Engineering Ethics

An Introduction to Ethics and its Relevance to the Profession of Engineering

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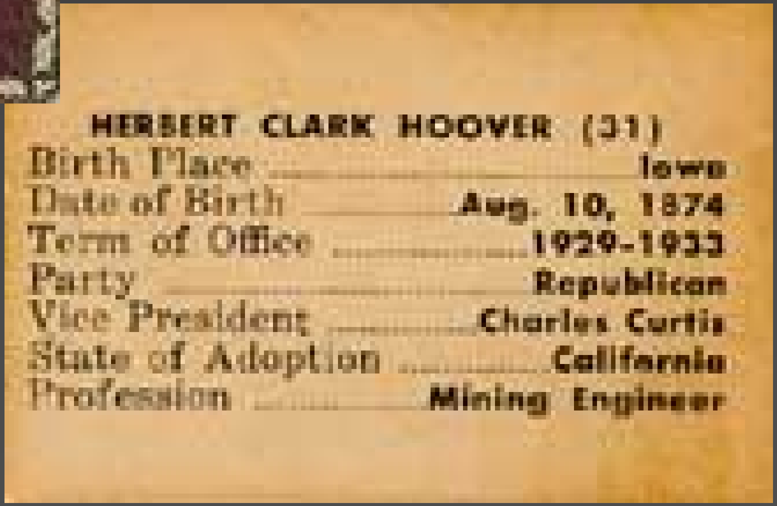
Outline of Material

- What are ethics and morals?
  - Ethical theories
  - Professional Ethics
- What is the engineering profession?
  - What is an engineer
    - How we see ourselves
    - How the public views us
  - The social impact of engineering
    - Serving the public needs
    - The double-edged sword of engineering
  - Professional Licensing
    - The process: education, examination, experience
    - What the stamp and signature means…
- Engineering ethics

Herbert Hoover (on engineering)

"The great liability of the engineer compared to men of other professions is that his works are out in the open where all can see them. His acts, step by step, are in hard substance. He cannot bury his mistakes in the grave like the doctors. He cannot argue them into thin air or blame the judge like the lawyers….He cannot, like the politician, screen his shortcomings by blaming his opponents and hope that the people will forget. ***The engineer simply cannot deny that he did it.*** *If his works do not work, he is damned forever."*



HERBERT CLARK HOOVER (31)

Birth Place	Iowa
Date of Birth	Aug. 10, 1874
Term of Office	1929-1933
Party	Republican
Vice President	Charles Curtis
State of Adoption	California
Profession	Mining Engineer

Engineering (past and present)

- Past
  - The independent craftsman and consultant
  - Individualism and accountability
  - The personally identifiable engineer
- Present
  - Engineer is now less visible to the public
  - Technology is the domain of the "corporation"
  - Anonymity of the Engineer
  - Focused on serving the organization rather than the public

Ethics Vocabulary

Obligation

Virtue

Responsibility

Professionalism

Ethics

Morals

Courage

Character

Integrity

Honesty

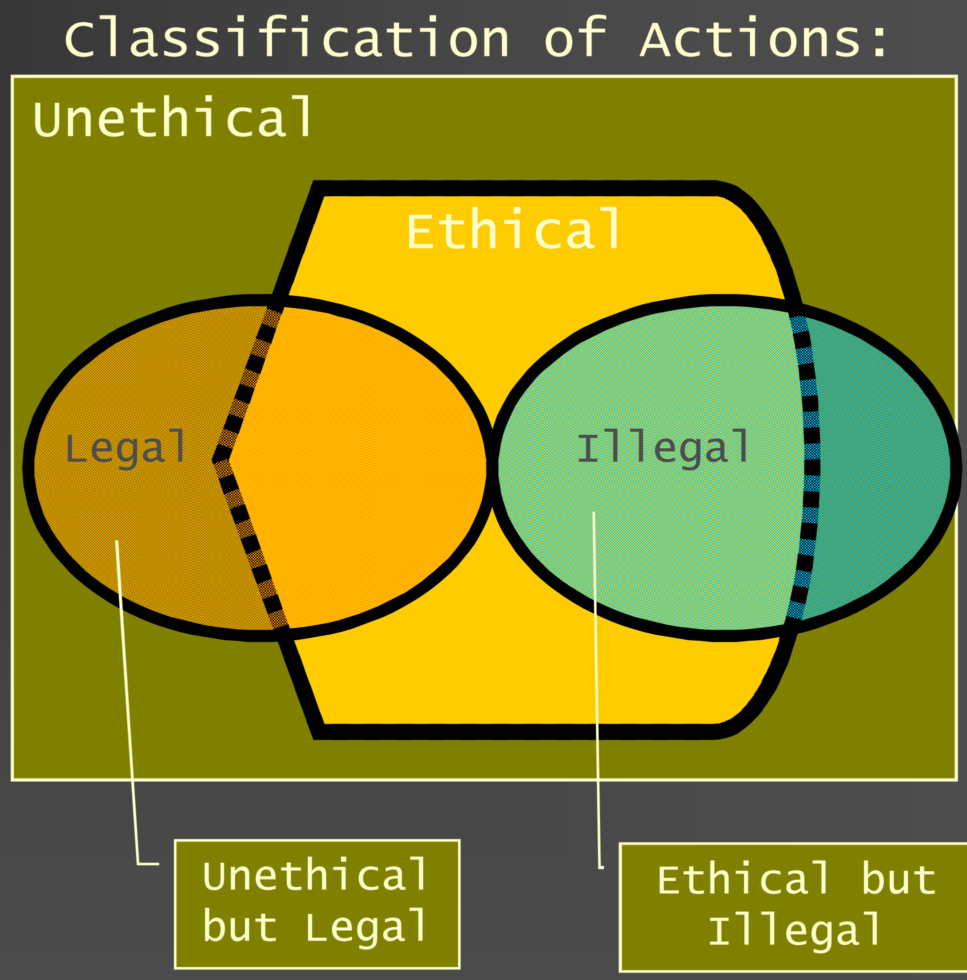
Accountability

Ideals

Self-Respect

Ethics, Morals, and the Law

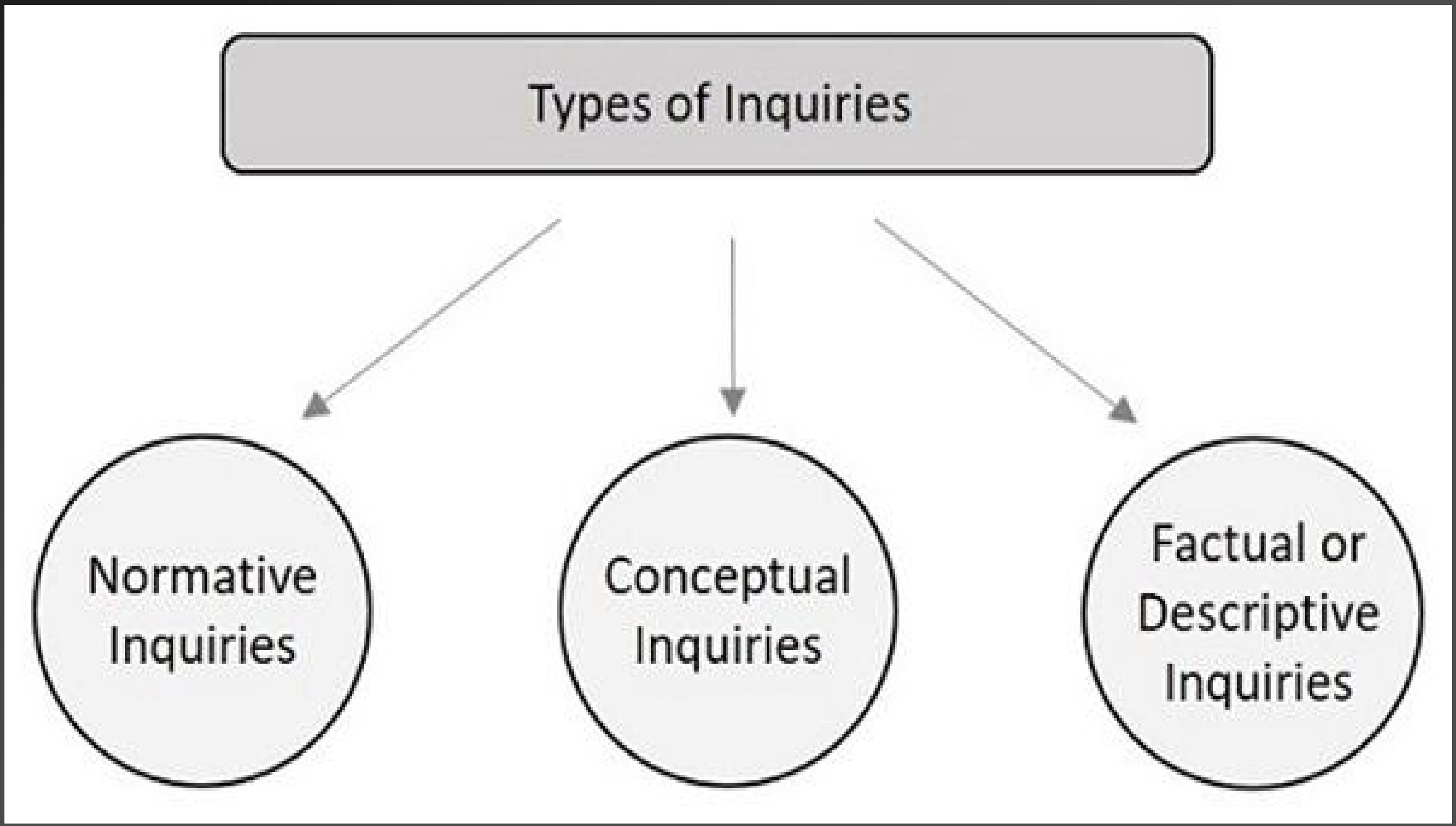
- Morals
  - Principles of right and wrong
- Ethics
  - A set of moral principles guiding behavior and action
- Laws
  - *<u>Binding</u>* codes of conduct; formally recognized and enforced
  - Company Policies



Types of Inquires

- The issues can be resolved by following an investigation procedure, step by step in order to have a clear understanding towards the issue. Here we have three different types of inquiries.
- Judging the issues has to be followed by a systematic procedure to avoid any flaws. Engineering ethics involves investigations into values, meanings and facts. Following are the different types of inquiries made for this.
  - Normative inquiries
  - Conceptual inquiries
  - Factual or descriptive inquiries

Inquires


Types of Inquiries
Normative Inquiries
Conceptual Inquiries
Factual or Descriptive Inquiries

Normative Inquires

- Normative Inquiry refers to the description that describes **what one ought to do** under a specific circumstance. This is the expected ideal response, which might differ from what one believes to be right or wrong.
- This list identifies and justifies the morally desirable nature for guiding individuals or groups. This includes the responsibility of engineers to protect the public safety and how they should respond under such dangerous practices. Normative inquiries also quote the laws and procedures that affect the engineering practice on moral grounds. They refer to the thought process where the moral rights are to be implemented in order to fulfill their professional obligations.

Conceptual Inquiries

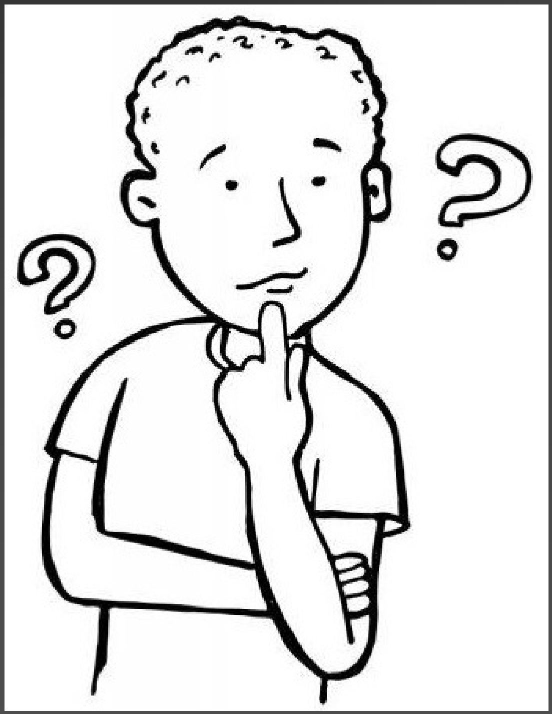
- Conceptual Inquiry refers to the description of the meaning of concepts, principles and issues related to engineering ethics. The ethics that an engineer should possess to protect the safety, health and welfare of the public, etc. are described under conceptual inquiries.
- It describes what safety is and mentions the marginal issues of safety along with the precautions an engineer should take to avoid risk. Conceptual inquiries mention the moral aspects of bribery and how its effects, along with the professional ethics and professionalism.

Factual and Descriptive Inquiries

- Factual Inquiry or the descriptive inquiry help to provide the facts for understanding and finding solutions to the value based issues. The engineer has to conduct factual inquiries by using scientific techniques.
- This helps in providing the information regarding the business realities such as engineering practice, history of engineering profession, the effectiveness of professional societies, the procedures to be adopted when assessing risks and psychological profiles of engineers.
- Let us now go through the concept of Moral dilemma that a person faces when confronted with a situation.

Types of Complexities

- At times, the situations occur where one cannot make immediate decisions as the moral reasons come into conflict. The moral reasons can be rights, duties, goods or obligations, which make the decision making complex.



Complexities

- The difficulties in arriving to a solution, when segregated, can be divided into the following three sections.
  - **Vagueness**
    - This refers to the condition where the doubt lies in whether the action refers to good or bad. This is just like having a thought that following the rules is mandatory. This sometimes includes the unwritten rules like being loyal, having respect, maintaining confidentiality, etc.
  - **Conflicting reasons**
    - When you know about the solutions you have, the making of better choice among the ones you have, will be the internal conflict. Fixing the priorities depends upon the knowledge and the moral values one has. The reason why the particular choice is being made, makes sense.

Complexities

- **Disagreement**
- When there are two or more solutions and none among them is mandatory, the final solution selected should be best suitable under existing and the most probable conditions. The interpretation regarding the moral reasons behind the choice and analysis should be made keeping in mind whether this is the better or the worse solution in the probable aspects.

Steps in Facing Moral Dilemmas

- Whenever a person is faced with a moral dilemma, the issue is to be solved with a stepwise approach as this will generate a better output. The steps include the following
  - **Identification**

  The step of identification involves the following
  - The issue has to be thoroughly understood.
  - The duties and the responsibilities of the persons involved are to be clearly known.
  - The moral factors related to the issue are to be understood.
  - The conflicting responsibilities, the competing rights and the clashing ideas involved are to be identified.

Moral Dilemmas

- **Ranking**
  - The considerations in the issue are to be listed down. Then they have to be ranked according to the priorities. The moral aspect has to be considered to rank the issues. The advantages of a single person should never be given any importance unless any moral reason is there behind it. No partiality is allowed.
- **Inquiries**
  - The inquiry of details involved in the issue is to be completely made. All the facts related to the issue are brought into light. Considering the alternative courses of action for resolving and tracing, full implications are also needed.

Moral Dilemmas

- **Discussions**
  - Discussions are to be made with other members, as different minds look at the issue in different views to give different solutions. The complete analysis of a problem gives chances to different viewpoints, perspectives and opinions from which a better solution can be drawn.
- **Final Solution**
  - After analyzing different perspectives and considering the facts and reasons on the basis of truths and understanding the flaws which lead to the issue, a final solution has to be drawn out. This solution will add value to the whole analysis, in all aspects.

Moral Autonomy

- Moral Autonomy is the philosophy which is self-governing or self-determining, i.e., **acting independently** without the influence or distortion of others. The moral autonomy relates to the individual ideas whether right or wrong conduct which is independent of ethical issues. The concept of moral autonomy helps in improving self-determination.
- **Moral Autonomy** is concerned with independent attitude of a person related to moral/ethical issues. This concept is found in moral, ethical and even in political philosophy.

Moral Autonomy – Skills Needed

- **Ability to relate the problems with the problems of law, economics and religious principles** – It is essential to have the ability to analyze a problem and finding the relation with the existing law or the topic of issue with the existing principles on that topic. The ability to distinguish between both of them and finding the moral reasons.
- **Skill to process, clarify and understand the arguments against the moral issues** – If the issue is against some moral values or the ethical values to be followed in the society, then clarity should be maintained about the differences and similarities. Both of these differences and similarities are to be judged based on why they are a matter of concern and in what aspect.

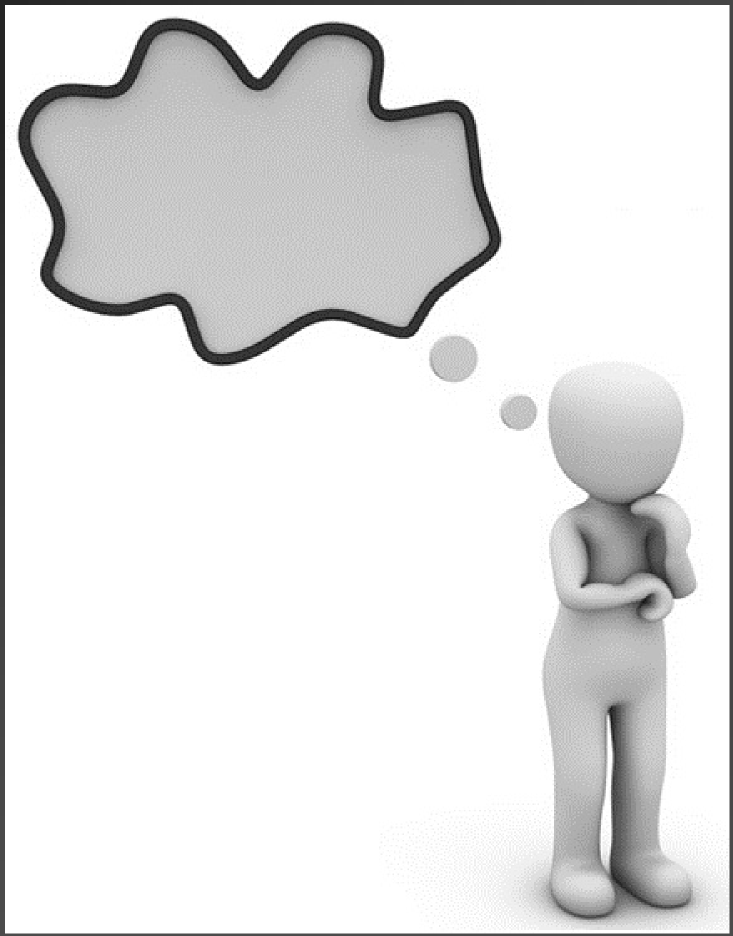
Moral Autonomy – Skills Needed

- **Ability to suggest the solutions to moral issues on the basis of facts** − If the moral issues are not fulfilling and needs to be, then the solutions are to be suggested according to the moral issues based on the facts and truths of the issue. These suggestions must be consistent and must include all the aspects of the problem. No partiality is to be allowed in any such aspect.
- **Must have the imaginative skill to view the problems from all the viewpoints** − After having known about the facts and illusions of the issue, a clear understanding is attained in viewing the problem in all kinds of viewpoints. This enables one to be able to suggest a proper alternative solution.

Moral Autonomy – Skills Needed

- **Tolerance while giving moral judgment, which may cause trouble** – When the whole analysis is made considering all the viewpoints of the issue, the final output might be or might not be pleasing to the persons involved. Hence while declaring the judgment or the decisions taken, a detailed description of the actions done should be given, while the actions ought to be done should be presented in a better way, to ensure others that the decisions have been taken without any partialities towards any party.

Skills for Improving Moral Autonomy



Improving Moral Autonomy

- Moral autonomy reflects the concept of individuality. This relates to the idea of building one's self with the moral values one has while developing psychologically.
- To have moral autonomy in all the aspects, one should have a lot of **patience** and interest. One should adhere to the basic principles of humanity and should be strict with the Don'ts he has in mind and liberal with his Do's. The kindness towards his fellow beings is also an important concept to be kept in mind. Inculcation of all these important qualities, enhances the skills of Moral autonomy in a person.

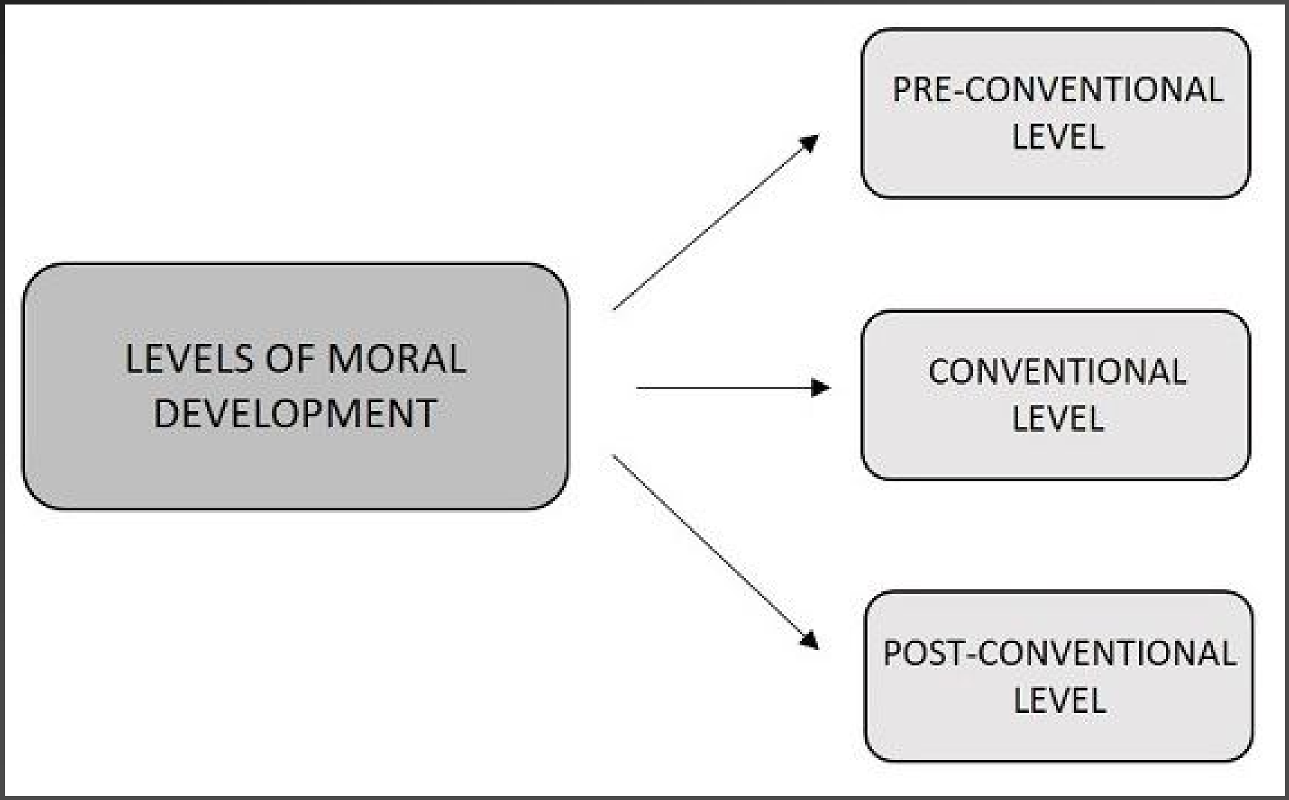
Improving Moral Autonomy

- A Person must have adequate knowledge and understanding about the use of ethical language so as to defend or support his views with others. He must have better **knowledge** in understanding the importance of suggestions and better solutions while resolving moral problems and also about the importance of tolerance on some critical situations.
- Above all, one must understand the importance of maintaining **moral honesty** and should be liberal to understand the human behavior under certain circumstances.

Ethical Theories: Kohlberg

- Lawrence Kohlberg's theory of moral reasoning development
  - Built on Jean Piaget's theory of developmental stages
  - A transitional development process occurring through maturation from childhood to adulthood.
  - Six (6) stages across three (3) levels
  - Moral reasoning is not learned but constructed through interaction with society and environment
  - Environmental factors may affect the speed of development, but not the direction.
  - Stages cannot be skipped

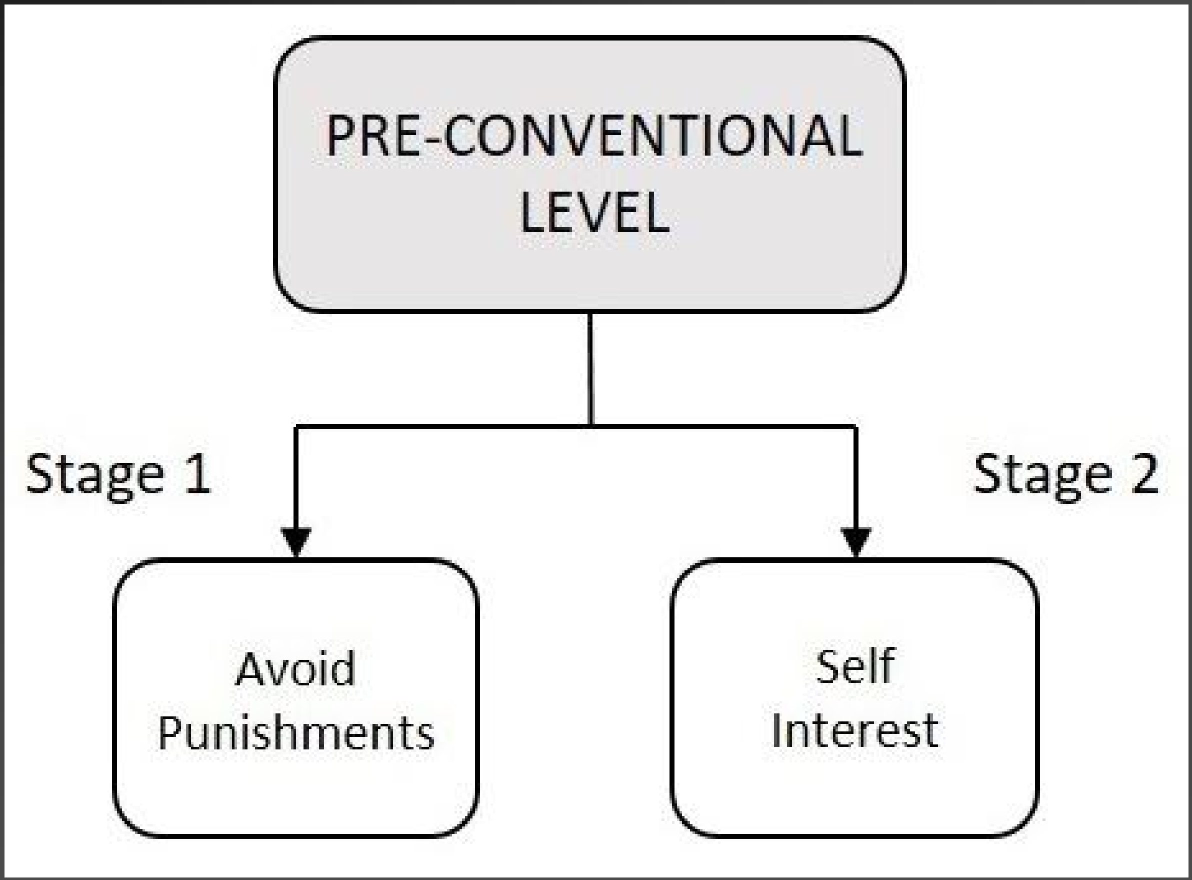
Levels of moral Development



Level 1: Pre-conventional

- Driving mechanisms:
  - Egocentrism
  - Personal Interests (seek reward and avoid punishment)
- Interpersonal and societal roles are not conceptualized
- Also labeled "Pre-Moral" Level. Kohlberg considered those in this level as not yet exhibiting a philosophical "moral" foundation.

