly digital world. By considering issues of privacy, intellectual property, computer crime, professional responsibility, and social impact, we can strive to use and develop computer technology in ways that are ethical, responsible, and beneficial to society. As technology continues to advance, the importance of thoughtful ethical reflection in this domain will only grow.

Engineers as Managers

Introduction: The transition of engineers into management roles is a common and often crucial pathway within organizations, particularly those that are technology-driven. Engineers possess a unique blend of technical expertise, analytical skills, and problem-solving abilities that can be highly valuable in management. However, the shift from a primarily technical focus to one that involves leading people, making strategic decisions, and managing resources requires the development of new skills and perspectives. This topic explores the role of engineers as managers, the skills they bring, the challenges they face, and the competencies they need to succeed.

Why Engineers Become Managers:

Several factors contribute to engineers moving into management:

- **Technical Expertise:** Their deep understanding of the technology and processes involved in the organization's work often makes them well-suited to lead technical teams.
- **Problem-Solving Skills:** Engineers are trained to identify, analyze, and solve complex problems, a skill highly transferable to management.
- **Analytical Thinking:** Their ability to think logically and systematically helps in decision-making and strategic planning.
- **Project Management Experience:** Many engineering roles involve project management, providing a foundation for broader managerial responsibilities.
- **Career Progression:** Management roles often represent a natural step for career advancement within technical organizations.

Skills Engineers Bring to Management:

Engineers typically possess a strong foundation in the following areas that are beneficial for management:

1. **Technical Proficiency:** A deep understanding of the core technologies and engineering principles relevant to the organization. This allows them to understand the challenges faced by their teams and make informed technical decisions.
2. **Analytical and Problem-Solving Skills:** The ability to break down complex issues, analyse data, and develop effective solutions. This is crucial for strategic planning, process improvement, and resolving technical roadblocks.
3. **Logical Thinking:** A systematic and rational approach to tasks and decision-making, which helps in creating structure and clarity within teams.
4. **Attention to Detail:** The precision and accuracy required in engineering work can translate to careful planning and execution in management.
5. **Project Management Fundamentals:** Experience with planning, organizing, and executing projects, including managing timelines and resources.

Challenges Faced by Engineers Transitioning to Management:

While their technical background is a strength, engineers moving into management often encounter challenges that require them to develop new skills:

1. **People Management:** Leading and motivating teams, providing feedback, resolving conflicts, and fostering collaboration. This often requires strong interpersonal and communication skills, which may not be the primary focus in engineering education.
2. **Communication Skills:** Effectively communicating with diverse audiences, including technical teams, non-technical stakeholders, and upper management. This involves not only technical communication but also persuasive communication, active listening, and providing clear direction.
3. **Strategic Thinking:** Moving beyond day-to-day technical tasks to think about the broader goals and direction of the organization. This involves understanding market trends, competitive landscapes, and the long-term implications of decisions.
4. **Delegation:** Learning to effectively assign tasks and empower team members, rather than trying to solve every problem individually.
5. **Dealing with Ambiguity and Uncertainty:** Management often involves making decisions with incomplete information, which can be different from the more structured problem-solving in engineering.

Essential Skills for Engineers as Effective Managers:

To be successful managers, engineers need to cultivate a range of skills beyond their technical expertise:

- **Leadership:** Inspiring and guiding teams towards achieving common goals, setting a vision, and empowering others.
- **Communication:** Clearly and effectively conveying information, both technical and non-technical, in written and verbal forms. Active listening and providing constructive feedback are also crucial.
- **Interpersonal Skills:** Building and maintaining positive relationships, understanding team dynamics, and resolving conflicts effectively. Empathy and emotional intelligence are important here.
- **Delegation:** Trusting team members and effectively assigning tasks, providing the necessary support and autonomy.

- **Decision-Making:** Making timely and informed decisions, often under pressure and with incomplete information.
- **Strategic Thinking:** Understanding the big picture, anticipating future trends, and aligning team activities with organizational goals.
- **Financial Acumen:** Understanding budgets, resource allocation, and the financial implications of technical decisions.

Developing Management Skills:

Engineers can develop the necessary management skills through various means:

- **On-the-Job Experience:** Taking on leadership roles within projects and gradually increasing responsibilities.
- **Mentorship:** Learning from experienced managers within the organization.
- **Formal Training:** Participating in management development programs, workshops, and courses.
- **Self-Study:** Reading books and articles on leadership, management, and related topics.
- **Seeking Feedback:** Actively soliciting feedback from peers, team members, and superiors to identify areas for improvement.

Conclusion: Engineers bring valuable technical and analytical skills to management roles. Their ability to understand complex systems and solve problems makes them well-positioned to lead technical teams and drive innovation. However, the transition to management requires a conscious effort to develop essential soft skills such as leadership, communication, and interpersonal abilities. By embracing these new competencies, engineers can become highly effective managers who bridge the gap between technical expertise and strategic organizational goals, contributing significantly to the success of their organizations.