Pre-conventional



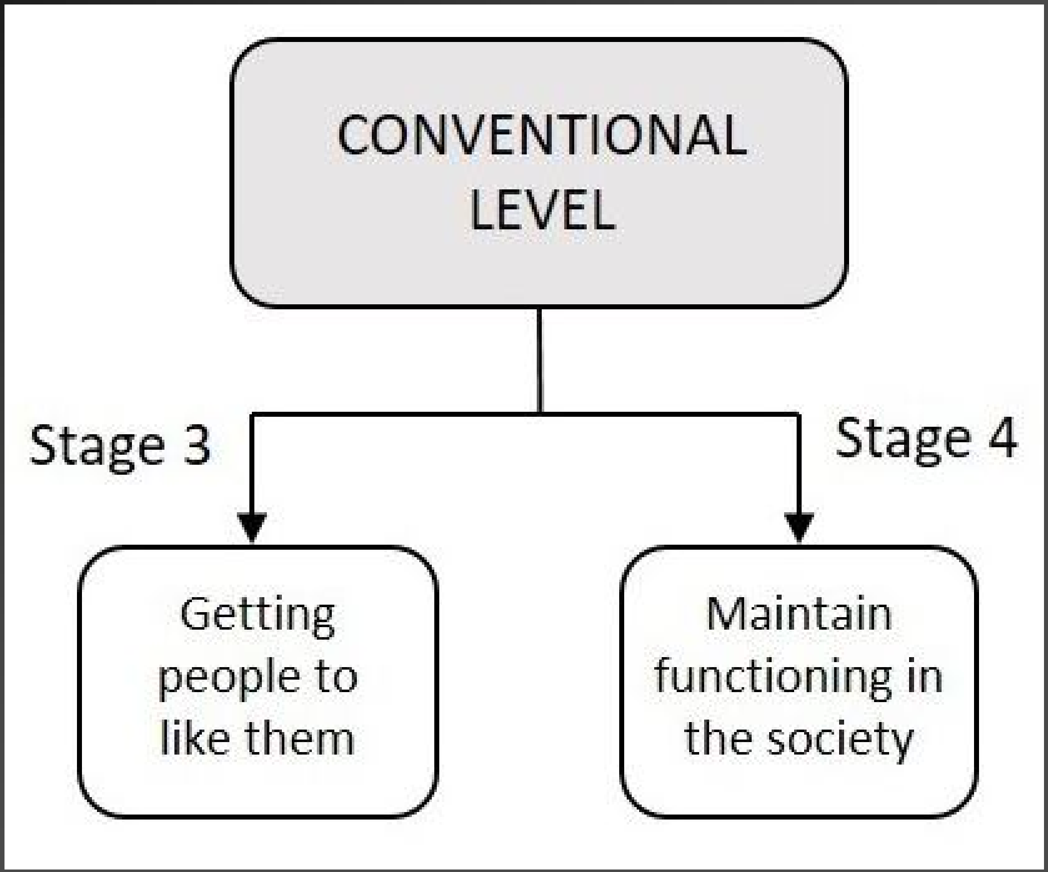
Level 1: Pre-conventional

- Stage 1: Obedience
  - Consequences of action determine future behavior
    - Actions rewarded are “right” and are repeated
    - Actions punished are “wrong” and are avoided
    - Punishment avoidance is primary motivator
- Stage 2: *Quid pro quo*
  - Good behavior results in others’ actions that satisfy one’s own personal needs
  - Rewards are primary motivators
  - Interpersonal interaction is important only to the extent that the situation can be manipulated for personal benefit— “When I do something good, I get something good”

Level 2: Conventional

- Also labeled “Role-Conformity” Level. Kohlberg considered those in this level as starting to recognize themselves as a part of the larger society
- Driving mechanisms:
  - Trust and Loyalty
  - Citizenship
  - Recognition of others’ feelings
- “Golden Rule” thinking begins

Conventional



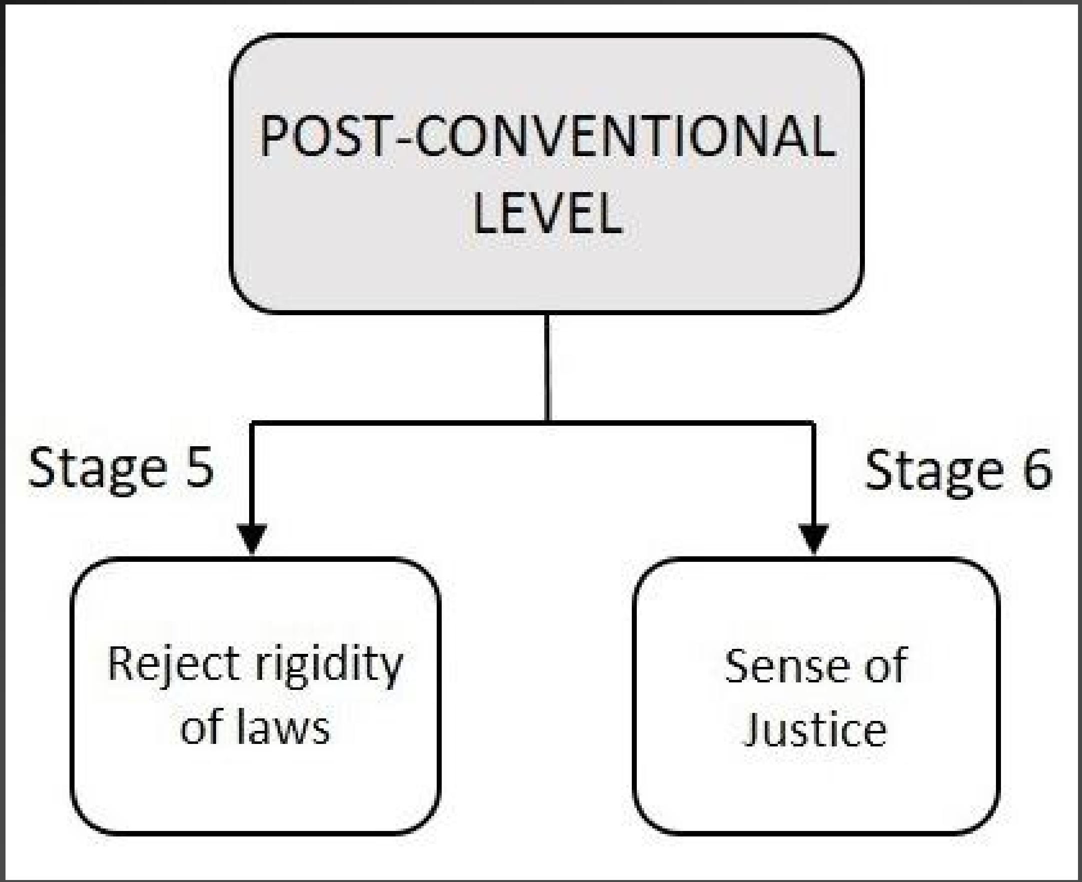
Level 2: Conventional

- Stage 3: Sociability
  - "Good Boy – Nice Girl" orientation
  - Approval seeking behavior drives moral reasoning
- Stage 4: Law & Order
  - Obey the letter of the law
  - Social system is stable and predictable
  - Conformation to laws is construed as "moral" and correct
  - Avoidance of guilt and or censure is primary motivator

Level 3: Post-Conventional

- Also labeled “Principled” Level. Kohlberg considered those in this level as consciously validating society’s laws while developing their own universal ethical principles
- Driving mechanisms:
  - Resolving conflicts between what is “legal” and what is “moral”
  - Personal Conscience

Post-Conventional



Level 3: Principled

- Stage 5: Societal Consensus
  - Consensus of the majority (the democratic process) results in "good laws"
  - "Good laws" are followed to the extent they do not interfere with life, liberty and the pursuit of happiness (individual rights).
  - Use of "due process" to change laws
- Stage 6: Principled
  - Universal principles are recognized and accepted.
  - When principles are in conflict with the law, however, the principle is the guide in determining moral reasoning.
  - Conscience-based

Ethical Theories: Kohlberg

- Criticisms
  - Moral reasoning does not necessarily correlate with moral *behavior* (action)
  - Culturally-biased toward democratic societies espousing strong “individual rights”
    - A “community-centered” viewpoint was a significant omission in Levels 2 and 3
    - Research, however, tends to support the “universality” of the theory for Stages 1 through 5
  - Some researchers have posited that the theory has a gender-bias (against females)

Heinz's Dilemma

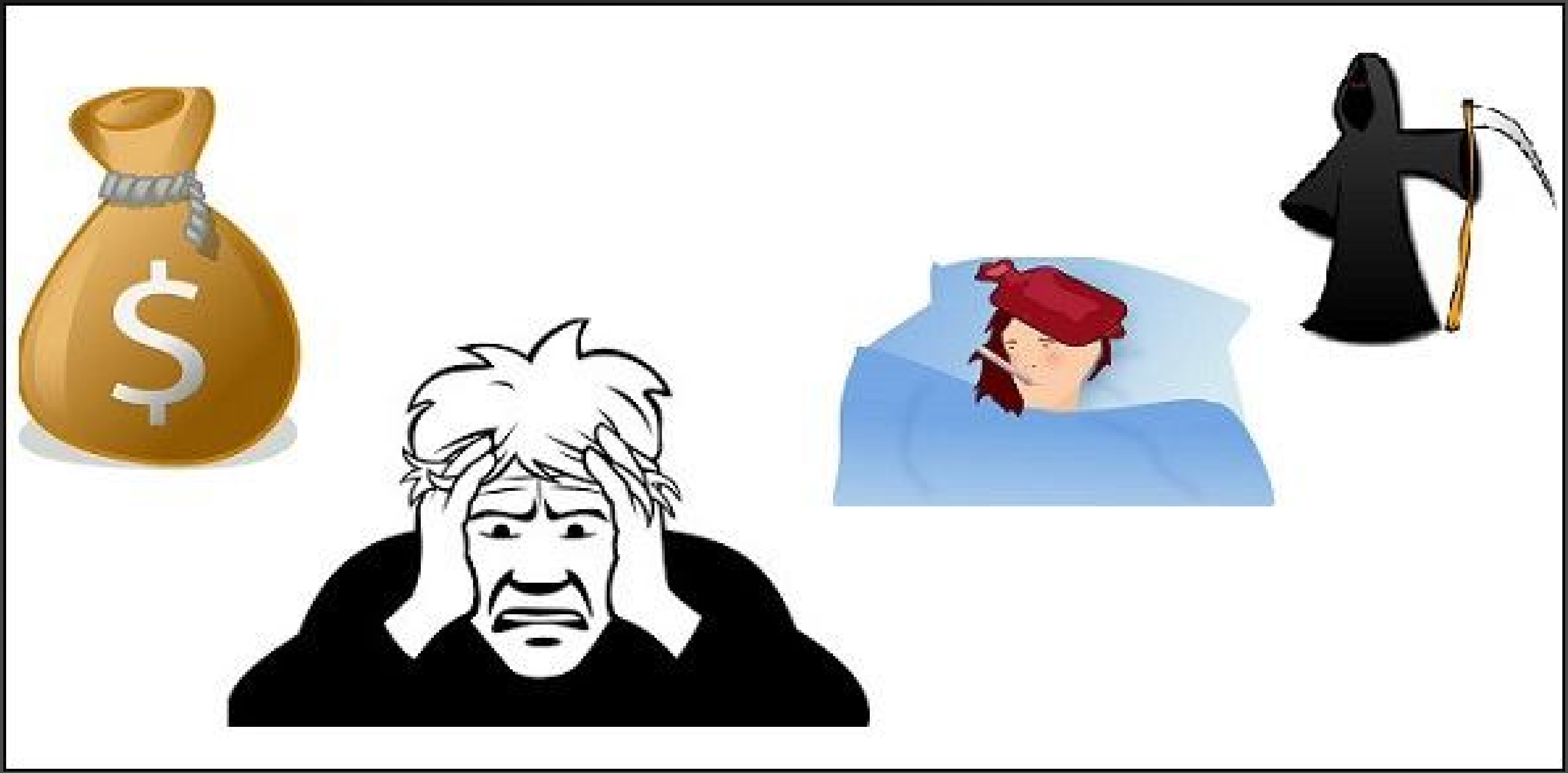
- Lawrence Kohlberg quoted an example for his Moral development theory. This example is popularly called the **Heinz's Dilemma**.
- **Story of Heinz**
- A story of a middle-aged ordinary middle-class man, called Heinz is considered as an example. **Heinz** is an ordinary man having a wife. His **wife suffers** from a **dreadful disease**. Doctors believe that a special drug which was invented recently and is available at the BIG pharma store, can only save his wife.

Heinz's Dilemma

- When Heinz went to buy the drug, the drug-seller costed it around Rs 20,000 while the actual manufacturing cost of the drug is Rs. 200. Heinz borrowed the money from friends and lenders and could finally collect only Rs. 10,000. Though Heinz pleaded a lot, the **greedy drug-seller** refused to sell the drug at low cost.
- Now, Heinz had no other option but to **steal the drug** from the shop to **save the life** of his wife. Is this a better option to do?

  What is your judgment?

Heinz's Dilemma



Heinz's Dilemma

- Now, to solve this Heinz's dilemma, a thinker has the following options.

Options for the Thinker

- Heinz should not steal the drug because it is the disobedience of law.
- Heinz can steal the drug, but should be punished by the law.
- **Heinz can steal the drug and no law should punish him.**

The answer which you choose indicates your moral development. Each answer has its consequences and explanation. Let us go through the answers.

Heinz's Dilemma

- **Heinz should not steal the drug because it is the disobedience of law.**
- This decision makes it impossible for Heinz to save his wife. His wife dies and the rich drug-seller becomes richer. Though the law was obeyed, no moral justice was done. This is a pre-conventional level of moral thinking.

Heinz's Dilemma

- **Heinz can steal the drug, but should be punished by the law.**
- This decision helps Heinz save his wife, but Heinz will be kept in prison. Though Heinz took a moral decision, he had to undergo the punishment. This is a Conventional level of moral thinking.

Heinz’s Dilemma

- **Heinz can steal the drug and no law should punish him.**
- This decision lets Heinz save his wife and both of them can live happily. This thinking is based on the thought that the rigidity in law should be rejected and justice should be done on moral grounds. This is a post-conventional level of moral thinking.

Gilligan's Theory

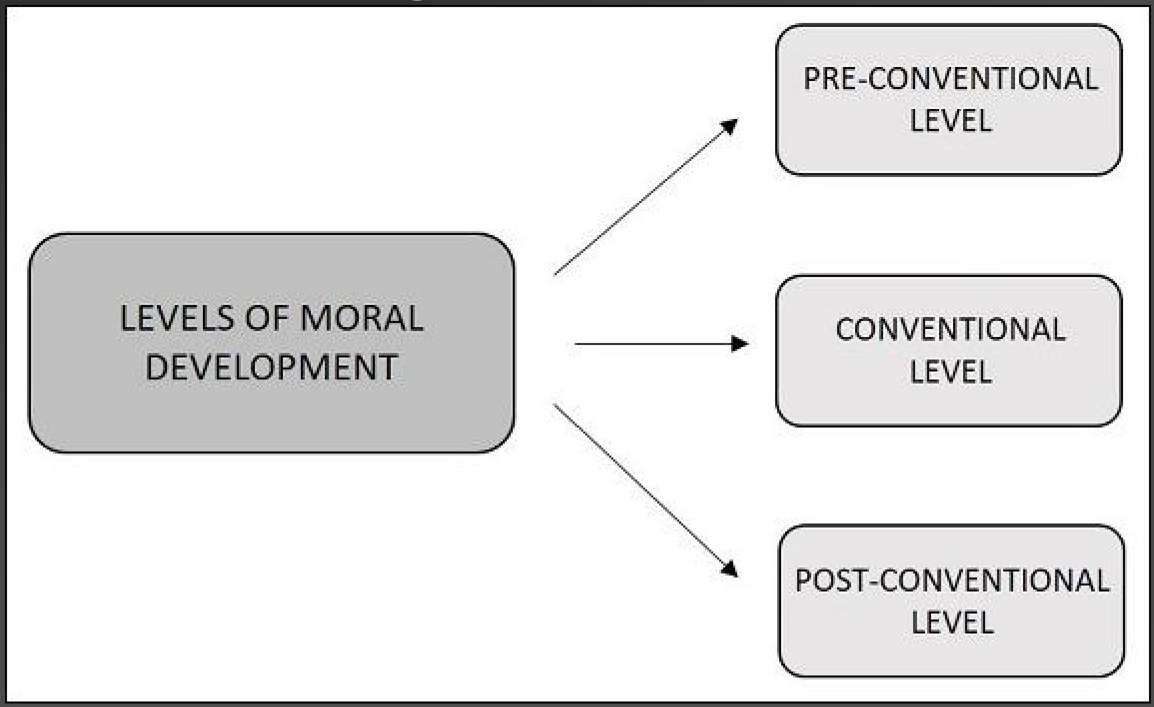
- This is an advancement of Kohlberg's theory. It had been observed that Kohlberg's theory was proposed based on the moral thinking of privileged white men and boys.
- **Carol Gilligan**, a psychological theorist, Gilligan was a research assistant for Lawrence Kohlberg, but she eventually became independent and criticized some of his theories.

Gilligan's Theory

- Carol Gilligan opines that **Kohlberg's** theories are biased upon the **male thinking** process.
- According to Gilligan, Kohlberg seemed to have studied only **privileged men and boys**. She believed that **women** face a lot of psychological challenges and they are not moral widgets. The women's point of view on moral development involves **caring** which shows its effect on human **relationships**.

Gilligan's Theory

- Hence she proposed a theory which has the same three stages of Kohlberg but with different stages of moral development



Gilligan’s Theory

- Though the names of the stages are the same, the stages differ in this method.
- The moral development in Gilligan’s theory are based on pro-social behaviors such as Altruism, caring and helping and the traits such as honesty, fairness and respect.

Gilligan’s Theory

- **Pre-conventional Level**
  - A person in this stage cares for oneself to ensure survival.
  - Though the person’s attitude is selfish, this is the transition phase, where the person finds the connection between oneself and others.
- **Conventional Level**
  - In this stage, the person feels responsible and shows care towards other people.
  - Carol Gilligan believes that this moral thinking can be identified in the role of a mother and a wife. This sometimes leads to the ignorance of the self.

Gilligan’s Theory

- **Post-conventional Level**
  - This is the stage, where the principle of care for self as well as others, is accepted.
  - However, a section of people may never reach this level.

According to the Carol Gilligan’s theory of moral development, changes occur due to the **change of self** rather than the **critical thinking**.

It was stated that the post-conventional level of Kohlberg is not attained by women. But Carol Gilligan researched and found that the post-conventional level of thinking is not being easy for women to go through because they **care** for the relationships.

Gilligan's Theory

- **Levels of Thinking**
  - Carol Gilligan states that the post-conventional level of moral thinking can be dealt based on the **two types of thinking**. Gilligan's theory is based on the two main ideas
  - The care-based morality (usually found in women)
  - The justice-based morality (usually found in men).

Gilligan’s Theory

- **Care-based Morality**
  - Care-based morality is the kind of thinking found in women. This is based on the following principles.
    - More emphasis is given to inter-connected relationships and universality.
    - Acting justly focuses on avoidance of violence.
    - Women with this are usually interested in helping others.
    - More common in girls because of their connections to their mothers.
    - Because girls remain connected to their mothers, they are less inclined to worry about issues of fairness.

Gilligan's Theory

- **Justice-based Morality**
  - Justice-based morality is the kind of thinking found in men. This is based on the following principles.
    - They view the world as being composed of autonomous individuals who interact with one another.
    - Acting justly means avoiding inequality.
    - Individuals with this are usually interested in protecting individuality.
    - Thought to be more common among boys because of their need to differentiate between themselves and their mothers.
    - Because they are separated from their mothers, boys become more concerned with the concept of inequality.

Consensus and Controversy

- The moral judgment may lead to conflicts if they are not delivered properly without hurting the feelings of the persons involved. There are two stages after the judgment. The stages are described below
- **Consensus**
  - This is that state where people come into agreement with the judgement given by getting convinced with the moral reasons. This will leave the persons with a feel that justice has been done, the verdict may favor any party.

Consensus and Controversy

- **Controversy**
  - This is that state where the persons involved in an issue are not satisfied by the verdict and might feel that it was decided on partial interests. This will leave the people with a sense of dissatisfaction that justice was not done, which might lead to another conflict.

Professions and Professionalism

Profession

- Profession means a job or an occupation, that helps a person earn his living. The main criteria of a profession involves the following.
  - **Advanced expertise** – The criteria of a profession is to have sound knowledge in both technical aspects and liberal arts as well. In general, continuing education and updating knowledge are also important.
  - **Self-regulation** – An organization that provides a profession, plays a major role in setting standards for the admission to the profession, drafting codes of ethics, enforcing the standards of conduct and representing the profession before the public and the government.

Professions and Professionalism

- **Public good** – Any occupation serves some public good by maintaining high ethical standards throughout a profession. This is a part of professional ethics where each occupation is intended to serve for the welfare of the public, directly or indirectly to a certain extent.

Professions and Professionalism

- **Professionals**
  - A person who is paid for getting involved in a particular profession in order to earn a living as well as to satisfy the laws of that profession can be understood as a Professional. The definition of a professional is given differently by different experts in the field. Let us see the following definitions −
    - *“Only consulting engineers who are basically independent and have freedom from coercion can be called as professionals.”* − **Robert L. Whitelaw**

Professions and Professionalism

- “Professionals have to meet the expectations of clients and employers. Professional restrains are to be imposed by only laws and government regulations and not by personal conscience.” − **Samuel Florman**
- *“Engineers are professionals when they attain standards of achievement in education, job performance or creativity in engineering and accept the most basic moral responsibilities to the public as well as employers, clients, colleagues and subordinates.”* - **Mike martin and Ronald Schinzinger**

Professions and Professionalism

Models of Professional Engineers

- An engineer who is a professional, has some tasks to perform by which he acts as any of the following, which can be termed as Models of Professional Engineers.
  - **Savior** − A person who saves someone or something from any danger is called a Savior. An engineer who saves a group of people or a company from a technical danger can also be called a **Savior**. The Y2K problem that created problems for computers and computer networks around the world was solved by engineers who were the saviors.

Professions and Professionalism

- **Guardian** – A person who knows the direction towards a better future is known to be the Guardian for the same. An engineer who knows the direction in which there is scope for the technology to develop can also be called a **Guardian**. This engineer provides the organization with innovative ideas for technological development.
- **Bureaucratic Servant** – A person who is loyal and can solve problems when they occur using his own skills, is a Bureaucratic servant. An engineer who can be a loyal person to the organization and also the one who solves the technical problems the company encounters, using his special skills can be termed as a **Bureaucratic servant**. The company relies on his decision-making capability for the future growth.

Professions and Professionalism

- **Social Servant** – A person who works for the benefit of the society without any selfish interest and does not work on any business grounds, is called a Social servant. An engineer who receives a task as part of the government's concern for the society considering the directives laid by the society and accomplishes the assigned tasks can be termed as a **Social Servant**. He knows what the society needs.
- **Social Enabler or Catalyst** – A person who makes the society understand its welfare and works towards the benefits of the people in it, is a Social Enabler. An engineer who plays a vital role in a company and helps company along with society to understand their needs and supports their decisions in work can be termed as a **Social Enabler or Catalyst**. This person quickens the procedure and helps maintain good environment in the company.

Professions and Professionalism

- **Game Player** – A person who plays a game according to the rules given is a Game player in general. An engineer who acts as neither a servant nor a master, but provides his services and plans his works according to the economic game rules in a given time, can be termed as a **Game player**. He is smart enough to handle the economic conditions of the company.

Professions and Professionalism

- **Professionalism**
  - Professionalism covers comprehensively all areas of practice of a particular profession. It requires skills and responsibilities involved in engineering profession. Professionalism implies a certain set of attitudes.
  - The art of **Professionalism** can be understood as the practice of doing the right thing, because of how one feels.

Professions and Professionalism

- Professionals make a profession of the specific kind of activity and conduct to which they commit themselves and to which they can be expected to conform. Moral ideals specify virtue, i.e., desirable feature of character. Virtues are desirable ways of relating to other individuals, groups and organizations. Virtues involve motives, attitudes and emotions.
- According to Aristotle, virtues are the **"acquired habits that enable us to engage effectively in rational activities that defines us as human beings."**

Professional Ideals and Virtues

- The virtues represent excellence in core moral behavior. The essentials for any professional to excel in the profession are behavior, skills and knowledge. The behavior shows the moral ideology of the professional.
  - The moral ideals specify the virtue, i.e., the desirable character traits that talk a lot about the **motives, attitude** and **emotions** of an individual.

Professional Ideals and Virtues

- Public spirited virtues
- Proficiency virtues
- Team work virtues
- Self-governance virtues
  - The virtues mentioned above show the professional responsibility of an individual. Hence, the professionalism that comes in with these virtues is called **Responsible Professionalism**. Let us now understand each virtue in detail.

Public-spirited Virtues

- An engineer should focus on the good of the clients and the public at large, which means no harm should be done intentionally. The code of professional conduct in the field of engineering includes avoiding harm and protecting, as well promoting the public safety, health and welfare.

Public-spirited Virtues

- Maintaining a sense of community with faith and hope within the society and being generous by extending time, talent and money to professional societies and communities, an engineer can maintain the public-spirited virtue. Finally, justice within corporations, government and economic practices becomes an essential virtue that an engineer should always possess.

Proficiency Virtues

- These refer to the virtues followed in the profession according to the talent and intellect of an engineer. The moral values that include this virtue are competence and diligence. The **competence** is being successful in the job being done and the **diligence** is taking care and having alertness to dangers in the job. Creativity should also be present in accomplishing the assigned task.

Teamwork Virtues

- These virtues represent the coordination among team members which means working successfully with other professionals. These include cooperative nature along with loyalty and respect towards their organization, which makes the engineers motivate the team professionals to work towards their valuable goals.

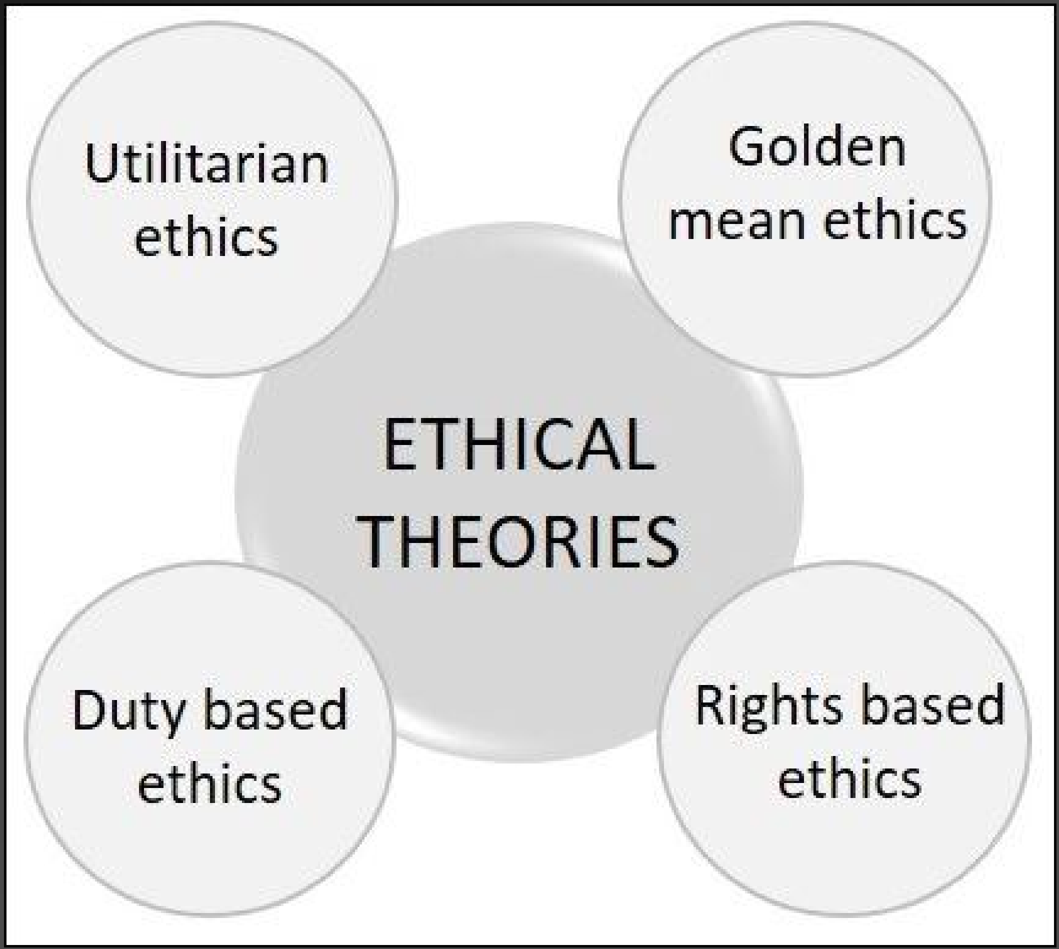
Self-governance Virtues

- These virtues are concerned with moral responsibilities which represent integrity and self-respect of the person. The integrity actually means the moral integrity which refers to the actions, attitude and emotions of the person concerned during his professional period.

Self-governance Virtues

- The self-governance virtues center on commitment, courage, self-discipline, perseverance, self-respect and integrity. The truthfulness and trustworthiness which represent his honesty are the crucial moral values to be kept up by a professional.

Ethical Theories



Ethical Theories

- Virtue ethics – Emphasizes on ideals of good character
- Rights ethics, Duty ethics & Utilitarianism ethics – Emphasizes on principles about right and wrong conduct
- In each we will see a classical theory and a contemporary theory to see its implication in todays context

Virtue Ethics

- CLASSICAL THEORY
- Virtue ethics - Plato (427-324 BCE) and Aristotle (384-322 BCE)
- Development of good character traits and habits
- Be a moral person rather than just follow rules
- Agent-oriented rather than action or rule-oriented
- Develop character traits such as kindness, truthfulness, honesty, trustworthiness, helpfulness, generosity, and justice
- More likely to work in homogeneous societies rather than our pluralistic one
- Consequences often *should* be taken into account

Virtue ethics – Aristotle Golden Mean

- Wisdom – Good judgment (King of virtues)
- His definition of virtue is therefore: “A state that decides, consisting in a mean, the mean relative to us, which is defined by reference to which the prudent person would define it.” (*Nicomachean Ethics, II, 7).*
- Some Virtues:
  - 1. **Cardinal: Justice, Courage, Wisdom, and Moderation**
  - 2. **Spiritual: Faith, Hope, and Love**
  - 3. Some **other famous ones: patience, honesty, loyalty, etc.**

Virtue ethics – Aristotle Golden Mean

- Foolhardiness – Courage – Cowardice
- Reveal all – Truthfulness – Secretive
- Waste resource – Generosity – Miserly
- Effusive – Friendliness – Sulky
    - Danger & Risk
    - Truth telling
    - Giving
    - Personal relationships

Virtue ethics – Alasdair MacIntyre

- **CONTEMPORARY**
- Social practices for Public Good
  - Internal Good
  - External good
- Professional responsibility
  - Public spirited virtues – Justice, generosity.
  - Proficiency virtues – Competence, creativity, diligence
  - Team work virtues – Collegiality, effective communication, cooperativeness, respect authority.

Virtue ethics – Alasdair MacIntyre

- Self-governance virtues – Self Understanding, humility, good moral judgment, courage, self discipline, self respect, Self esteem, integrity
- Integrity – Unity
- Honesty – Truthfulness & Trustworthiness
- Self Respect – Moral
- Self Esteem - Psychological

Utilitarian Ethics

- **CLASSICAL**
- Jeremy Bentham in the late 18th century and John Stuart Mill (1806-1873) formulated this way of thinking. Such “hedonistic” utilitarians argue that the principle to judge our moral thinking is utility, that is,
- The maximization of happiness, in the sense of pleasure and the minimization of suffering, in the sense of pain.

Utilitarian Ethics

- In any situation the morally right thing to do is the action that promotes the greatest happiness for the greatest number of people.
- **MOST GOOD FOR MOST OF THE PEOPLE**
  - Action is right in proportion as they tend to promote happiness, wrong as they tend to produce the reverence of happiness. By happiness are intended pleasure and the absence of pain: by unhappiness are pain and the privation of pleasure. (Mill, (1962). 6)

Act Utilitarianism

- Actions that maximizes the utility i.e **HAPPINESS**
- Any Action that maximizes this utility leads to goodness
- Goodness is
  - a) Intrinsic Good - Happiness
  - b) Instrumental Good – Provide means for Happiness
- Consequence of Goodness is **pleasure**

Act Utilitarianism

- Happy life means many pleasures
  - Bodily Pleasures – Eating, exercise, etc
  - Higher Pleasures
    - Intellectual Inquiry
    - Creative accomplishment
    - Appreciation of Beauty
    - Friendship
- Mill Concentrated on Higher pleasures

Act Utilitarianism

- **QUALITY VERSUS QUANTITY OF PLEASURE**: MILL VERSUS BENTHAM
- Mill holds that qualitative distinction among pleasures is as real as quantitative distinction. Intellectual pleasures are better than sensuous pleasures. Mill believes that we ought to seek satisfaction of higher capacities
- Mental pleasure is higher than the physical pleasure. Creation, discovery and contemplation are mental pleasures.

Act Utilitarianism

- One important point to take note of is that the pleasure or happiness in question here can be understood qualitatively as well as quantitatively. In other words, if human beings generally (after full reflection and knowledge of the facts) have valued friendship over Cheetos, then one would resist betraying a single friend (quality) even if one is promised a lifetime supply of Cheetos (quantity) in return.

Rule Utilitarianism

- **Contemporary**
- Richard Brandt proposed this theory, following the Mill's ACT utilitarianism
- The Most good for most people can be obtained only by following the **RULE**
- Moral rules is the Primary act that gives pleasures of higher level
- Individual acts are right if they confirm to the rules

Rule Utilitarianism

- Rational Desires – are those desires we would have and approve of it if we scrutinized our desires in light of all relevant information about our world and our psychology
- Drug use – self destructive not a rational desire
- Reading a book – Rational desire

Duty Ethics

- **Classical**
- Immanuel Kant (1724-1804)
- Duties and obligations that people have to one another.
- People have rational natures
- People should never be treated as means to the ends of others
- Each individual has the same moral worth as every other.

Duty Ethics

- He argued that what truly made an action moral was not the consequences but the intentions.
- One can be saved by a fall, for example, by a branch that happened to be there just as much as by someone grabbing your hand, but Kant would point out that it is only the latter event that we call “moral.”

Duty Ethics – Categorical Imperative

- Morality, for Kant, is thus the desire to be a creature who chooses rationally and thus freely rather than a creature bound by deterministic psychological desires or circumstances.
  - Show respect to fellow beings
  - Duties are binding on us only if it is applicable to every one
  - Duties prescribe certain actions categorically

Duty Ethics – Categorical Imperative

- Hence he called them Categorical Imperatives
- Kant calls the fundamental principle of morality the categorical imperative.
- An imperative is a command. It tells us what we ought to do or what we should do.
- The categorical imperative contrasts with what Kant calls hypothetical imperatives.

Duty Ethics – Categorical Imperative

- Hypothetical Imperatives are based on certain conditions (Hypothesis)
- A hypothetical imperative is a command that begins with "if" for example,
  - If you want to get a good grade. you ought to study.
  - If you want to make a lot of money, you should work hard.
  - If you want to stay out of jail, you should not break the law.
  - If you want to be healthy do not overeat.

Duty Ethics – Categorical Imperative

- But the categorical imperative is un-hypothetical, no ifs whatsoever. Just do it!
- CI are based only on morality
  - You ought to behave morally. - if you want people to like you,
  - You should behave morally- if you want to go to heaven,
  - You should behave morally. It is just "you ought to behave morally." However, in Kant categorical imperative it is enjoined with the hypothetical imperative.

Duty Ethics

- Contemporary
- John Rawl
- Developed Kant's principles in new direction
- "Valid principles of duty are those that will be voluntarily agreed by rational people in an imaginary contracting situation"

Duty Ethics

- Rational People ----????
  - Lack of self knowledge (no intelligence, desires, achievements – No BIAS)
  - Lack of general knowledge about Psychology, economics, politics
  - Concern for promoting long term interests
  - In group environment they agree to each other without inhibitions

Duty Ethics

- All Human beings will agree upon in this hypothetical situation to TWO basic moral principles in a professional environment
  - 1. Each person is entitled to the most amount of LIBERTY compatible to an equal amount for others
  - 2. Differences in **SOCIAL & ECONOMICAL** benefits are justified only if it benefits all

Rights Ethics

- **CLASSICAL**
- John Locke (1632-1704)
- Human rights are predominant
  - Right to live, liberty, property
- View point was more individualistic
  - Prevent others from meddling in ones life
- Liberty Rights – NEGATIVE RIGHTS which places other people to have a duty of not to interfere in ones life.

Rights Ethics

- Distinguish:
- ***Positive*** right: a right to have or obtain something (other people have to do something)
- ***Negative*** right: a right to be free of something (other people have to not do something)
- John Locke spoke of only negative rights.

Rights Ethics

- Contemporary
- A.I. Melden – Liberty and welfare rights
- Rights seen in perspective with other people
- View point is on the society
- Welfare rights – POSITIVE RIGHTS
- Places rights to community benefits to lead a decent human life.

Use of Ethical Theories

- Resolving Moral Dilemmas
- Justifying Moral Obligations
- Relating Professional and Ordinary Morality

Professional Moral Reasoning

- McCuen (1979)
  - Adaptation of Kohlberg's Theory of Moral Reasoning
  - Draws parallels between personal and professional ethics
  - Defines categories or "dimensions" rather than developmental stages
    - "Regression" is realistic
    - A lens through which to view reasoning and behavior

McCuen's Ethical Dimensions

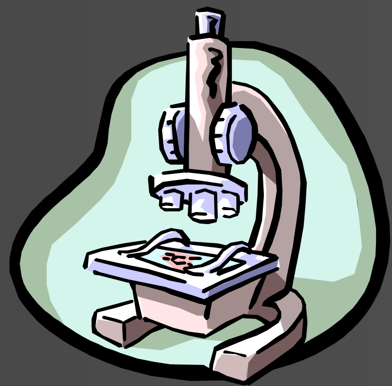
LEVEL 1 Pre-professional	LEVEL 2 Professional	LEVEL 3 Principled Professional
Stage 1: Concern is for the gain of the individual (not the company, client, or profession)	**Stage 3:** Loyalty to company is primary focus. Team-player behavior precludes concern for society and environment.	**Stage 5**: Service to human welfare is paramount. Societal rules, morays and values may trump professional standards and corporate loyalty.
Stage 2: Corporate loyalty, client confidence, proper conduct are pursued but again only for personal gain and advancement.	**Stage 4:** Loyalty to company is connected to loyalty to the profession. Good engineering is good for the profession, but the societal concerns are not emphasized.	**Stage 6**: Professional conduct is guided solely by a sense of fairness and genuine concern for society, individuals, and the environment. Decisions are based only on well-established personal principles and may contradict professional codes and even social rules.

McCuen's Six Categories of Professional Engineering Morality (McCuen, R. H. (1979). "The Ethical Dimensions of Professionalism." Issues in Engineering **105**(E12): 89-105.)

The Engineering Profession

- How we view ourselves:
  - Problem-solvers
  - Engineering is enjoyable; *esprit de corps*
  - Engineering benefits people, provides a public service
  - Engineering provides the most freedom of all professions (Florman, 1976)
  - Engineering is an honorable profession

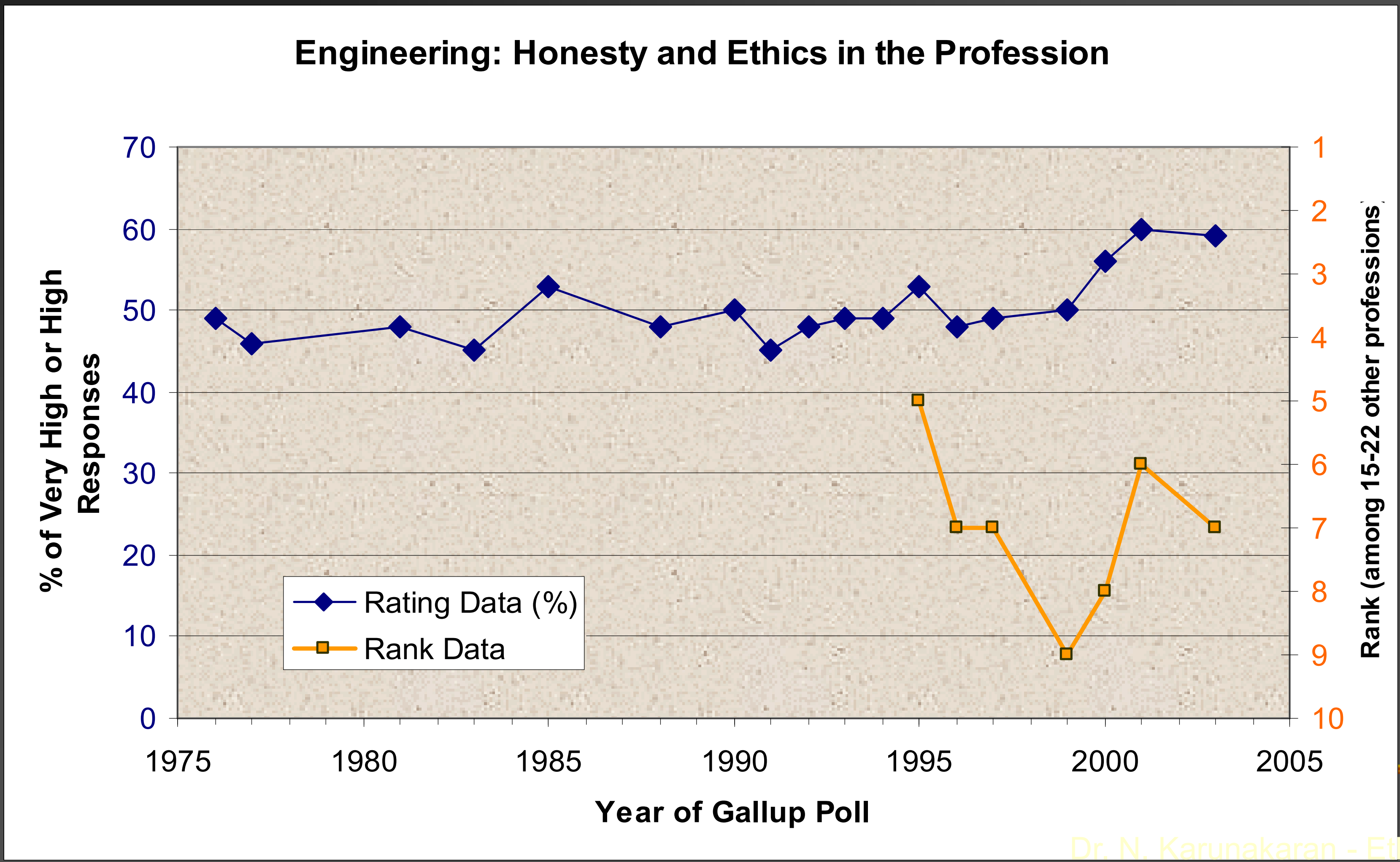
The Engineering Profession



- How the public views engineering:
  - The Engineer's Role
    - Engineers as Utilitarians
    - Engineers as Positivists
    - Applied Physical Scientists
  - This role does not mesh well with an overarching "social science" bias of the public.
  - Rational, pragmatic, logical and systematic approaches to problem solving tend to alienate the engineer from the public
  - Only a 50% "Very High" or "High" rating on honesty
    - Consistently behind medical field and teachers
    - A public relations problem, not an ethics issue per se.
    - "Best Practices" to include applied social science

The Engineering Profession

- Gallup Poll “Honesty and Ethics in Professions”



The Engineering Profession

	% Very High/High Rating					RANKING			
Profession	**2003**	**2001**	**2000**	**1999**		**2003**	**2001**	**2000**	**1999**
Nurses	83	84	79	73		1	1	1	1
Medical Doctors	68	66	63	58		2	4	4	4
Veterinarians	68		66	63		3		3	3
Pharmacists	67	68	67	69		4	2	2	2
Dentists	61	56	58	52		5	8	7	7
College Teachers	59	58	59	52		6	7	6	6
Engineers	**59**	**60**	**56**	**50**		**7**	**6**	**8**	**9**
Policemen	59	68	55	52		8	3	9	8
Clergy	56	64	59	56		9	5	5	5
Psychiatrists	38					10			
Bankers	35	34	37	30		11	9	10	10
Chiropractors	31			26		12			11
State Governors	26		31	24		13		11	12
Journalists	25	29	21	24		14	10	14	13
Senators	20		24	17		15		12	15
Business Execs	18	25	22	23		16	11	13	14
Congressmen	17	25	21	11		17	12	15	18
Lawyers	16	18	17	13		18	14	17	17
Stockbrokers	15	19	19	16		19	13	16	16
Advertising practitioners	12	11	10	9		20	16	19	21
Insurance salesmen	12	13	11	10		21	15	18	19
HMO managers	11			10		22			20
Car salesmen	7	8	7	8		23	17	20	22

What is Engineering Ethics*

- The study of the moral issues and decisions confronting individuals and organizations engaged in engineering
- The study of related questions about the moral ideals, character, policies, and relationships of people and corporations involved in technological activity.

* from Martin. M. & Schinzinger, R. Ethics in Engineering (3rd Ed.) (New York: McGraw-Hill, 1996, pp. 2-3.

Ethics and Engineering

- Where the ethical issues can arise:
  - Conceptualization, Design, Testing, Manufacturing, Sales, Service
  - Supervision and Project Teams
    - Project timelines and budgets
    - Expectations, opinions, or judgments
  - Products: Unsafe or Less than Useful
    - Designed for obsolescence
    - Inferior materials or components
    - Unforeseen harmful effects to society

Ethics and Engineering

- Other fields where ethics are critical
  - Medical Ethics
  - Legal Ethics
  - Business Ethics (closest to Engineering Ethics)
  - Scientific Ethics
- An “applied ethics” domain (rather than a theoretical analysis of philosophy)
- Engineering occurs at the confluence of *technology*, *social science*, and *business*
  - Engineering is done by people and for people
  - Engineers’ decisions have a impact on all three areas in the confluence
  - The public nature of an engineer’s work ensures that ethics will always play a role

Ethics and Engineering

- **Impacts of an engineer's ethical decisions:**
  - The Products & Services (safety and utility)
  - The Company and its Stockholders
  - The Public and Society (benefits to the people)
  - Environment (Earth and beyond)
  - The Profession (how the public views it)
  - The Law (how legislation affects the profession and industry)
  - Personal Position (job, internal moral conflict)
- Typically, good ethical decisions…
  - …may be just that: "good," but rarely "great" or "ideal"
  - …will not always be in the best interest (irrespective of the timeline) of all stakeholders
  - …are not automatic but require thought, consideration, evaluation, and communication (much like the "design process")

Social Experimentation

Ethics in engineering
Unit II
Dr. N. Karunakaran

Titanic

The Times Dispatch

WHOLE NUMBER 18,957. RICHMOND, VA., TUESDAY, APRIL 16, 1912. PRICE TWO CE

Titanic, Giant White Star Liner, Sinks After Collision With Iceberg on Her Maiden Voyage, and 1,800 Lives Are Reported Lost in World's Greatest Marine Disaste

WIRELESS CALLS SEND VESSELS RUSHING TO AID OF SEA COLOSSUS

Through the Night They Drive With Full Speed to Reach Titanic.

MEANTIME, WORLD WAITS IN AGONY OF SUSPENSE

OF ALL ON BOARD ONLY 675 KNOW TO HAVE ESCA DEATH IN OC

Those Rescued M Women and Child Who Were Tak Off in Boats.

BITS OF WRECKA ALL THAT IS L OF GREAT VE

- Unsinkable
- Largest ship
- 16 water tight compartments
- 5 compartments flooded
- Total capacity 3547 (incl Crew)
- 1522 out of 2227 died

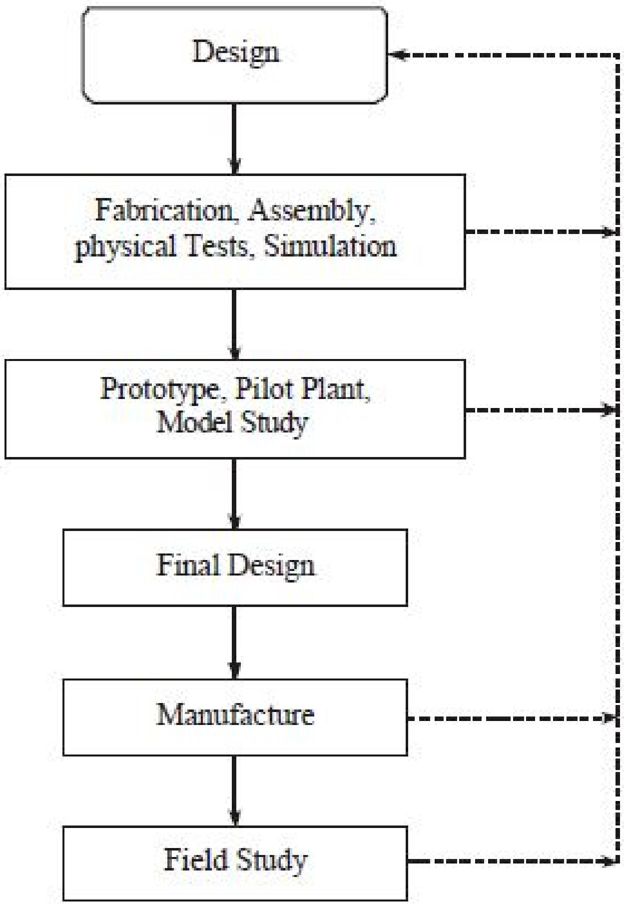
Titanic

- The tragedy of ‘Titanic’ happened on April 15, 1912. Because of the **insufficient number of life boats resulting in the** death of 1522 out of 2227
- Life boat capacity available was only 825
- It was ¼ of Total capacity
- Is there any other reasons for the ship to sink ????

Experimentation

- Technical complacency
  - Murphy's Law – If anything can go wrong it will – sooner or later
  - All product of technology present some potential dangers and is inherently a risky activity
  - Hence engineering viewed as an experimental process
  - It's an experiment conducted not in lab (controlled) but on social scale with human

ENGINEERING AS EXPERIMENTATION



- Design as an interactive process
- 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 AS EXPERIMENTATION

- Several redesigns are made upon the feedback information on the performance or failure in the field or in the factory. Besides the tests, each engineering project is modified during execution, based on the periodical feedback on the progress and the lessons from other sources. Hence, the development of a product or a project as a whole may be considered as an experiment.

Engineering Projects VS. Standard Experiments - *Similarities*

- 1. Partial ignorance: The project is usually executed in partial ignorance. Uncertainties exist in the model assumed.
  - The behavior of materials purchased is uncertain and not constant. They may vary with the suppliers, processed lot, time, and the process used in shaping the materials (e.g., sheet or plate, rod or wire, forged or cast or welded). There may be variations in the grain structure and its resulting failure stress. It is not possible to collect data on all variations. In some cases, extrapolation, interpolation, assumptions of linear behavior over the range of parameters, accelerated testing, simulations, and virtual testing are resorted.

Engineering Projects VS. Standard Experiments - *Similarities*

- 2. Uncertainty: The final outcomes of projects are also uncertain, as in experiments.
  - Some times unintended results, side effects (bye-products), and unsafe operation have also occurred.
  - Unexpected risks, such as undue seepage in a storage dam, leakage of nuclear radiation from an atomic power plant, presence of pesticides in food or soft drink bottle, an new irrigation canal spreading water-borne diseases, and an unsuspecting hair dryer causing lung cancer on the user from the asbestos gasket used in the product have been reported.

Engineering Projects VS. Standard Experiments - *Similarities*

- 3. Continuous monitoring: Monitoring continually the progress and gaining new knowledge are needed before, during, and after execution of project as in the case of experimentation.
  - The performance is to be monitored even during the use (or wrong use!) of the product by the end user/beneficiary.

Engineering Projects VS. Standard Experiments - *Similarities*

- 4. Learning from the past: Engineers normally learn from their own prior designs and infer from the analysis of operation and results, and sometimes from the reports of other engineers.
  - But this does not happen frequently. The absence of interest and channels of communication, ego in not seeking information, guilty upon the failure, fear of legal actions, and mere negligence have caused many a failure.

Engineering Projects VS. Standard Experiments - *Contrasts*

⌘1. Experimental control: In standard experiments, members for study are selected into two groups namely A and B at random. Group A are given special treatment. The group B is given no treatment and is called the 'controlled group'. But they are placed in the same environment as the other group A.

Engineering Projects VS. Standard Experiments - *Contrasts*

- This process is called the experimental control. This practice is adopted in the field of medicine. In engineering, this does not happen, except when the project is confined to laboratory experiments. This is because it is the clients or consumers who choose the product, exercise the control.

Engineering Projects VS. Standard Experiments - *Contrasts*

- It is not possible to make a random selection of participants from various groups. In engineering, through random sampling, the survey is made from among the users, to assess the results on the product.

Engineering Projects VS. Standard Experiments - *Contrasts*

- 2. Humane touch: Engineering experiments involve human souls, their needs, views, expectations, and creative use as in case of social experimentation.
- This point of view is not agreed by many of the engineers. But now the quality engineers and managers have fully realized this humane aspect.

Engineering Projects VS. Standard Experiments - *Contrasts*

- 3. Informed consent: Engineering experimentation is viewed as Societal Experiment since the subject and the beneficiary are human beings.
  - In this respect, it is similar to medical experimentation on human beings. In the case of medical practice, moral and legal rights have been recognized while planning for experimentation. Informed consent is practiced in medical experimentation. Such a practice is not there in scientific laboratory experiments.

Engineering Projects VS. Standard Experiments - *Contrasts*

- Informed consent has two basic elements:
- 1. Knowledge: The subject should be given all relevant information needed to make the decision to participate.
- 2. Voluntariness: Subject should take part without force, fraud or deception. Respect for rights of minorities to dissent and compensation for harmful effect are assumed here.

Engineering Projects VS. Standard Experiments - *Contrasts*

- For a valid consent, the following conditions are to be fulfilled:
  - 1. Consent must be voluntary
  - 2. All relevant information shall be presented / stated in a clearly understandable form
  - 3. Consenter shall be capable of processing the information and make rational decisions.
  - 4. The subject's consent may be offered in proxy by a group that represents many subjects of like-interests

Engineering Projects VS. Standard Experiments - *Contrasts*

- Informed consent when bringing an engineering product to market, implies letting the customer know the following:
  (*a*) *the knowledge about the product*

  (b) risks and benefits of using the product and

  (*c*) *all relevant information on the product, such as how to use and how not to use (do's and don'ts).*

Engineering Projects VS. Standard Experiments - *Contrasts*

- 4. Knowledge gained: Not much of new knowledge is developed in engineering experiments as in the case of scientific experiments in the laboratory.
- Engineering experiments at the most help us to (a) verify the adequacy of the design, (b) to check the stability of the design parameters, and (c) prepare for the unexpected outcomes, in the actual field environments.

Engineering Projects VS. Standard Experiments - *Contrasts*

- From the models tested in the laboratory to the pilot plant tested in the field, there are differences in performance as well as other outcomes.

ENGINEERS AS RESPONSIBLE EXPERIMENTERS

- In the engineering project, the engineers are the main technical enablers(or) facilitators.
- Their responsibility is shared with management, public, and others.
- The engineers have so many responsibilities for serving the society.

ENGINEERS AS RESPONSIBLE EXPERIMENTERS

- **1.Conscientiousness:** A primary duty is to protect the safety of human beings and respect their right of consent. [A conscientious commitment to live by moral values].
- **2.Moral Autonomy:** Unrestricted free personal involvement in all the steps of a project.

ENGINEERS AS RESPONSIBLE EXPERIMENTERS

- **3. Relevant information**: A constant awareness of the experimental nature of any project, imaginative forecasting of its possible side effects and a reasonable effort to monitor them. [comprehensive perspective or relative information].
- **4. Accountability**: Being accountable for the results of a project.

CONSCIENTIOUSNESS (sense of awareness)

- Conscientious means showing that one cares about the doing things well and thoroughly
- It means commitment to live according to certain values
- Engineers have to be sensitive to range of moral values and responsibilities
- Willingness to develop the skill and expend the effort needed to reach the best balance possible among various considerations.
- Conscientiousness means consciousness because mere intent is not sufficient.

CONSCIENTIOUSNESS (sense of awareness)

- Conscientiousness implies a desire to do a task well. Conscientious people are efficient and organized as opposed to easy-going and disorderly.
- 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.

CONSCIENTIOUSNESS (sense of awareness)

- One who thinks of oneself and one's benefits alone cannot be moral agents.
- Example: [Should not involve in…]The small negative duties such as altering data by fraud, violating patent right and breaking confidentiality.

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 individual's personality which leads to a committed action.

Relevant Information

- Without relevant factual information, conscientious is not possible.
- Moral concern involves a commitment (dedication) to obtain and assess all available relevant information.
- Moral concern involves a commitment to obtain and assess all available pertinent information.
- Another dimension to factual information is the **consequences of what one does.**

Relevant Information

- **Comprehensive Perspective**
- The engineer should grasp the context of his work and ensure that the work involved results in only moral ends. One should not ignore his conscience, if the product or project that he is involved will result in damaging the nervous system of the people (or even the enemy, in case of weapon development)

Relevant Information

- If a product has a built-in obsolete or redundant component to boost sales with a false claim. In possessing the factual information, the engineer should exhibit a moral concern and not agree for this design.
- Sometimes, the guilt is transferred to the government or the competitors. Some organizations think that they will let the government find the fault or let the fraudulent competitor be caught first.
- Finally, a full-scale environmental or social impact study of the product or project by individual engineers is useful but not possible, in practice.

Accountability

- Means being responsible, liable, answerable or obligated.
- Morally responsible peoples are expected to accept morally responsibility for their actions
- According to standley milgram, people are not willing to accept personal accountability when placed under authority

Accountability

The term Accountability means:

- 1. The capacity to understand and act on moral reasons
- 2. Willingness to submit one's actions to moral scrutiny and be responsive to the assessment of others. It includes being answerable for meeting specific obligations, i.e., liable to justify (or give reasonable excuses) the decisions, actions or means, and outcomes (sometimes unexpected), when required by the stakeholders or by law.

Accountability

- An engineer is always **answerable for what he had** undertaken. He must observe care and caution at every stage of his experiment, monitor it by his best capacity and skills and ultimately produce the outcome in the expected manner. **If there be failures or errors ,he must accept them with grace.**
- The people those who feel their responsibility, always accept moral responsibilities for their
- actions. It is known as **accountable.**

Accountability

- In short, 'accountable' means being **liable 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.

CODE OF ETHICS

- **CODE OF ETHICS/ ETHICAL CODES/ CODE OF CONDUCT**
- Codes are the **set of laws and standards.**
- Codes defines the **roles and responsibilities** of professionals.
- Ethical codes are adopted by **organizations to assist members in understanding the difference between 'right' and 'wrong' and in** applying that understanding to their decisions.
- These codes exhibit the rights, duties, and obligations of the members of a profession.

CODE OF ETHICS

- 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.**

Roles of codes and its functions

- 1. Inspiration and Guidance
- 2. Support
- 3. Deterrence and Discipline
- 4. Education and Mutual Understanding
- 5. Contributing to the profession's public image
- 6. Protecting the Status Quo
- 7. Promoting Business Interests

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.

INSPIRATION AND GUIDANCE

- 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)**

INSPIRATION AND GUIDANCE

- 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.

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.

Deterrence and discipline

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

Education and mutual understanding

- 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.

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 gives self regulation for the profession itself.

Protecting the Status Quo

(Protecting private/Social Issues)

- Codes establish **ethical conventions (Principles),** which can **help promote an agreed upon minimum** level of ethical conduct.

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. Only a few practicing engineers are the members of Professional Societies and so they **can not be obliged to abide by their codes.**
- 2. 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.
- 3. Codes are said to be coercive i.e., implemented by **threat or force.**

Limitations of Codes

- 4. Codes are restricted to **general and vague (Unclear) 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.
- 5. Engineering codes often have **internal conflicts. So they can't give** a solution or method for resolving the conflict.

RESEARCH ETHICS

- Research ethics involves the application of **fundamental ethical principles** to a variety of topics involving research, including scientific research.
- These include the **design and implementation** of research involving scientific misconduct such as fabrication of data and plagiarism, whistle blowing etc.

Role of Research Ethics

- First, It **promote the aims of research, such as** knowledge, truth, and avoidance of error. **For example,** prohibitions against fabricating, falsifying, or misrepresenting research data promote the truth and minimize error.
- Second, ethical standards promote the values that are **essential to collaborative work,** such as **trust, accountability, mutual respect, and fairness**.
- Third, many of the ethical norms help to ensure that researchers can be held **accountable to the public.**

Role of Research Ethics

- Fourth, ethical norms in research also help to **build public support for research.** People are more likely to fund a research project if they can trust the quality and integrity of research.
- Finally, many of the norms of research promote a variety of **other important moral and social values,** such as **social responsibility, human rights, compliance with the law, and public health and safety**.

RESEARCH ETHICS - Code For Researchers

- Obtaining Institutional Approval
- Informed Consent
- Treatment of Research Assistants and Participants
- Offering Inducements to Participants
- Deception in Research
- Debriefing Participants

RESEARCH ETHICS - Code For Researchers

- Treatment of Human subjects
- Treatment of Animals in Research
- Reporting Research Results
- Sharing Publication Credit
- Duplicate Publications of Data
- Ethics for Manuscript Reviewers

Human Subjects and Researchers

- Basic Ethical Principles in Treatment of Human Subjects
  - **Participation Must Be Voluntary**
  - **Researchers Must Obtain Informed Consent**
  - **Researchers Must Maintain Participant Confidentiality**

Caring for Animals in Research

- **APA Guidelines for Ethical Conduct in the Care and Use of Animals**
  - Minimize discomfort
  - Sanitary and comfortable conditions
  - Adequate food and water (taking into account experimental protocol)
  - Care by a licensed veterinarian
- Experiments approved by the **INSTITUTIONAL ANIMAL ETHICS COMMITTEE**

Caring for Animals in Research

- **Animal Welfare**
  - Generally accepted term for concerns about the care and use of animals in research
- **Animal Rights**
  - Idea that animals have the same rights as people. Not generally accepted.
- **Speciesism**
  - Term used to describe the discrimination of animals (treated differently than people).

Ethics in Scientific Writing

- Truth in Data Reporting
- Refrain from Plagiarism
  - Presenting another person's work as your own
- Take Authorship for only Work Performed
- Publish Data only Once
- Share Data after Publication
- Review the Work of Others Professionally

Balanced Outlook of 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.
- So the codes must be enforced with the **help of laws.**

Balanced Outlook of Law

- A balanced outlook of laws emphasizes the necessity of laws and regulations and their limitations in governing engineering practice
- What is Law?
- It is a body of rules of action prescribed by controlling legal authority and having binding legal force
- In general laws means all the rules established by authority or custom for regulating the behavior of members of a community or country

Balanced Outlook of Law

- Relationship between Laws and ethics:
- • Ethics- what is ought to do, what is not
- • Law – standard behavior required for individual

- • 1758- Babylons Building Code
- • 1852 US Stream boat Code

WHY LAW IN ENGINEERING

- Laws with respect to social implementation
- Laws are necessary because
  - People are not fully responsible
  - The companies are not encouraged to have moral initiative due to competition

WHY LAW IN ENGINEERING

- Engineers are expected to play vital role in framing implementing and propagating the rules of engineering. Strictly follow rules
- Laws lag in technological development
- Industries feel that laws are imposing excessive restrictions on engineering applications

ROLE OF LAW IN ENGINEERING

- **Precise rules and enforceable sanctions** are appropriate in cases of **ethical misconduct** that involve violations of well established and regularly reexamined procedures that have as their purpose the safety of public.
- It also provides a **self-interested motive** for most people and corporations to comply.
- Reasonable minimum standards are ensured of professional conduct.

ROLE OF LAW IN ENGINEERING

- They also serve as powerful support and defense for those who wish to act ethically in situations where ethical conduct might not be welcome.
- It is wrong to write off rule-making and rule following as ineffective. **Good laws, effectively enforced, clearly produce benefits.**

ROLE OF LAW IN ENGINEERING

- In areas of experimentation, rules must not attempt to cover all possible outcomes of an experiment, nor must they force the engineer to adopt a rigidly specified course of action. Here the regulations should be **broad based guidelines** but should hold the engineer accountable for his or her decisions.

THE PROBLEMS OF LAW IN ENGINEERING

- The greatest problem of law in engineering is of '**minimal compliance(Fulfillment)'.** Engineers and employers can **search for loop holes in the law** to barely keep to its letter while violating its spirit. Engineers will tend to refer to standard readymade specifications rather than come up with innovative ideas. **Minimal compliance led to the tragedy of the 'Titanic'.**

THE PROBLEMS OF LAW IN ENGINEERING

- Continually updating laws and regulations may be counter-productive and will make law always lag behind technology. This also **overburdens the rules and regulators.**
- Many laws are '**non-laws**' i.e. laws **without enforceable(ineffective)** sanctions. These frequently gives a **false sense of security to the public.**

THE PROBLEMS OF LAW IN ENGINEERING

- Highly powerful organizations, like the government can **violate the laws** when they think they can get away with it by inviting would be challengers, to face them in **lengthy and costly court proceedings.** This also creates frustration with the law.

INDUSTRIAL STANDARDS

- Industry standards are a **set of criteria within** an industry relating to the **standard functioning** and carrying out of operations in their respective fields of production.
- Industrial Standards are 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.

INDUSTRIAL STANDARDS

- 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.

Benefits of standards

- It helps manufacturers, clients and public
- It maintain a steady and balanced competition among industries
- It ensure a measure of quality
- Specification helps in achieving interchangeability

INDUSTRIAL STANDARDS

TYPES OF STANDARDS

Criterion	Purpose	Selected examples
Uniformity of physical properties and functions	Accuracy in measurement, interchangeability, ease of handling	Standards of weights, screw thread dimensions, standard time, film size
Safety and reliability	Prevention of injury, death, and loss of income or property	National Electric Code, boiler code, methods of handling toxic wastes
Quality of product	Fair value for price	Plywood grades, lamp life
Quality of personnel and service	Competence in carrying out tasks	Accreditation of schools, professional licenses
Use of accepted procedures	Sound design, ease of communications	Drawing symbols, test procedures
Separability	Freedom from interference	Highway lane markings, radio frequency bands

Industrial Standards

- International standards have become relevant with the development of the world trade.
- The International Standards Organization (ISO) has now detailed specifications for generic products/services with procedures that the manufacturers or service providers should follow to assure the quality of their products or service. ISO 9000-2000 series are typical examples in this direction. Others are CE
- Bureau of Indian Standards – Previously ISI

ROLE OF INDUSTRY STANDARD

- Standardization facilitates a healthy competition and designing of new concepts.
- Administration and the legislative bodies are benefited by the Industry standard. They govern the practical as well as the technological standards as per the legal requisites.

ROLE OF INDUSTRY STANDARD

- Optimum standards facilitate the creation of political as well as business related advantages. The reason being that the industry standard is worked out in consonance with the expertise of the corporate houses and different segments of the society.

ROLE OF INDUSTRY STANDARD

- In a nut shell, industry standard is a crucial tool in **acquiring industry goals related to managerial, technological as well as political.** Therefore, setting standards for the industry whether in the domestic market or international market provides assurance of transparency. The ultimate aim of setting industry standard is to provide a platform for giving shape to new creations.

Engineering – Social Experimentation

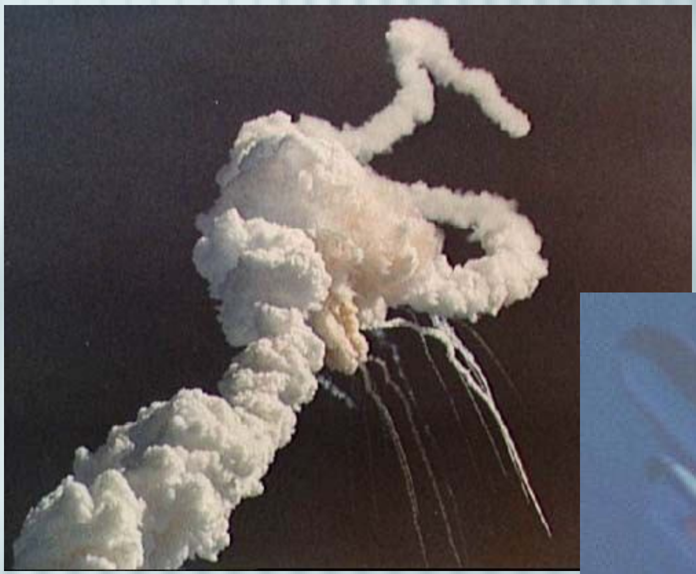
CASE STUDY: THE CHALLENGER

Dr. N. Karunakaran

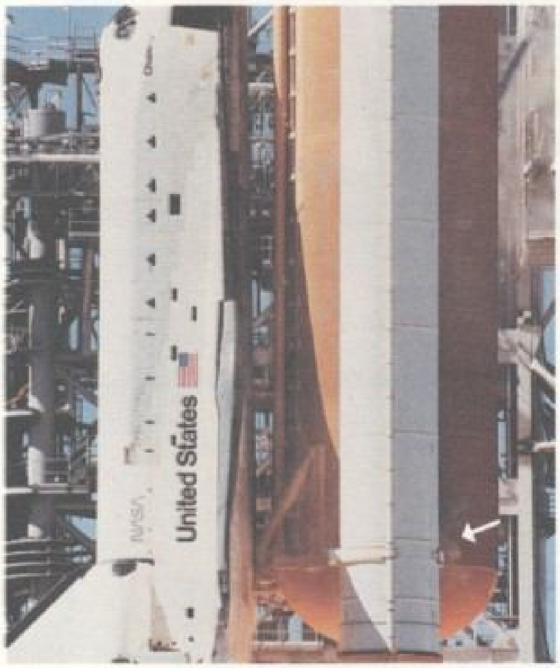
THE INCIDENT - JANUARY 28, 1986

Launch

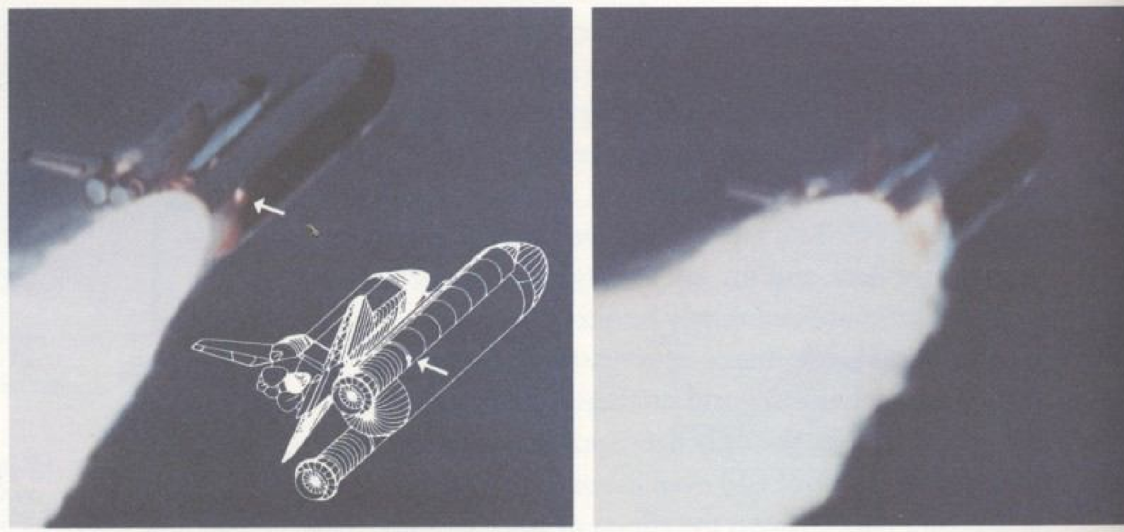
About 80 seconds after Launch
(shuttle broke down)



THE INCIDENT - JANUARY 28, 1986



Less than 1 second after ignition, a puff of smoke appeared at the aft joint of the right booster, indicating that the O-rings burned through and failed to seal. At this point, all was lost.

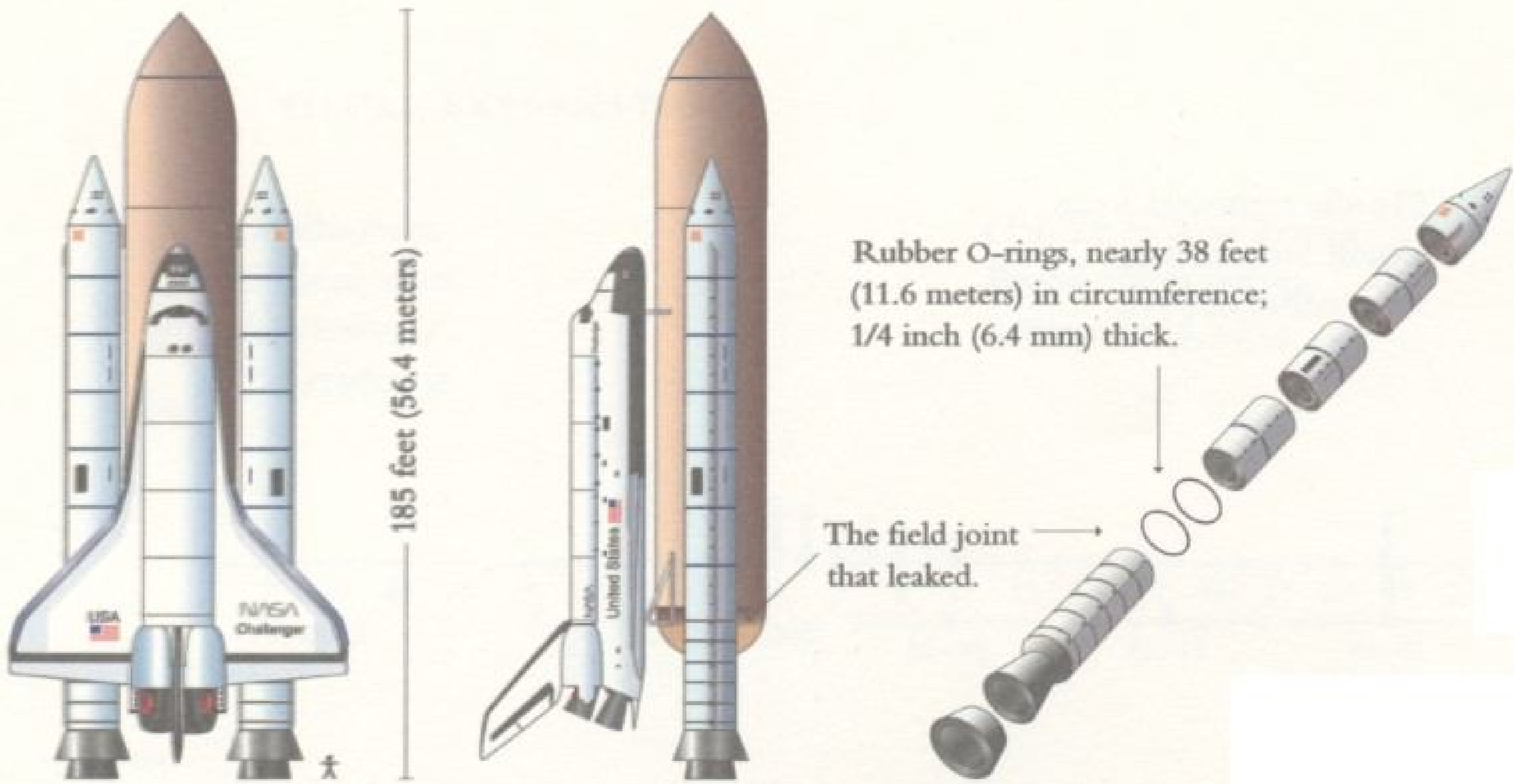


On the launch pad, the leak lasted only about 2 seconds and then apparently was plugged by putty and insulation as the shuttle rose, flying through rather strong cross-winds. Then 58.788 seconds after ignition, when the Challenger was 6 miles up, a flicker of flame emerged from the leaky joint. Within seconds, the flame grew and engulfed the fuel tank (containing liquid hydrogen and liquid oxygen). That tank ruptured and exploded, destroying the shuttle.

HERE'S THAT CREW!

The flight crew of Challenger 51-L. Front row, left to right: Michael J. Smith, pilot; Francis R. (Dick) Scobee, commander; Ronald E. McNair. Back row: Ellison S. Onizuka, S. Christa McAuliffe, Gregory B. Jarvis, Judith A. Resnik.

DESIGN OF SHUTTLE



The shuttle consists of an *orbiter* (which carries the crew and has powerful engines in the back), a large liquid-fuel *tank* for the orbiter engines, and 2 solid-fuel *booster rockets* mounted on the sides of the central tank.

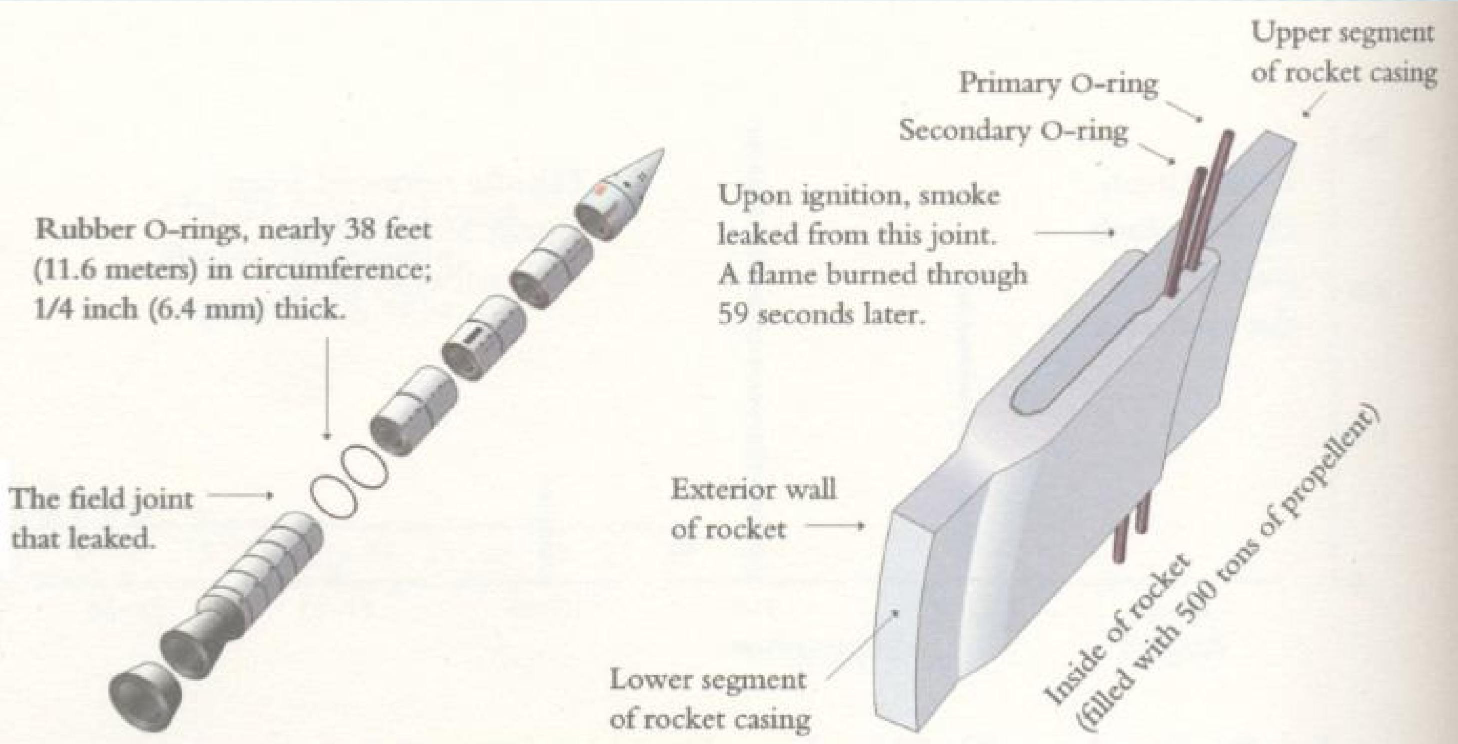
DESIGN OF THE SHUTTLE

- The orbiter of the Challenger had three main engines fuelled by liquid hydrogen. The fuel was carried in an external fuel tank which was jettisoned when empty.
- During lift-off, the main engines fire for about nine minutes, although initially the thrust was provided by the two booster rockets.
- These booster rockets are of the solid fuel type, each burning a million pound load of aluminum, potassium chloride, and iron oxide.

DESIGN OF THE SHUTTLE

- The casing of each booster rocket is about 150 feet long and 12 feet in diameter. This consists of cylindrical segments that are assembled at the launch site.
- There are four-field joints and they use seals consisting of pairs of O-rings made of vulcanized rubber. The O-rings work with a putty barrier made of zinc chromate.

O - RING



Where these segments mate, each joint is sealed by two rubber O-rings as shown above. In the case of the Challenger accident, one of these joints leaked, and a torch-like flame burned through the side of the booster rocket.

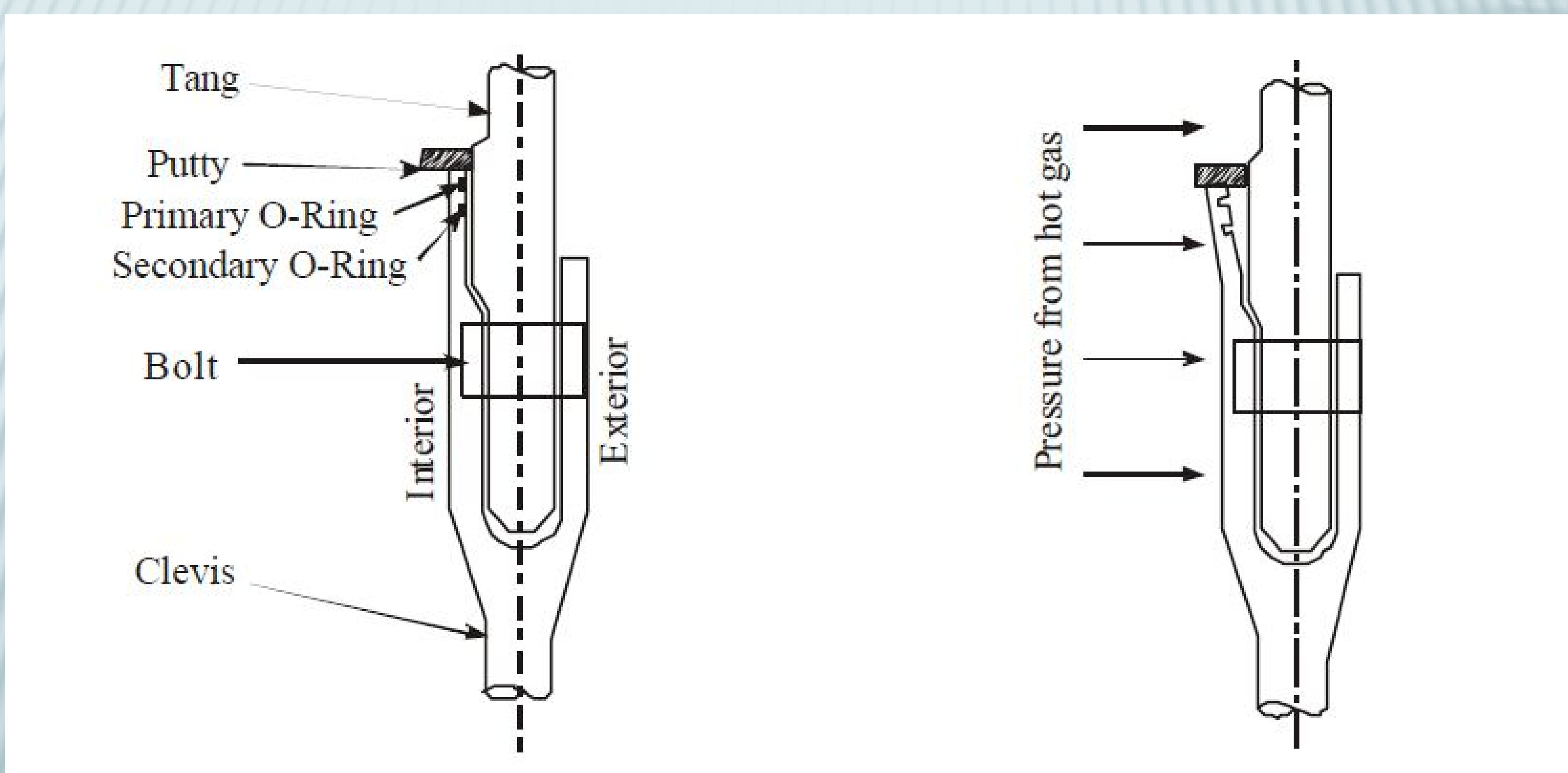
THE OWNERSHIP

- The engineers were employed with Rockwell International (manufacturers for the orbiter and main rocket), Morton-Thiokol (maker of booster rockets), and they worked for NASA.
- After many postponements, the launch of Challenger was set for morning of Jan 28, 1986.
- Allan J. McDonald was an engineer from Morton-Thiokol and the director of the Solid Rocket Booster Project.

THE OWNERSHIP

- He was skeptic about the freezing temperature conditions forecast for that morning, which was lower than the previous launch conditions.
- A teleconference between NASA engineers and MT engineers was arranged by Allan.
- Arnold Thompson and Roger Boisjoly, the seal experts at MT explained to the other engineers how the booster rocket walls would bulge upon launch and combustion gases can blow past the O-rings of the field joints

THE PROBLEM



Tang
Putty
Primary O-Ring
Secondary O-Ring
Bolt
Interior
Exterior
Clevis
Pressure from hot gas

THE PROBLEM

- On many of the previous flights the rings have been found to have charred and eroded. In freezing temperature, the rings and the putty packing are less pliable.
- From the past data gathered, at temperature less than 65 °F the O-rings failure was certain.
- But these data were not deliberated at that conference as the launch time was fast approaching.

THE PROBLEM

- The engineering managers Bob Lund and Joe Kilminster agreed that there was a safety problem.
- Boisjoly testified and recommended that no launch should be attempted with temperature less than 53 °F.
- These managers were annoyed to postpone the launch yet again.
- The top management of MT was planning for the renewal of contract with NASA, for making booster rocket.
- The managers told Bob Lund "to take-off the engineering hat and put on your management hat".

THE PROBLEM

- The judgment of the engineers was not given weightage.
- The inability of these engineers to substantiate that the launch would be unsafe was taken by NASA as an approval by Rockwell to launch.
- At 11.38 a.m. the rockets along with Challenger rose up the sky. The cameras recorded smoke coming out of one of the filed joints on the right booster rocket.
- Soon there was a flame that hit the external fuel tank. At 76 seconds into the flight, the Challenger at a height of 10 miles was totally engulfed in a fireball.
- The crew cabin fell into the ocean killing all the seven aboard.

CHART USED BY THIOKOL ENGINEERS ON JAN 27 BEFORE LAUNCH

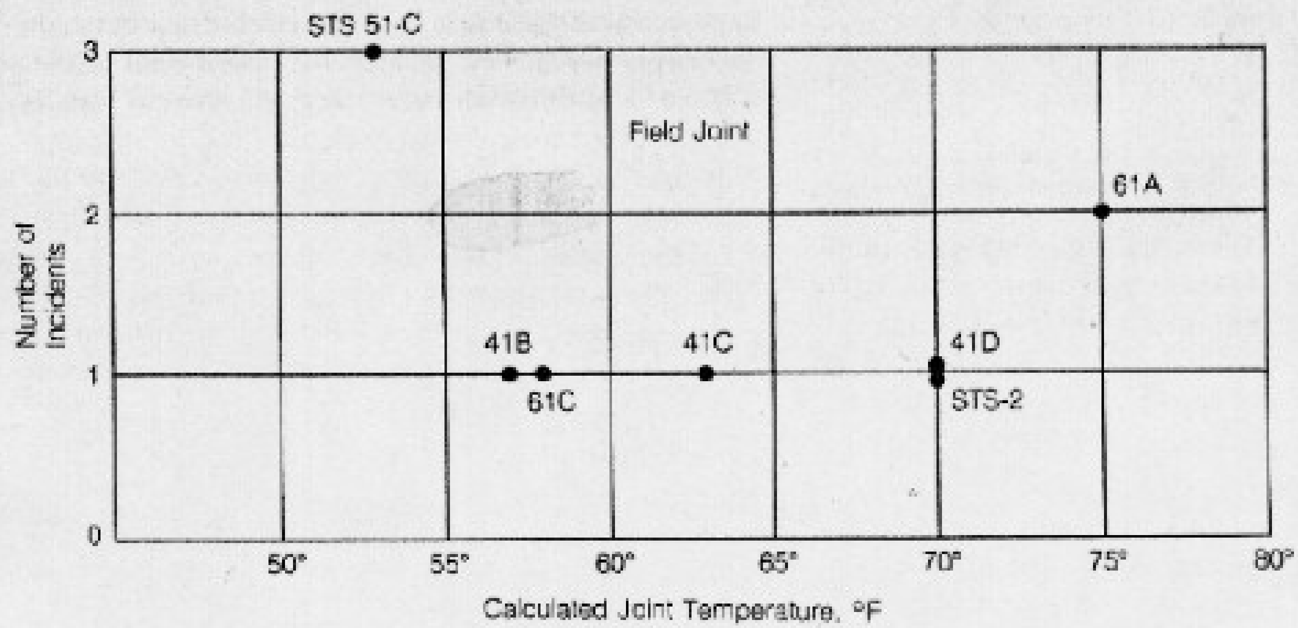


Figure 6
Plot of flights with incidents of O-ring thermal distress as function of temperature

A REVISED CHART BY ROGERS COMMISSION SHOWING ALL LAUNCHES

Temperature at Challenger Launch – 32 F

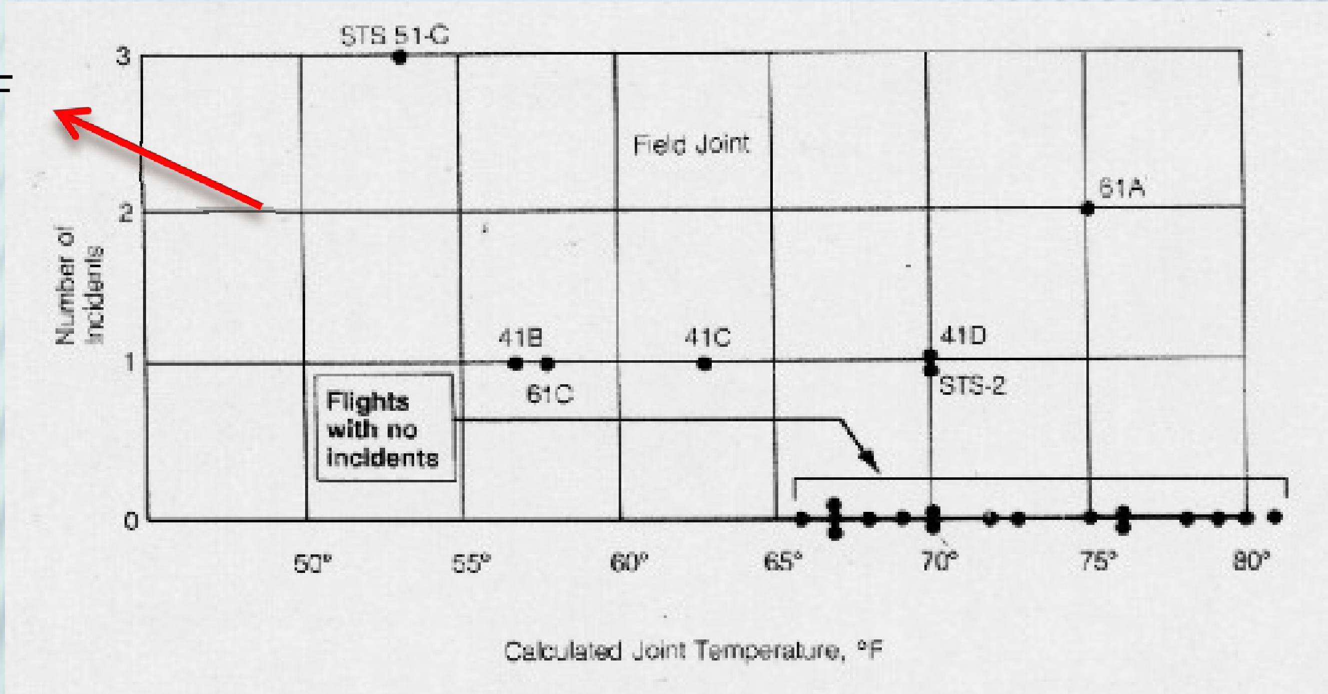


Figure 7
Plot of flights with and without incidents of O-ring thermal distress

NORMATIVE ISSUES

- 1. The crew had no escape mechanism. Douglas, the engineer, designed an abort module to allow the separation of the orbiter, triggered by a field-joint leak. But such a 'safe exit' was rejected as too expensive, and because of an accompanying reduction in payload.
- 2. The crew were not informed of the problems existing in the field joints. The principle of informed consent was not followed.
- 3. Engineers gave warning signals on safety. But the management group prevailed over and ignored the warning.

CONCEPTUAL ISSUES

- 1. NASA counted that the probability of failure of the craft was one in one lakh launches. But it was expected that only the 100000th launch will fail.
- 2. There were 700 criticality-1 items, which included the field joints. A failure in any one of them would have caused the tragedy. No back-up or stand-bye had been provided for these criticality-1 components.

FACTUAL/DESCRIPTIVE ISSUES

- 1. Field joints gave way in earlier flights. But the authorities felt the risk is not high.
- 2. NASA has disregarded warnings about the bad weather, at the time of launch, because they wanted to complete the project, prove their supremacy, get the funding from Government continued and get an applaud from the President of USA.
- 3. The inability of the Rockwell Engineers (manufacturer) to prove that the lift-off was unsafe. This was interpreted by the NASA, as an approval by Rockwell to launch.

THE AFTERMATH

- Causes of the accident are attributed to
  - Inability of the O-rings to expand and seal at low temperatures.
  - Heat shield putty did not perform at low temperatures
  - Fits and seating of the O-ring was affected by low temperature
- After all the testimonials
  - Biosjoly is taken off the project and subtly harassed by Thiokol management.

Ethics in Engineering Unit – III Safety & Risk

Dr. N. Karunakaran

Safety

- Safety in aircrafts – The recent incident at Kerala - Flight IX-1344 went down at Kerala's Calicut International Airport
- Though it was India's worst passenger aircraft accident since 2010, the number of casualties was significantly lower than the one in Mangaluru when another Air India Express flight from Dubai overshot the table-top runway and slid down a hill, killing 158 people.
- The flight has crashed while landing with 191 passengers on board. Eighteen people died in Kerala and more than 150 were injured.

Safety

- Reasons for accidents
  - 1. Table top runway
  - 2. Inefficiency of pilots
  - 3. Weather conditions
  - 4. Malfunction of control systems
  - 5. Malfunction of Mechanical systems
  - 6. Air traffic controller error
  - 7. Other causes. There are many other factors that can contribute to a plane crash, including sabotage and poor runway maintenance. One of the most surprisingly common factors in aviation accidents is birds. If a large bird collides with a windscreen or an engine, it can cause damage that may contribute to a plane crash.

What is safety ?

- Safety is a relative term – Safe for some one need not be safe for every one
  - Plastic bag in a child's hand
  - Pollution of air – age and physical condition dependent
- Hence absolute safety is a myth and its impossible

- According to William W Lowrance, the famous consultant of those times, Safety was defined as

  "**A thing is safe if its risks are judged to be acceptable**."
- Its a value judgment of individuals or groups of people

Underestimation of Risk

- Let the first case be where we seriously **underestimate** the risks of something. Buying a non-brand electric dryer from a local market without any guarantee, may eventually send us to a hospital with a severe electric shock or burn. While buying this dryer, according to Lowrance definition, this is quite safe, as the risks are judged to be acceptable.

Overestimation of Risks

- Let the second case be where we grossly **overestimate** the risks of something. If we suddenly know that the consumption of carbonated beverages like cola are the cause of cancer for 5% of the world's cancer patients, then we start worrying considering Cola as a poisonous drink. So, in this case, according to Lowrance definition, the Cola becomes unsafe the moment we judged the risks of using it to be unacceptable for us.

No estimation of Risks

- Let the third case be a situation wherein, a group makes no judgment at all about whether the risks of a thing are acceptable or not. As defined by Lowrance, this is the position where the thing is neither safe nor unsafe with respect to that group. Just like using the products of certain brands are considered safe, while others are not where nothing seems to differ. – Cars are they safe?

Modified definition for safety

- "A thing is safe, if were its risks fully known, those risks would be judged as acceptable in light of settled value principles"
  - Knowledge – the condition brought in
  - Risks – Acceptable or not
  - Relativity – fairly, moderately, etc.

Safety and its estimation

- Hence safety is frequently expressed in terms of degree and comparisons. The words like **fairly-safe** and **relatively-safe** are used where an individual is judged on the basis of settled values and it is further decided that the risks of anything are more or less acceptable in comparison with the risks of the other thing. For example, the consideration that road travel is safer than air-travel.

Risk

- Any work which might lead to harm us and is not considered safe, can be understood as a risk.
- According to a popular definition, "**A risk is the potential that something unwanted and harmful may occur**."
- According to William D Rowe, **potential for the realization of unwanted consequences from impending events**.

Risk

- Risk is a broad concept covering many different types of unwanted occurrences.
- When it comes to technology, it can equally well include dangers
  - of bodily harm,
  - of economic loss or
  - of environmental degradation.
- These in turn can be caused by delayed job completion, faulty products or systems or economically or environmentally injurious solutions to technological problems.

SAFETY AND RISK

- Safety was defined as *the risk that is known and judged as acceptable*. But, risk is a potential that something unwanted and harmful may occur.
- It is the result of an unsafe situation, sometimes unanticipated, during its use.

- Probability of safety = 1 – Probability of risk
- Probability of Risk = Probability of occurrence × Consequence in magnitude

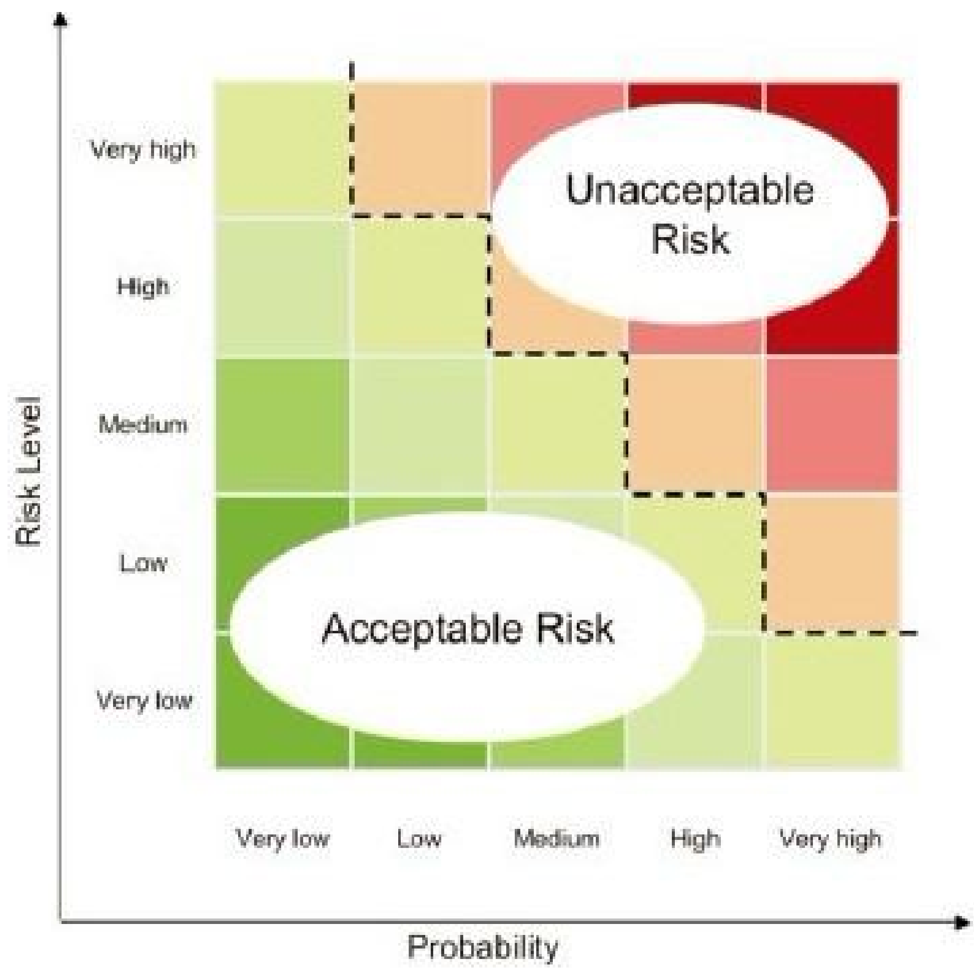
Acceptability of Risk

- A risk is acceptable when those affected are generally no longer apprehensive about it.
  - Apprehensiveness – depends on how the risk is perceived
- Acceptable risk refers to the level of human and property injury or loss from an industrial process that is considered to be tolerable by an individual, household, group, organization, community, region, state, or nation in view of the social, political, and economic cost-benefit analysis.
  - For instance, the risk of flooding can be accepted once every 500 years but it is unacceptable in every ten years.

Acceptability of Risk

- It is management's responsibility to set their company's level of risk. As a professional, it is your responsibility to work with management and help them understand what it means to define an acceptable level of risk.
- Each company has its own acceptable risk level, which is derived from its legal and regulatory compliance responsibilities.

Acceptable Risk vs Unacceptable Risk



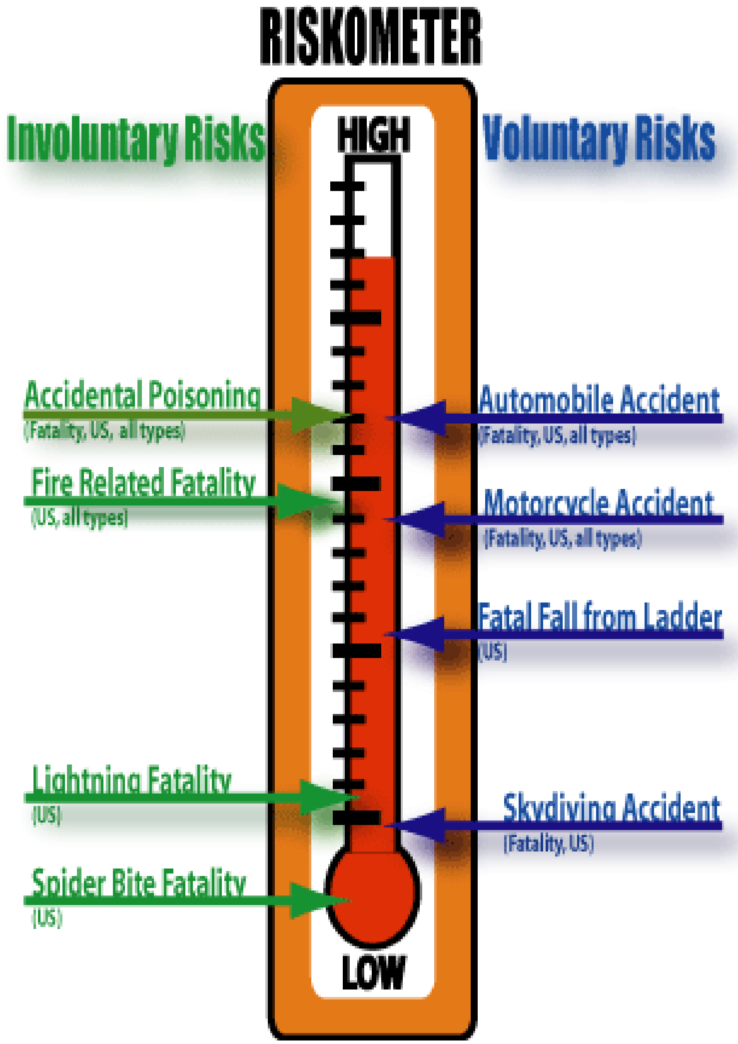
Voluntary risk & Control

- A person is said to take *'VOLUNTARY RISK'* when he is subjected to risk by either his own actions or action taken by others -*volunteers to take that risk without any apprehension.*
  - Eg : Driving a dirt bike over rough ground for amusement
- Voluntary risks have to do with lifestyle choices. They are the risks that people take knowing that they may have consequences.
  - These risks include smoking tobacco, driving a car, skydiving, and climbing a ladder.

Voluntary risk & Control

- Involuntary risks are risks that people take either not knowing that they are at risk, or they are unable to control the fact that they are at risk, such as secondhand (Passive)smoke.
- These risks often include environmental hazards such as lightning, cyclones, tsunamis, and tornadoes.

Voluntary risk vs Involuntary risk



Effect of Information and Risk Assessment

- Risks are perceived based on HOW the information is given
  - If "X" doesn't care to wear the seat belts in the car then the information he has perceived is that the probability of having an accident on any trip is very small. But if "X" has the knowledge that in the course of 50 Years of driving at 800 trips per year there is a probability of 1 in 3 that they will receive at least one disability injury. With this information "X" seat belt habit would change.

Effect of Information and Risk Assessment

- Studies have shown that a change in manner in which information about danger is presented can lead to a striking reversal of preferences.
- An experiment in which 2 groups of 150 people were given strategies for combating a disease
  - First Group
  - While preparing for an Asian disease outbreak which will kill 600 people – Two programs are proposed
    - If Program A is adopted, 200 people will be saved
    - If Program B is adopted 1/3rd probability that 600 people will be saved and 2/3rd probability that no one will be saved
    - Which program will you adopt?

Effect of Information and Risk Assessment

- Researchers reported that 72% selected Program A and only 28% selected program B
- Hence the vivid prospect of saving 200 people was the information perceived and felt that the 1/3rd probability of saving all 600 was never thought about

Effect of Information and Risk Assessment

- Second Group given the same problem but in different wordings
- While preparing for an Asian disease outbreak which will kill 600 people – Two programs are proposed
  - If Program C is adopted, 400 people will die
  - If Program D is adopted 1/3rd probability that nobody will die and 2/3rd probability that 600 people will die
  - Which program will you adopt?

Effect of Information and Risk Assessment

- This time only 22% chose program C which is same as A
- 78% chose program D which is identical to B
- Conclusions:
- 1. Options that are firm will be preferred
- 2. Options that are perceived as firm losses would be preferred

JOB RELATED RISKS

- Many workers *are taking risks in their jobs* in their stride like being exposed to asbestos.
- *Exposure to risks* on a job is in one sense of *voluntary nature* since one can always refuse to submit to the work or may have control over how the job is done.
- But generally workers have *no choice* other than what they are told to do since they *want to stick to the only job* available to them.

JOB RELATED RISKS

- But they are *not* generally informed about the *exposure to toxic* substances and other dangers which are *not readily seen, smelt,* heard or otherwise sensed.
- Occupational health and safety regulations and unions can have a better say in correcting these situations but still things are far below expected safety standards.

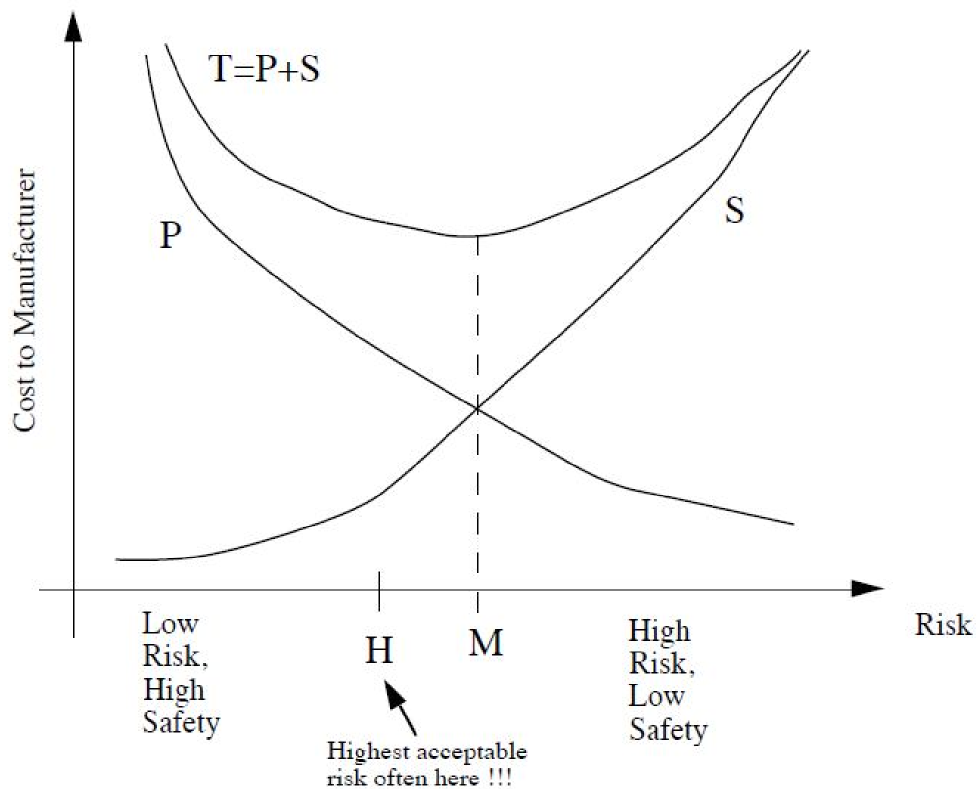
ASSESSMENT OF SAFETY AND RISK

- Absolute safety is not possible.
- Any improvement in making a product safe involves an increase in the cost of production.
- A product involves primary cost (Production) and secondary cost, both are taken into consideration in calculating the total cost.
- The secondary costs are warranty expenses, loss of customer goodwill and loss of even customers and so on.
- Therefore, it is very important for the manufacturer and the users to have some understanding to know about the risks connected with any product and know how much it will cost to reduce those risks

ASSESSMENT OF SAFETY AND RISK

- Safety can be improved in an engineering product only with an increase in cost.
- *Unsafe products increase secondary costs to the producer beyond the primary (production)* costs
- It should now be clear that '*safety comes with a price*' only.

ASSESSMENT OF SAFETY AND RISK



P - Primary cost of products, including cost of safety measures involved.
S - Secondary costs including warranty, loss of customer goodwill
T - Total cost = P+S
Minimum total cost occurs at M.
H - Highest acceptable risk may fall below risk at least cost M.

ASSESSMENT OF SAFETY AND RISK

- Fig. indicates how high safety and low risks lead to high primary cost and low secondary cost.
- The other extreme is low safety and high risks.
- One saves on primary cost but pays more because of high secondary costs.
- In between where the slopes of the primary and secondary costs, curves are equal in magnitude but opposite in direction, is the point of minimum total cost (M).
- If all costs can be quantified, that optimum point will be the goal. For an optimal design, we must be clear about how to determine the risk and how to compare losses with benefits.

ASSESSMENT OF SAFETY AND RISK

- What is the goal of risk assessment?
- The aim of the risk assessment process is to remove a hazard or reduce the level of its risk by adding precautions or control measures, as necessary. By doing so, you have created a safer and healthier workplace.

Factors that determine Risk

- 1. Knowledge of Risk
- 2. Uncertainties in Design
- 3. Uncertainties in Materials

Knowledge of Risk

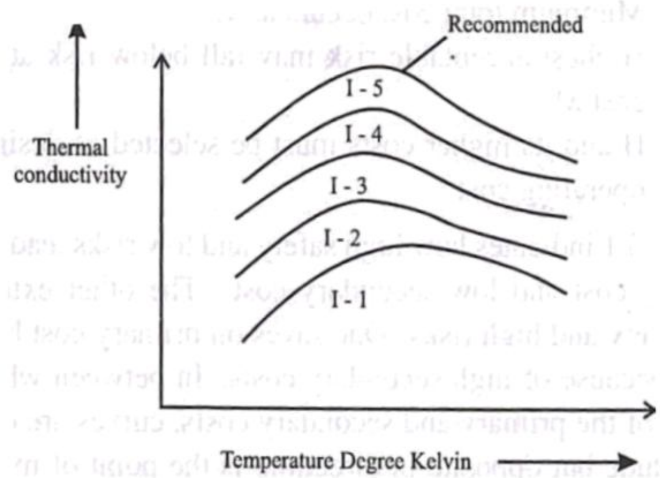
- Historical Data
  - Standard products its available
  - New products – Blind
- Sharing of data
  - As a policy some don't share – Propriety item
  - New application for old technology
  - Releasing data may hurt their competitive position
- A new company / product have to learn from scratch.

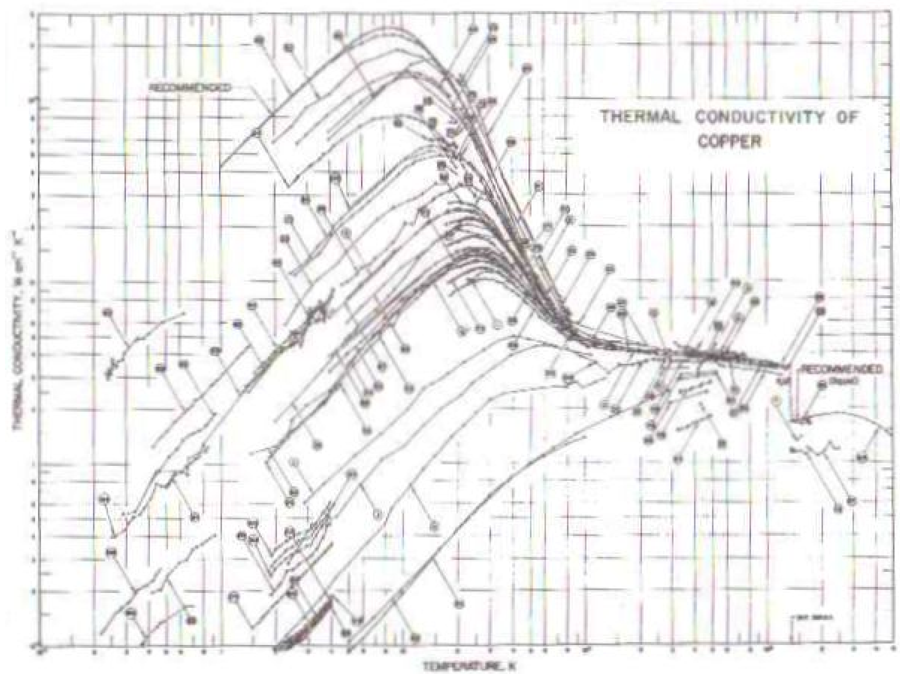
Uncertainties in Design

- Risk is never intentionally incorporated into a product, Risk arises because of the many uncertainties faced by the design engineers, the manufacturing engineer and even applications engineers.
- There are uncertainties regarding the quality of materials by which the products are made. The level of skill in manufacturing a product is also factor for uncertainties.
- Even a careful analyst will face difficulties when confronted with uncertain data

Uncertainties in Design

- The Figure gives the thermal conductivity of the copper over a wide range of temperatures as observed by different investigators.
- The variation in result will influence engineering decision about safety.





Uncertainties in Design

- Purpose of design
  - ROI plays an important role – Invest 1 crore and get 1 lakh profit or spend 50 lakhs to get 1 lack of profit
- Application of design
  - Static and dynamic conditions – Napoleons Army
  - Vibration and its analysis
- Supplier's data are based on statistical averages

Uncertainties in Materials

- To account for uncertainties about materials or components, as well as incomplete knowledge about the actual operating conditions of the projects, engineers have introduced a factor called —factor of safety.
- Factor of safety is defined as ultimate stress by working stress (Safe or allowable stress).
  - When actual stress on the member exceeds the allowable stress it will fail. That is, the product may be said to be safe when the actual stress less than the allowable stress.

Factor of Safety

- FOS – is intended for stress due to anticipated loads (DUTY) and stress the product is designed to withstand (CAPABILITY)
- So if capability is > than Duty the product is safe
- FOS = Material Strength / Design load = 1 or > 1
- FOS = Pdesign / Pmax

For instance, if the maximum load is 1,000 kgs, and the factor of safety is 3, then the design load that must be adopted is 3 x 1,000 = 3,000 kgs.

The accepted engineering practices go further and also introduce "ignorance factors" accounting for the use of untested new materials, configurations, modeling approaches, unpredictable load values, or unaccounted-for emergency uses. For an ignorance factor IF, the design load would be:

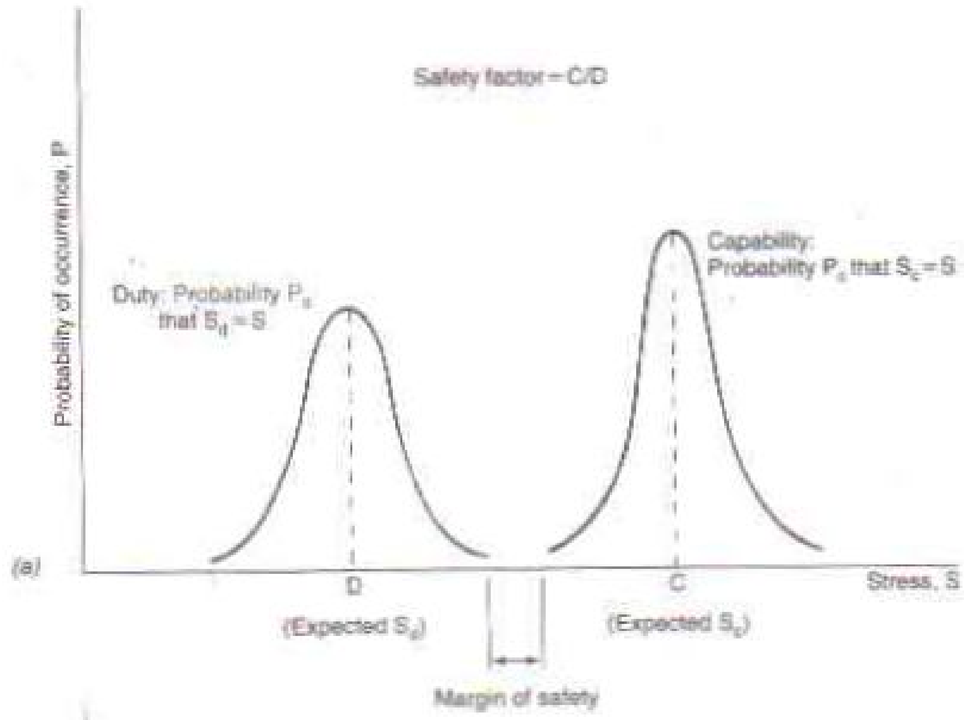
$$P'_{design} = IF\,.\,FS\,.\,P_{\max}$$

Factor of Safety

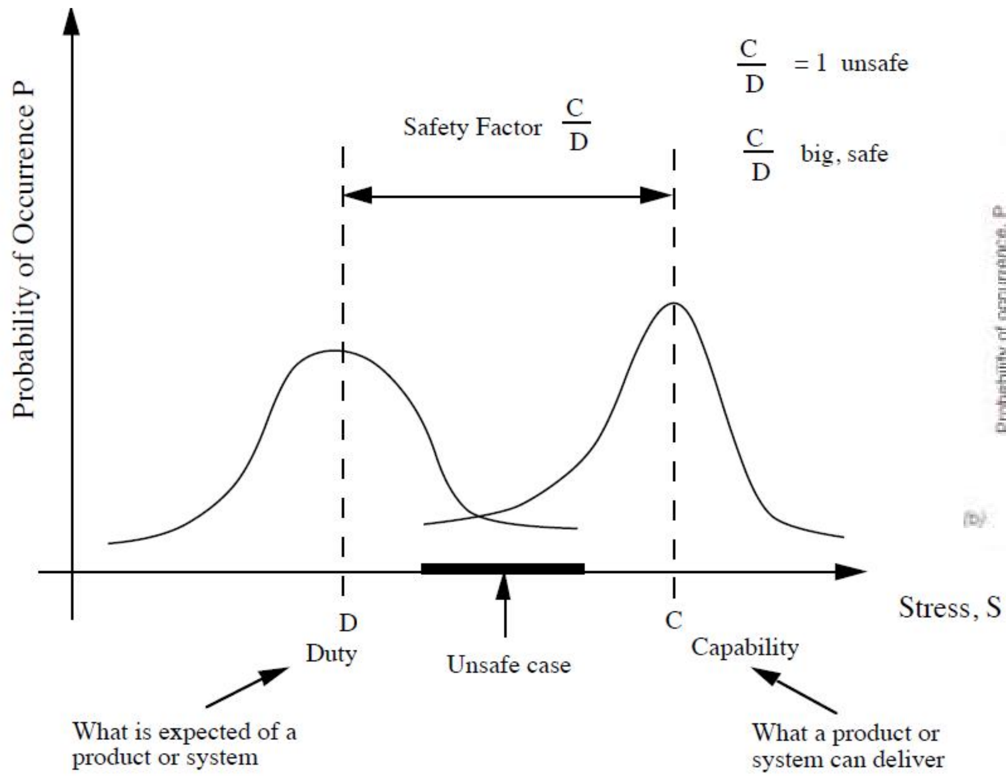
As an example, if the ignorance factor is 2, then the design load would be 2 x 3 x 1,000 = 6,000 kgs. A prudent designer will design a structural member that can thus withstand 2 x 3 = 6 times the maximum load. This value of the product of the safety factor and the ignorance factor is the norm rather than the exception in judicious engineering practice.

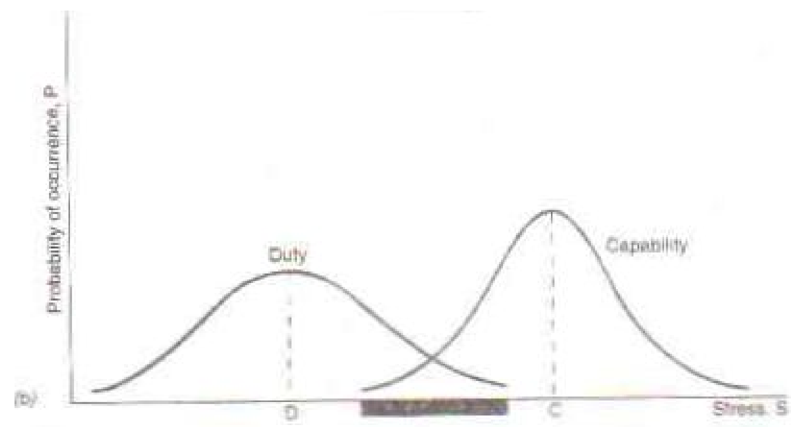
- So Capability by Duty Should be >1
- In Manufacturing various sub components are assembled to give final product.
- Each of these components having their own FOS, so its not possible to ascertain the actual capability and actual duty as a single value.
- Hence we can go for a probability distribution, C/D Curves

Margin of Safety



Margin of Safety





The safety factor concepts completely ignore the factor of variability that results in different reliability for FOS. Hence margin of safety is more reliable.

Testing strategies for safety

- ***Some commonly used testing methods:***
  - Using the **past experience** in checking the design and performance.
  - **Prototype testing.** Here the one product tested may not be representative of the population of products.
  - **Tests simulated** under approximately actual conditions to know the performance flaws on safety.
  - **Routine quality assurance tests** on production runs.

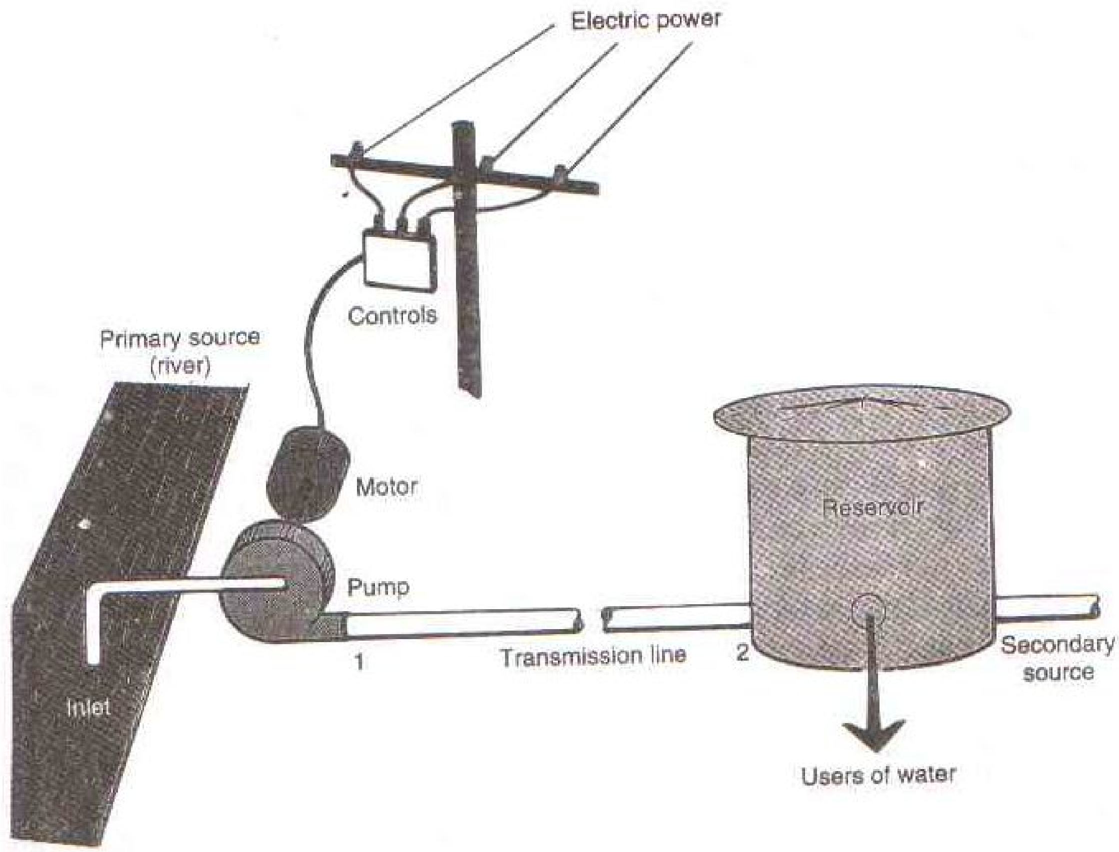
Testing strategies for safety

- The testing procedures are not always carried out properly. Hence we cannot trust the testing procedures uncritically.
- Some tests are also destructive and obviously it is impossible to do destructive testing and improve safety.
- In such cases, a simulation that traces hypothetical risky outcomes could be applied.

When Testing is inappropriate

- **Scenario Analysis** (Event -> Consequences)
- **Failure Modes & Effects Analysis** (Failure modes of each component)
  - This approach systematically examines the failure modes of each component, without however, focusing on relationships among the elements of a complex system.
- **Fault Tree Analysis** (System Failure -> Possible Causes at component level)
  - A system failure is proposed and then events are traced back to possible causes at the component level. The reverse of the fault-tree analysis is 'event – tree analysis'. This method most effectively illustrates the disciplined approach required to capture as much as possible of everything that affects proper functioning and safety of a complex system.

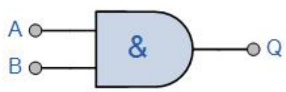
When Testing is inappropriate



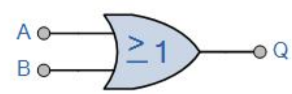
A Simple Water System

When Testing is inappropriate

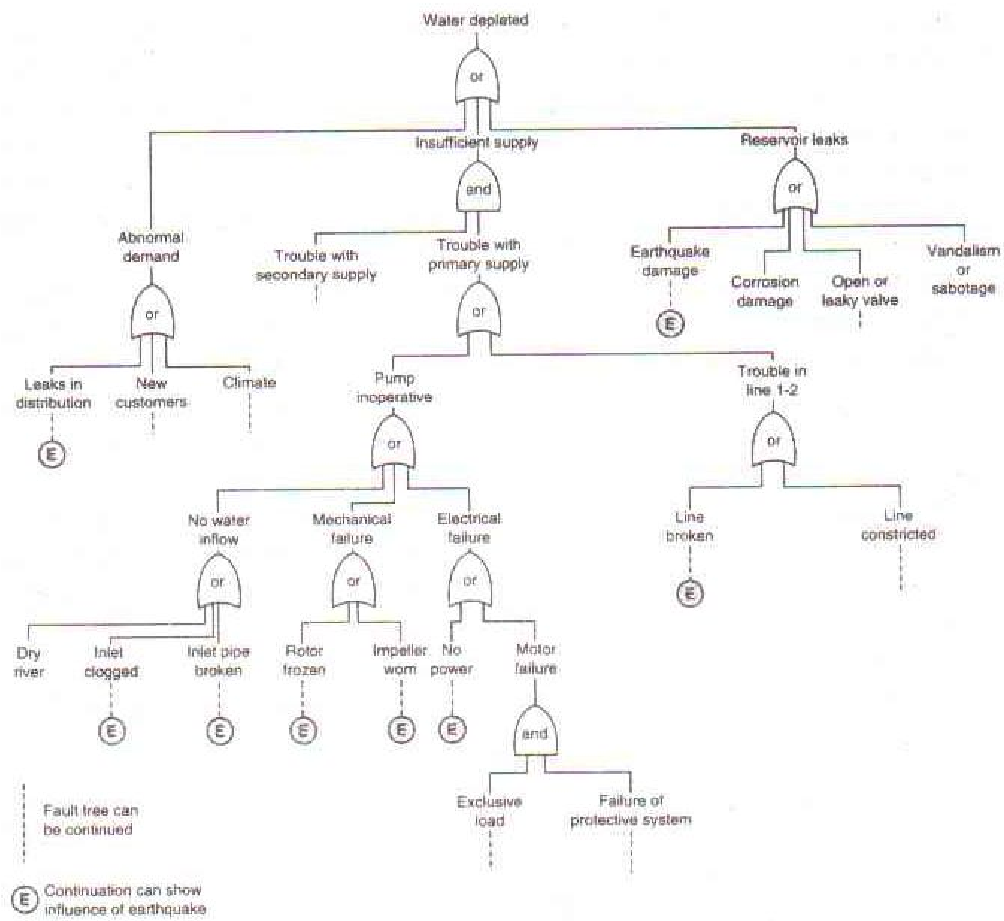
The Logic AND Gate

Symbol	Truth Table		
	B	A	Q
 2-input AND Digital Logic Gate	0	0	0
	0	1	0
	1	0	0
	1	1	1
Boolean Expression **Q = A.B**	Read as A **AND** B gives Q		

The Logic OR Gate

Symbol	Truth Table		
	B	A	Q
	0	0	0
	0	1	1
	1	0	1
	1	1	1
Boolean Expression Q = A + B	Read as A **OR** B gives Q		

When Testing is inappropriate



Failure in a Simple Water System analyzed by Fault Tree Analysis

RISK-BENEFIT ANALYSIS

- Risk-benefit analysis involving studies, testing about the comparison of the **risk of a situation** to its related **benefits.**
- Risk Benefit analysis (RBA) is an approach to risk assessment that focuses **not just on the risks of the activity,** but on the **benefits of the activity.**
- Risk–benefit analysis is analysis that seeks to quantify the risk and benefits and hence their ratio.
- Exposure to personal risk is recognized as a normal aspect of everyday life. A certain level of risk in our lives is accepted as necessary to achieve certain benefits.

RISK-BENEFIT ANALYSIS

- Risk is an essential element in the development of children's physical, emotional and intellectual development.
- Risk isn't just about physical actions – for example climbing a tree or skateboarding. It's also about taking intellectual risks – trying anything for the first time, testing new ideas, accepting other people's opinions (even
- if you don't agree with them).
- For example, driving an automobile is a risk most people take daily.

RISK-BENEFIT ANALYSIS

- Evaluations of future risk can be:
- **Real future risk,** as disclosed by the fully matured future circumstances when they develop.
- **Statistical risk,** as determined by currently available data, as measured actuarially for insurance premiums.
- **Projected risk,** as analytically based on system models structured from historical studies.
- **Perceived risk,** as intuitively seen by individuals.

Conceptual difficulties in RBA

- Both risks and benefits lie in future
- Heavy discounting of future because the very low present values of cost/benefits do not give a true picture of future sufferings.
- Can we express risks & benefits in a common set of units?
- Risks can be expressed in one set of units (deaths on the highway) and benefits in another (speed of travel)

Conceptual difficulties in RBA

- Many large projects, especially public works are undertaken based on risk-benefit analysis. The following are the questions to be answered:
- i) Is the product worth risks connected with its use?
- ii) What are the benefits?
- iii) Are benefits more than the risks and so on?
- iv) Are we willing to take a risk as long as the project gives sufficient benefit or gain?
- v) If the risk and benefit can be readily expressed in a common set of units, say lives or rupees, it is relatively easy to carry out risk benefit analysis and we can try to come out on their benefit side.

Example – Pond Dipping

- **Pond dipping** is a fun and simple way for children to explore an aquatic habitat.
- Children will be able to observe a diversity of different creatures from leeches to dragonfly nymphs.

Example – Pond Dipping

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
POND DIPPING: Slippery pond decking	The decking allows close access to the contents of the pond and is an essential component of exploring this habitat.	Slips, trips and falls. Cuts, grazes and abrasions. Drowning (die through submersion in and inhalation of water).	Young people; adults	• Banks shallow and planted to prevent accidental entry. • No access to banks for young people; use decking or 'beach' area only. • Deepest area is centre of pond– keep to edges. • Dipping platform kept clear of trip hazards (e.g. nets, trays) • Pond use rules clearly displayed and reviewed at the start of each session.	Low

Example-Nuclear Reactor Risk Assessment

ACTIVITY	How will people BENEFIT from this?	Possible hazards	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Nuclear Power Plant	Produces electricity.	•Radioactive Waste Disposal •Environmental Impact. •Nuclear Accidents •High cost •Can explode anytime.	•People •Environment •Nature	• Use with proper training	High

The major reasons for RBA are :

- 1. To know risks and benefits and weigh them each
- 2. To decide on designs, advisability of product/project
- 3. To suggest and modify the design so that the risks are eliminated or reduced

Limitations of RBA

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

- 1. Primarily the benefits may go to one group and risks may go to another group. Is it ethically correct?
- 2. Is an individual or government empowered to impose a risk on someone else on behalf of supposed benefit to somebody else? Sometimes, people who are exposed to maximum risks may get only the minimum benefits. In such cases, there is even violation of rights.

Limitations of RBA

- 3. The units for comparison are not the same, e.g., commissioning the express highways may add a few highway deaths versus faster and comfortable travel for several commuters. The benefits may be in terms of fuel, money and time saved, but lives of human being sacrificed.
  - How do we then compare properly?
- 4. Both risks and benefits lie in the future. The quantitative estimation of the future benefits, using the discounted present value (which may fluctuate), may not be correct and sometime misleading.
- Both risks and benefits may have uncertainties. The estimated probability may differ from time to time and region to region.

Prevention measures of reducing risks.

- The engineer is faced with a difficult task of designing and manufacturing safe products.
- They have to give a fair accounting of benefits and risks for those products.
- They have to meet production schedule and help his or her company to maintain profits all the time.
- Of these objectives, the product safety is to be given top priority.

Prevention measures of reducing risks.

- The various steps towards reducing risks are as follows:
- 1.The operator should not do any error in operation. He should not be negligent towards discharging his duties. Accidents are caused by dangerous conditions that can be corrected. Dangerous design characteristics are to be given due consideration in the design. Safety devices may be provided to reduce accidents.
- 2. If safety is built into a product in the beginning itself it may not increase the cost. Any changes in the design later, may lead to increase in the cost.

Prevention measures of reducing risks.

- 3. We become aware about safety after a product has been manufactured and tested. If safety is not built into the original design, people can be hurt during the time of usage. Hence one should not be reluctant to change the design, safety point of view.
- 4. Warnings about hazards should be adequate. It is also better to have insurance coverage, but a warning merely indicates that a hazard is known to exist. This provides only minimal protection against harm. Sometimes, insurance rates are sky rocketing.
- Engineers should understand that reducing risk is not an impossible task even under financial and time constraints. Hence in the design, safety should be given top priority by an engineer.

Improved safety

- 1. The "**Magnetic door catch**" introduced on refrigerators. This prevents death by suffocation of children trapped in them. The catch provided to the door makes possible, door to be opened from the inside without major effort. This is also cheaper compared to old type of latches.
- 2. The "**Dead man-handle**" used by the engineer (engine-driver) to control train's speed. The train is accelerated only as long as some pressure is applied on the handle. If the engine driver reduces the pressure on the handle, the speed of the train also comes down. When the pressure is zero, the train automatically stops.
- 3. A car "**Safety belt**" is a simple attachment on the door ensures that the belt automatically goes into the position whenever one enters the car.

The Government Regulator approach to risk

- **Two approaches to acceptable risk**
- **Layperson:** wants to protect himself or herself from risk.
- **The government regulator:** wants as much assurance as possible that the public is not being exposed to unexpected harm.

The Government Regulator approach to risk

- **Example (Fire accident)**

DO's and DONT's

1. DO NOT allow to use lift. Use only staircase left side.
2. Do not run to fire zone without extinguisher.
3. Close window & door as you leave fire zone
4. Do not shout
5. DO NOT open door & not to switch on Exhaust fan
6. Do not waste time to collect personnel belongings.
7. Use wet towel on your mouth and nose
8. Crawl at lower level while passing through smoke are
9. Do not break sealed window . Do not open window suddenly
10. Do not jump out of window
11. The water buckets and sand buckets should not be removed unless required for fighting the fire.

Example(Flooding)-Before Flooding

- **Be prepared to evacuate**
  - Discuss flood management plan
  - Decide where you will meet if separated
  - Identify alternative travel routes that are not prone to flooding
  - Plan what to do with your precious belongings and hazardous materials
  - Fill your car's gas tank
  - Seal vents to basements to prevent flooding
  - If told to leave, do so quickly

- **Example(Flooding)-During Flooding**

such as sudden drop-offs, fallen trees or fallen power lines. Do not drive through flood water. Flood water is dangerous there may be hidden hazards

Do not turn on electricity and gas supplies until a qualified electrician/engineer has checked them. Be alert for gas leaks - do not smoke or use candles or open flames.

Bhopal Gas Tragedy

- On December 3, 1984, Union Carbide's pesticide-manufacturing plant in Bhopal, India leaked 40 tons of the deadly gas, methyl isocyanate into a sleeping, impoverished community – killing 2,500 within a few days, 10000 permanently disabled and injuring 100,000 people. Ten years later, it increased to 4000 to 7000 deaths and injuries to 600,000.

Bhopal Gas Tragedy

- **Risks taken:**
- Storage tank of Methyl Isocyanate gas was filled to more than 75% capacity as against Union Carbide's spec. that it should never be more than 60% full.
- The company's West Virginia plant was controlling the safety systems and detected leakages through computers but at Bhopal the plant only used manual labour for control and leak detection. The Methyl Isocyanate gas, being highly concentrated, burns parts of body with which it comes into contact, even blinding eyes and destroying lungs.

Bhopal Gas Tragedy

- **Causal Factors:**
- Three protective systems out of service
- Plant was understaffed due to costs.
- Very high inventory of MIC, an extremely toxic material.
- The accident occurred in the early morning.
- Most of the people killed lived in a shanty (poorly built) town located very close to the plant fence.

Bhopal Gas Tragedy

- Workers made the following attempts to save the plant:

- They tried to turn on the plant's refrigeration system to cool down the environment and slow the reaction. (The refrigeration system had been drained of coolant weeks before and never refilled - it cost too much.)
- They tried to route expanding gases to a neighboring tank. (The tank's pressure gauge was broken and indicated the tank was full when it was really empty.)
- They tried to purge the gases through a scrubber. (The scrubber was designed for flow rates, temperatures and pressures that were a fraction of what was by this time escaping from the tank. The scrubber was as a result ineffective.)

Bhopal Gas Tragedy

- Workers made the following attempts to save the plant:

- They tried to route the gases through a flare tower - to burn them away. (The supply line to the flare tower was broken and hadn't been replaced.)
- They tried to spray water on the gases and have them settle to the ground, by this time the chemical reaction was nearly completed. (The gases were escaping at a point 120 feet above ground; the hoses were designed to shoot water up to 100 feet into the air.)
- In just 2 hours the chemicals escaped to form a deadly cloud over hundreds of thousands of people incl. poor migrant laborers who stayed close to the plant.

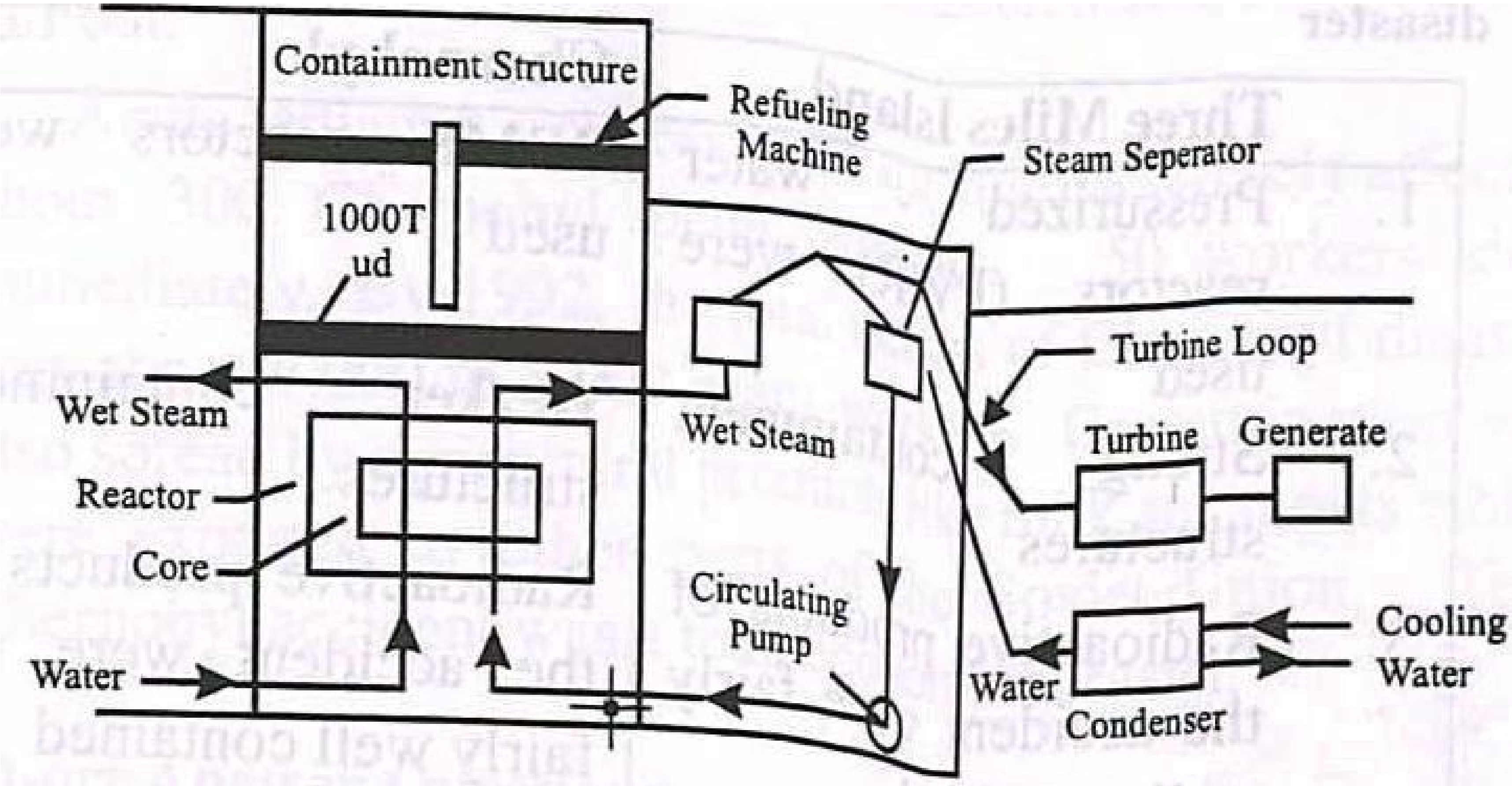
Chernobyl Nuclear reactor plant disaster

- The Nuclear Power Plant at Chernobyl (Ukraine-then USSR) had six reactors by 1986. The output of the plant was 6,000 Megawatts.
- The reactors were of a type called RBMK. The Soviet-designed RBMK (**reaktor bolshoy moshchnosty kanalny**, high-power channel reactor) is a water-cooled reactor with individual fuel channels and using graphite as its moderator. It is also known as the light water graphite reactor (LWGR).
- What happened in Chernobyl was a **terrible reactor fire**. On April 25th 1986, a test was under taken by the plant personnel and the plant was shut down for general maintenance purposes.

Chernobyl Nuclear reactor plant disaster

- During the course of servicing and maintenance work, the reactor operators disconnected the **emergency core-cooling system**. So, its power consumption will not affect the test results. This was the first one of the many safety violations.
- Another error occurred when a **control device was not properly reprogrammed**, to maintain the power at 700 to 1000 Megawatts level.

Chernobyl Nuclear reactor plant disaster



Chernobyl Nuclear reactor plant disaster

- This left the reactor in a dangerous position. The reactor was now running free, its control rods out, and its safety system disconnected.
- The reactor was free to do as it wished.
- As the core becomes hotter it allows fission to increase. This produced a sudden increase in power, in reactor 4, from 7% to many times of its rated thermal output. The effect was equal to that of half tone of TNT, exploding in the core. The fuel did not have time to melt. It simply shattered in to fragments.

Chernobyl Nuclear reactor plant disaster

- The fuel came in contact with water.
- A second explosion took place and it lifted and shifted a 1000 tonne concrete roof, separating the reactor from the refueling area above it.
- The fuel rods interacted with the circulating water to form hydrogen. This produced a wonderful display of fireworks. The radioactive fine materials were driven sky-high by the heat.
- What followed was a large scale accident, while the fire fighters lost their lives extinguishing the blaze.
- It took many hours to warn the surrounding people. Not only the Soviet Republic but also the entire Europe had not prepared themselves to handle such a grave disaster, that is, radioactive fallout.

Chernobyl Nuclear reactor plant disaster

- Acute radiation sickness and burn injuries severely affected about 300 Chernobyl plant workers. 50 workers died immediately. By 1992, the total deaths of Chernobyl disaster was about 6,000 to 8,000 plant workers.
- Contamination was also spread by agricultural products like milk and meats which were exported to other parts of the Soviet Union.
- Thus Chernobyl accident was a total economic disaster.

UNIT IV

RESPONSIBILITY TO EMPLOYERS

If we consider corporations first of all as communities – not legal fictions, not monolithic entities, not faceless bureaucracies, not matrices of price / earning ratios, net assets and liabilities – then the activities and ethics of business become much more comprehensible and much more human.

-Robert C. Solomon

INTRODUCTION

- Data General Corporation grew spectacularly during its first decade of operation, quickly becoming a Fortune 500 company that was ranked third in overall sales of small computers.
- However, it began to fall behind the competition and desperately needed a powerful new microcomputer to sustain its share of the market.
- The development of that computer is chronicled by Tracy Kidder in his Pulitzer Prize–winning book The Soul of a New Machine.
- Tom West, one of Data General's most trusted engineers, convinced management that he could build the new computer within one year—an unprecedented time for a project of its importance.
- West assembled a team of fifteen exceptionally motivated although relatively inexperienced young engineers, many of whom were just out of school.

INTRODUCTION

- Within six months they designed the central processing unit, and they delivered the complete computer ahead of schedule.
- Named the Eclipse MV/8000, the computer immediately became a major marketing success.
- The remarkable success was possible in part because the engineers came to identify themselves with the project and the product:
  - "Ninety-eight percent of the thrill comes from knowing that the thing you designed works, and works almost the way you expected it would.
- If that happens, part of you is in that machine."
- The "soul" of the new machine was not any one person.

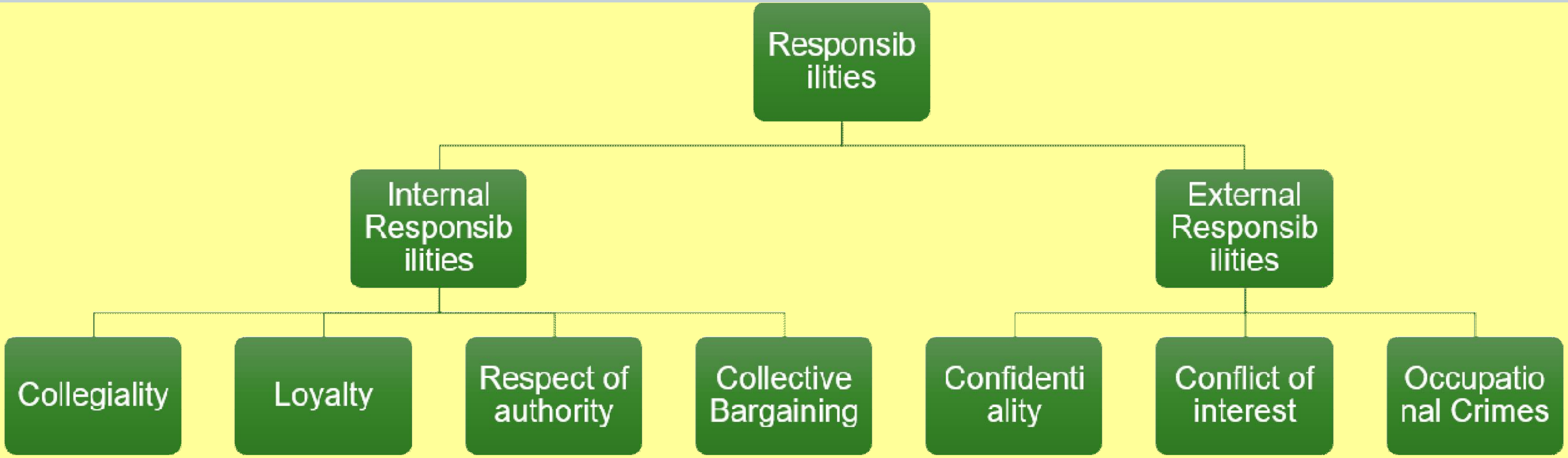
INTRODUCTION

- Instead, it was the team of engineers who invested themselves in the product through their personal commitment to work together creatively with colleagues as part of a design group.
- As might be expected, personality clashes occurred during the sometimes frenzied work schedule, but conflict was minimized by a commitment to teamwork, collegiality, and shared identification with the group's project.
- More worrisome, there were times when the engineers pushed themselves to their limits, imposing burdens on their families and their health, but for the most part those times remained limited.

INTRODUCTION

- Kidder ends his book by quoting a regional sales manager speaking to the sales representatives preparing to market the new computer: " 'What motivates people?' he asked.
- He answered his own question, saying, 'Ego and the money to buy things that they and their families want.'
- The engineers, of course, cared about money and ego, but Kidder makes it clear that those motives could not explain how it was possible for them to accomplish what they did.
- Professionalism involves much more, including both a sense of fun and excitement, personal commitments that have moral dimensions, and teamwork.
- The kind of commitments shown by the engineers understandably ranks high on the list of expectations that employers have of the engineers
- Engineers in turn should see top performance at a professional level as their main responsibility, accompanied by others such as maintaining confidentiality and avoiding conflicts of interest.
- Engineers also need the opportunity to perform responsibly, and this means that their professional and employee rights must be respected.

INTRODUCTION



COLLEGIALITY

COLLEGIALITY

- Important virtue but it may seem to be out of place competition among engineers is high
- When engineering codes of ethics mention collegiality, they generally cite acts that constitute disloyalty
- NSPE code states that
  - Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice or employment of other engineers, nor untruthfully criticise other engineers work. Engineers who believe others guilty of unethical or illegal practice shall present such information to the proper authority for action.

Definition of Collegiality

- Collegiality is a kind of connectedness grounded in respect for professional expertise and in commitment to the goals and values of the profession, and as such collegiality includes a disposition to support and cooperate with ones colleagues.
- The central elements of collegiality are
  - respect
  - commitment
  - connectedness and cooperation

COLLEGIALITY

Respect

- Respect means valuing one's colleague for their professional skill and their devotion to the social goods promoted by the profession
- In case of engineering this means affirming the worth of other engineers engaged in producing socially useful and safe products
- Like friendship collegial respect is reciprocal but does not involve personal affection

COLLEGIALITY

Commitment:

- Sharing devotion to the moral ideals essential in the practice of engineering
- Even when there is fierce competition among engineers working for competing corporate groups, there should prevail a sense that all engineers share a concern for overall good made possible through this competition
- Analogous to the sense of underlying values beyond winning which is maintained by competing sports teams

COLLEGIALITY

Connectedness:

- It is an awareness of being part of a cooperative undertaking created by shared commitments and expertise
- It is more than acting in ways to show respect to the peers
- This must be done with an appropriate attitude of affirming peers worth with a sense of being united with them in an enterprise defined by common goals
- This sense of unity with other engineers evokes cooperation and mutual support

COLLEGIALITY

- Collegiality as a Virtue
- A valuable trait that should be encouraged among engineers and professionals is viewed by Ihara, Professor of Philosophy, as
  - From the perspective of the society, collegiality is an instrumental value; it is good as a means of promoting professional aims
  - By enlivening one's sense of shared commitment to others, collegiality supports personal efforts to act responsibly in concert with colleagues
- Strengthens motivation to live upto professional standards

COLLEGIALITY AND LOYALTY

- Viewed from the perspective of the professionals, collegiality is intrinsically valuable
- Defines the professional community composed of many individuals jointly pursuing the public good
- Such community cannot continue without some shared awareness of mutual commitment to professional ideals

- Like most of virtues collegiality is distorted when peers appeal to it in silencing whistle blowers on corporate corruption
- Cannot be an excuse to shield irresponsible conduct
- Ihara suggests people engaging in gross misconduct cease to be colleagues
- Collegiality can degenerate into mere group self interest rather than shared devotion to public good

Senses of Loyalty

- Loyalty to employer can mean two things
- **Agency Loyalty**
  - Acting to fulfil one's contractual duties to an employer
  - Duties are specified to the particular tasks
    - for which paid for or
    - more general activities of cooperating with the colleagues and follow legitimate authority
  - Agency loyalty is entirely a matter of actions irrespective of the motives

LOYALTY

- Identification Loyalty
  - Contrastingly got to do more with emotions, attitudes and a sense of personal identity as it is done with actions
  - Understood as agency loyalty motivated by identification with a group to which one is loyal
  - It implies seeking to meet moral duties to a group or organization willingly with personal attachment and affirmation
  - People who do their work grudgingly or spitefully are not loyal in this sense, even though they may adequately perform all their work responsibilities and hence manifest agency-loyalty

LOYALTY

- In both senses, loyalty can be a desirable character attribute
- Either sense might be meant when codes of ethics assert that engineers ought to be loyal (or faithful agents or trustees) to employers and clients
- Certain specific duties such as those intended under the injunction to be loyal or faithful agents include
  - To avoid conflicts of interest
  - To protect confidential information
  - To be honest in making estimates
  - To admit one's error
- Sometimes there is additional implication to identify oneself for legitimate purposes of corporations

LOYALTY

- Within proper limits Agency loyalty to employers is an obligation
- It comprises the sum total of obligation to employers
- According to john H.Fielder, identification of loyalty is obligatory, only when the two conditions are meet.
  - Employees must be treated fairly, they should be given their share of benefits and burdens
  - Employees must see that their goals are achieved by and through a group in which they participate
- These goals include pleasures of affiliating with the group, recognition for valuable contribution and a sense of worth and accomplishment.
- Second, employees must be treated fairly receiving equal benefits or burdens

LOYALTY

- Imagine a group working on a project reaches a stage where continuation depends on a particular person working overtime
- If group identification takes place the person asked to work overtime would be rightly subject to blame for refusing
- Under appropriate conditions of urgency the request would have the force of an obligation rather than a morally optional act
- Fielder says a variety of excusing conditions may arise
- Employed professionals may find the project morally objectionable or the health condition make overtime work dangerous
- But in the absence of excusing conditions failure to identify with the group and accept obligation of overtime work constitutes to alienation

LOYALTY

- Is Fielder correct in believing that corporate identification is an obligation when two conditions are met?
- The primary argument for his view that refusal to identify with a group and work overtime can endanger completion of the project under time constraints
- This arguments shows that there is an obligation to do one's fair share of work under difficult conditions
- The requirement would seem to be contained in agency-loyalty based contractual agreements

LOYALTY

- Corporations deserve identification-loyalty if the they seek to maintain a sense of community where professionals and other employees as stakeholders
- Corporations that regards its workers as mere tools for maximizing profits can require agency-loyalty but cannot foster identification-loyalty
- Identification-loyalty is reciprocal: Employees can be expected to be loyal to companies only when they show strong commitments to their employees

LOYALTY

- Identification-loyalty can be commendable without being obligatory
- It is often a virtue but not strictly obligatory
- Considered good when it contributes to a sense of corporate community and increases productivity
- Nevertheless absence of identification-loyalty need not be moral defect, source of guilt or objectionable form of alienation
- Identification-loyalty is not fully under voluntary control nor open to demand by the employers

MISGUIDED LOYALTY

- The 1970 Clean Air Act requires car manufacturers to conduct 50,000-mile durability tests on new engines using only one tune-up.
- Test results on emissions must be reported to the Environmental Protection Agency (EPA), which decides whether the engines meet current pollution standards.
- In May 1972, top managers at Ford Motor Company were eagerly awaiting government approval of the test results they had submitted oil engines for 1973 Ford cars.
- They had every reason to be confident of the results they had submitted to EPA, which were based upon tests conducted by their own employees; their only concern was about meeting tight production schedules once EPA's approval was received.
- Their confidence was shattered, however, when then Ford president Lee Iacocca received a memo from a specialist in the computer division.

MISGUIDED LOYALTY

- That computer specialist had been examining the computer tapes from the tests to review the effectiveness of his division in support of engine development.
- His memo identified numerous irregularities in the test records, showing unauthorized maintenance of which EPA was not notified.
- The memo also stated that when the specialist sought an explanation of the irregularities from the engine division he was urged to burn the computer tapes and forget the matter.
- Intensive research into the matter by management quickly verified the information contained in the memo.
- Evidently, four "supervisory technical" employees who had conducted the original tests had ordered or engaged in over 300 acts of illegal maintenance on the test engines.
- Spark plugs and points had been replaced frequently, carburettors cleaned, and ignition timing repeatedly reset.

MISGUIDED LOYALTY

- These adjustments lowered the levels of pollutants emitted.
- Within 3 days Mr. Iacocca revealed to the EPA officials all he had learned about the tests and withdrew Fords application for certification of four major types of engines.
- In spite of its full cooperation with EPA investigators, the company was fined $7 million in criminal and civil fines for having conducted improper tests and issued false reports to the government.
- Because of the record size of the fines, Ford received damaging publicity on front-page newspaper articles (for example, in the New York Times and the Los Angeles Times, 14 Feb. 1973).
- It was also hurt by the costs of new tests that had to be conducted on an around-the-clock emergency basis and by having to delay production schedules.

MISGUIDED LOYALTY

Misguided Loyalty?

- Nothing written about the Ford test scandal tells what motivated the Ford supervisors and other engineers and technicians involved.
- Possibly it was only a self-interested concern—a desire to make themselves look good by ensuring their engines would pass tile qualifying tests.
- But it is equally possible that they were acting as loyal employees.
- Ford had been late in obtaining some government approvals the previous year, and perhaps the individuals believed— however mistakenly—that they were serving the company's best interests by avoiding such difficulties this year.
- Perhaps some of them were merely following orders from higher up to tamper with the engines.
- In any case, management was not particularly punitive: despite the staggering costs incurred, no one who had participated in rigging the tests was fired and the four supervisors were merely transferred to new positions.

PROFESSIONALISM & LOYALTY

- This case suggests three points concerning the relationship between professional responsibility and loyalty to companies or employers.
- First, acting on professional commitments to the public can be a more effective way to serve a company than a mere willingness to do anything one sees as good for the company. Ford would have benefited much more from engineers committed to professional standards than it did by the misguided loyalty shown to it by its employees.
- Second, it is clear from the example that loyalty to companies or their current owners should not be equated with merely obeying one's immediate supervisor. It would have shown a greater loyalty to Ford to act in a way consistent with the concerns of higher management, rather than in a manner consistent with the aims of an immediate supervisor.
- Third, the case illustrates how, an engineer might have professional obligations to both an employer and to the public that reinforce rather than contradict each other. Thus there need be no general contrast between the moral status of employees and professionals. In fact, obligations to the public and to one's employees point in the same direction.

PROFESSIONALISM & LOYALTY

- Obligations to the public and employers do not coincide
- Engineers seeking to protect the public is often overruled by the management
- When there are disagreements on technical matters engineers are told not to push their views
- Both senses of loyalty are virtues depending on organizations / groups / cause involved and on circumstances they are displayed
- Though loyalty is a virtue it has its limits and needs to be balanced against other virtues like responsible concern for public good
- There is a moral obligation not to act loyally when the goals of the employer are not attuned to public good

RESPECT FOR AUTHORITY

- Salaried engineers have obligations to respect their employers' legitimate authority.
- But what is the nature of this authority?
- How far should it be recognized by salaried professionals as being morally justified?
- In order to address these questions it is important to discuss of how and why authority arises within institutions.
- Then several distinctions will be drawn which make it clear Why such authority is not automatically the same as moral authority.

RESPECT FOR AUTHORITY

Institutional Authority

- Need for authority relationships in meeting the organizational goals is clear
- Decisions must be made in situations where allowing everyone to exercise unrestrained individual discretion would result in chaos
- Clear lines of authority provide a means of identifying areas of personal responsibility and accountability
- Institutional authority is acquired , exercised and defined within institutions
- It is an institutional rights given to people to exercise power based on the resources of the institution
- Given to individuals to meet their institutional duties – assigned tasks – within organizations

RESPECT FOR AUTHORITY

- Managerial tasks, for example, may be to allocate money or other resources, to make policy decisions or recommendations, or to oversee projects and issue directives to subordinates on particular topics.
- In order to enable managers to meet these duties organizations assign them with the authority
- Institutional rights (authority) and duties are the two sides of the same coin, and they deal with precisely the same activities and functions.
- Project engineers, for example, have the institutional duty to ensure that the projects they supervise are successfully completed, and they are given the institutional rights or authority necessary to carry out this duty.
- Obviously, too, these rights involve a certain amount of freedom or liberty: It would be self-defeating for all to assign tasks but to deny the freedom from interference necessary to perform them.

Institutional Versus Expert Authority

- It clearly benefits institutions to give authority to the individuals best qualified to serve the institution's goals in a given capacity.
- But in practice there is not always a perfect match between the authority granted and the qualifications needed to exercise it.
- Incompetence is found in all large institutions, and there is some truth in the cynical remark that in bureaucracies people tend to rise to their own level of incompetence.
- Institutional authority should not be equated with expert authority

RESPECT FOR AUTHORITY

- Expert authority is the possession of knowledge, skill or competence to perform a task or to provide guidance
- Doctors are authorities on health and well being and civil engineers on structures and transportation
- One of the key competencies for management is leadership ability has its own expert authority called ‘authority for leadership’ helps to effectively direct others
- Engineers can exercise expert authority on matters where they have little or no institutional authority
- Institutional authority which extend no further than the right to provide the management with inputs on ways to carry out a job
- Staff engineers, advisors and consultants are vested with expert authority while line managers are vested with institutional authority

RESPECT FOR AUTHORITY

Authority versus Power

- Institutional authority must also he distinguished from power.
- Institutional authority typically carries with it an allotment of the resources needed to complete tasks.
- Yet ineffectual persons may not he able to summon the power which their position allows them to exercise.
- A manager, for example, who lacks the skills of leadership may he unable to inspire and encourage employees to produce in ways the institution requires
- Conversely, people who are especially effective may acquire great power or influence—power which goes well beyond the authority attached to the positions they hold.
- Charisma tic leaders often have influence outside their domains of authority.
- And highly respected engineers of proven integrity ma y have power within all exceeding their explicit institutional rights.

RESPECT FOR AUTHORITY

Morally Justified Authority

- The preceding distinctions clear the way for making two observations.
- First, an employer may have the institutional authority to direct engineers to do something which is not morally justified
- Second, engineers may have an institutional duty to obey a directive which is morally unjustified and which it is their moral duty, all things considered, to disobey.
- Institutional duties are not synonymous with the morally justified duties
- To repeat: Institutional authority is the institutional right to exercise certain kinds of power, and this right is merely the liberty which the rules of the institution a person has.
- Institutional duties are the duties specified by the rules of the institution, either directly as attached to offices and positions or indirectly as delegated by a superior
- These rights and duties may be established as means to the end of meeting institutional goals.

RESPECT FOR AUTHORITY

- But they are not thereby moral rights and duties, or morally justified institutional rights and duties.
- Before concluding that a specific act of exercising institutional authority is morally justified, one would need to know
  - whether tie institutional goals are themselves morally permissible or morally desirable and
  - whether the act violates basic moral duties.
- Engineers do take on moral obligations to meet their institutional duties when they accept employment—but only so long as meeting those institutional duties is morally permissible.
- An employment contract can be viewed as a morally conditioned mutual promise.
- Promises to act immorally are either invalid or automatically overridden by moral considerations.
- The relationship between moral rights and duties and institutional rights and duties is complex.

RESPECT FOR AUTHORITY

- **Human rights and institutional rights** cannot be equated
- By definition, human rights (such as the rights to life, liberty, and the pursuit of happiness) are possessed by virtue of being a person, not by virtue of being a member of an institution.
- However, some institutional rights and duties can be equated with special moral rights and duties namely , those which are morally justified.
- For example, through employment agreements employees acquire a special institutional duty to protect proprietary information and employers have an institutional right to require that employees do so.
- Those duties and rights can he morally justified, either through some argument deriving from the employment contract itself or because of other, independent considerations, they are also moral duties and rights.

RESPECT FOR AUTHORITY

- **Accepting and Obeying Authority**
- Let us now shift perspective from the authority of employers to the recognition of that authority by their employees.
- Employees recognize their employer's authority when for the most part they accept the guidance and obey the directives issued by the employer having to do with the areas of activity covered by the employer's institutional authority.
- There are exceptions, since it is possible in special cases to recognize someone's authority but to disobey an order on moral grounds.
- But the present concern is to obtain a clearer idea of what accepting authority under normal conditions should and should not involve
- In his classic text, Administrative Behaviour, Herbert Simon states:
  - "A subordinate is said to accept authority whenever he permits his behavior to be guided by the decision of a superior, without independently examining the merits of that decision"

RESPECT FOR AUTHORITY

- In general, authority relationships are
  - "all situations where suggestions are accepted without any critical review or consideration“
- Again,
  - "the characteristic which distinguishes authority from other kinds of influence is... that a subordinate holds in abeyance his own critical faculties for choosing between alternatives and uses the formal criterion of the receipt of a command or signal as his basis for choice“
- In Simon's view, the reasoning of subordinates in their role as subordinates is at most aimed at anticipating commands by asking themselves how their superiors would wish them to behave in a given situation.
- Simon notes that all employees place limits on the "zone of acceptance" in which they are willing to accept their employer's authority.
- But within that zone, an "individual, relaxing his own critical faculties, permits the communicated decision of another person to guide his own choice”
- While this automatic obedience within the "zone of acceptance of an employer's authority is understandable, it also carries with it the risk of becoming blind and unthinking in regard to moral matters.

RESPECT FOR AUTHORITY

- The problem which arises then is that the boundaries of tolerance are easily expanded and rationalized when expediency so dictates
- Thus the size of any person's "zone of acceptance" could become a measure of the lack of that individual's moral integrity.
- To avoid this problem, employees must he reflective concerning the justified extent of their "zone of acceptance" of employers' authority.
- In a sense, they should never suspend their critical review of employers' directives
- Therefore, it can be concludes that:
  - As professionals engineers have obligations to accept their employers' institutional authority.
  - But this is not an obligation to obey blindly.
  - Professional autonomy entails exercising independent judgment, even though it does not mean disregarding legitimate directives
  - The basic moral task of salaried engineers is to be aware of their obligations to obey employers on the one hand and to protect and serve the public and clients on the other

PARAMOUNT OBLIGATION

- The engineers paramount obligation is to protect the public health, safety, and welfare, rather than the obligations of loyalty and faithful service to employers
- The engineers have obligations to accept their employers institutional authority. But it does not mean that they have to obey obligations blindly.
- Engineers must weigh their obligations to the public, their employers, their colleagues, and others.

COLLECTIVE BARGAINING

- Is it possible for an engineer to be a professional, dedicated to the highest ethical standards of professional conduct, while simultaneously being a member and supporter of a union?
- The question is too complex to warrant a simple answer.
- Before answering it we would need to know what kind of union and union activities are at issue. Lacking this information, the answer is impossible
- Observers have argued that the ethical aspects of professionalism in engineering are inherently inconsistent with unionism—that is, with union ideology and practice.
- Young engineers were prevented from joining unions on the fact that they are professionals
- In Engineers and Their Professions, John Kemper writes:
  - There is little doubt that unionism and professionalism are incompatible. Professionalism holds that the interests of society and of the client (or employer) are paramount. Unions are collective bargaining agents that sometimes place the economic interests of the members ahead of those of the client or employer (Kemper, 1982, 267).

COLLECTIVE BARGAINING

- A number of professional societies have also held that loyalty to employers and the public is incompatible with any form of collective bargaining.
- The National Society of Professional Engineers (NSPE) has fervently led the opposition to union organizing of engineers and similar activities.
- Its position is reflected in the NSPE code of ethics:
  - "Engineers shall not actively participate in strikes, picket lines, or other collective coercive action“

Historical Note

- The beginning of engineering unionism in the United States occurred during World War I
- Marine architects and drafters were dissatisfied with their salaries at a time of both rising living costs and rising wages of blue-collar workers.
- Various groups were organized which later unified to become American Federation of Technical Engineers, an affiliate of the former American Federation of Labour (AFL).
- Most contemporary engineering unions, however, had their origin during the 1940s.
- These groups usually remained independent of the large national unions like the AFL and the CIO (Congress of Industrial Organizations)
- World War II and its aftermath brought widespread job insecurity, unhappiness with salaries, and lessened professional recognition, yet engineering unions were never able to organize most engineers.
- In fact, at their peak during the late 1950s, engineering unions had only 10 percent of the total number of engineers as members.

COLLECTIVE BARGAINING

- These observations do not necessarily apply to all industries.
- In the aerospace industry, for instance, a history of high job turnover has created a highly mobile group of engineers with lessened job security.
- When engineers at two major aerospace firms were polled in a study by Archie Kleingartner, 30 percent of those eligible to join were found to be members of unions.
- A surprising number of engineers working for the two firms disagreed with the statement that "it is impossible for an engineer to belong to a union and at the same time to maintain the standards of his profession."
- The percentages disagreeing ranged from 68 percent among low-level professionals to 91 percent among high-level professionals
- As a result of his study, Kleingartner concluded that
  - - the majority of engineers interviewed.., do not view unionism as threatening their professionalism, and very likely also they do not see it coming between them and management in any fundamental way. They attribute substantially less importance to the potentially disrupting effects of unions than does management. The engineers view unions as limited institutions performing certain limited functions

COLLECTIVE BARGAINING

- When a union is viewed as an external service organization and not as an embodiment of collective will, its size will depend greatly on how well it fulfils its functions
- Lacking real bargaining powers engineers' unions find it hard to overcome opposition from management and professional societies even when quality of work life is low and attitude toward management are negative
- Engineers also show an increasing interest in becoming managers themselves.
- An engineering degree and several years of experience can open doors in this direction.
- Employers encourage the trend by making engineers identify with management early on.
- Professional societies oppose unionization because of the issue of conflicting loyalties and on the grounds that it is unprofessional.
- NSPE has two arguments in support of this stand : "faithful agent argument" and the second the "public service argument

COLLECTIVE BARGAINING

The Faithful Agent Argument

- In the current NSPE Code the ban on the use of " collective or coercive action" appears as one of the principles of obligation concerning professional integrity
- Yet in versions it was placed prominently in the first section, which dealt with loyalty to employers:
  - Section 1—The Engineer will be guided in all his professional relations by the highest standards of integrity, and will act ill matters for each client or employer as a faithful agent or trustee.
  - He will not actively participate in strikes, picket lines, or other collective coercive action (1979 NSPE Code).
- The implication is that being the faithful trustee of one's employer is incompatible with actively supporting collective action aimed against that employer.
- In 1976, for example, NSPE's Board of Ethical Review reiterated it in discussing a hypothetical example of a case concerned the unionized employees in a state highway department.

COLLECTIVE BARGAINING

- The employees, most of whom were not engineers, voted to strike when their demands for a pay increase of 60 percent and other benefits were denied.
- The Board of Ethical Review insisted that it was unethical for the engineers to participate actively, but Passive participation, such as not crossing picket lines, was ruled permissible if it was necessary to avoid physical danger or abuse.
- The argument given was concise:
  - "the engineers have a higher standard than self-interest; they, have the necessary ethical duty to act for their employer as a faithful agent or trustee."

COLLECTIVE BARGAINING

- Obviously, the Board saw active support of a strike or other collective action used against an employer as a violation of professional ethics
- It identified with the duty engineers have to serve as their employer's "faithful agents or trustees.“
- Many people involved in engineering would agree with such a view, and certainly a case call made for it.
- The conduct under discussion involves several features, any one of which might seem inconsistent with loyalty to employers:
  - (1) It goes against the desires or interests of the employer,
  - (2) it uses coercion or force against the employer, and
  - (3) it involves collective and organized opposition.

COLLECTIVE BARGAINING

- **The Public Service Argument**
- A second general argument against unions begins by emphasizing that the paramount obligation of engineers is to serve the public.
- It then notes that by definition unions seek to promote the special interests of their members, not the interests of the general public.
- It is inevitable, so the argument continues, that clashes will occur, posing a threat to the meeting of professional commitments to the public.
- Strikes, which are the ultimate source of power for unions, may wreak havoc with the public good.
- Witness what has happened in recent strikes by police officers, firefighters, teachers, and nurses.
- Imagine what would happen to the economy if all computer engineers and technicians were to go on strike!

COLLECTIVE BARGAINING

- Yet once again it points out only the dangers of unions and assumes that engineering unions must act irresponsibly.
- Of course many unions have acted in that way, but not all
- It is at least possible that a collective bargaining group for engineers, whether called a union, a guild, or an association, led by professional engineers, could devote itself to promoting the interests of engineers only within the limits set by professional concern for the public good.
- It could also devote itself to giving positive support to ethical conduct by engineers—which, after all, is part of the self-interest of morally concerned engineers.
- The collective power of a guild or union might prevent the vindictive firing of responsible whistleblowers
- It might also secure certain economic benefits, such as portable pensions, which would allow engineers a greater measure of freedom to act in the face of possible dismissal for whistle-blowing or for refusing to act unethically

CONFIDENTIALITY

- Keeping confidences is one of the most central and widely acknowledged duties of any profession
- Defence attorney must keep clients' information confidential, doctors and counsellors must keep information on their patients confidential and teachers must keep at least personal information about their students confidential
- So too employed engineers must keep privileged information about their companies and clients confidential

CONFIDENTIALITY

Definition

- The duty of confidentiality is the duty to keep secret all information deemed desirable to keep secret.
- Often this is understood to be any data concerning the company's business or technical processes that are not already public knowledge.
- Though vague, it clearly points to the employer or client as the main source of the decision as to what information is to be treated as confidential. "Keep secret" is a relational expression.
- It always makes sense to ask, "Secret with respect to whom?"
- In some government organizations, such as the Federal Bureau of Investigation (FBI) and Central Intelligence Agency (CIA), highly elaborate systems for classifying information have been developed that identify which individuals and groups may have access to what information.
- Within other governmental agencies and private companies, engineers and other employees are usually expected to withhold information labelled "confidential" from unauthorized people both inside and outside the organization.

CONFIDENTIALITY

- The second question, which concerns the criteria for identifying what information should be treated as confidential
- One criterion is suggested in the code of ethics of the Accrediting Board for Engineering and Technology.
  - "Engineers shall treat information coming to them in the course of their assignments as confidential"
- Some of the information acquired on assignments is routine and widely known.
- It may be knowledge about new company facilities or plans or familiarity of technical processes while working on a project
- Another criterion would identify any information that would cause harm to the corporation or client if made public.
- One would need the talents of a fortune-teller to know what information would produce that result.
- Most businesses tacitly adopt yet another criterion: Confidential information is any information which the employer would like to have kept secret in order to compete effectively against business rivals.
- Often this is understood to be any data concerning the company's business or technical processes which are not already public knowledge.

CONFIDENTIALITY

Related Terms

- Several related terms should be distinguished. Privileged information means “available only on the basis of special privilege,” as those accorded to an employee
- Proprietary information is information that a company owns or is the proprietor of
- A rough synonym for “proprietary information” is trade secret – be virtually any type of information that has not become public
- An employer has taken steps to keep secret, and which is thereby given limited legal protection in common law that forbids employees from divulging it.

CONFIDENTIALITY

Related Terms

- Patents legally protect specific products (17 years) from being manufactured and sold by competitors without the express permission of the patent holder.
- Trade secrets don't have such protection, and a corporation can learn about a competitor's trade secrets through legal means – for instance, "reverse engineering – unknown design or process traced out by analyzing the final product.
- Patents do have the drawback of being public allowing competitors to work around them by finding alternative designs.

CONFIDENTIALITY

Justification and Limits

- Upon what moral basis does the confidentiality obligation rest, with its scope and obvious importance?
- Specifically, why are employers allowed to determine what information is to he treated as confidential?
- And what are the moral limits or restrictions on the confidentiality obligations of employees?
- Obligations of confidentiality can be justified at two levels
- At the first level they appeal to three ordinary moral considerations:

Respect for autonomy:

- *Recognizing the legitimate control* over private information (individuals or corporations).
- This control is required *to maintain their privacy* and protect their self-interest.

Respect for Promise

- Respecting promises in terms of employment contracts not to divulge certain information considered sensitive by the employer

Regard for public well being

- Only when there is a confidence that the physician will not reveal information, the patient will have the trust to confide in him.
- Similarly only when companies maintain some degree of confidentiality concerning their products, the benefits of competitiveness within a free market are promoted.

CONFIDENTIALITY

Second level of justification of the confidentiality obligation is to appeal directly to the major ethical theories

- **Rights ethicists** justify employees' confidentiality obligation by appealing to basic human rights: the right of employers to establish what information should he treated as confidential will be limited by other legitimate moral rights.
- Minimally, no employer has a right to prevent engineers from blowing the whistle in cases where public knowledge of information would save human lives and thereby protect the rights of people
- **Duty ethicists** will emphasize the basic duties of both employers and employees to maintain the trust placed in them at the time they committed themselves to all agreement
- This commitment is understood to extend beyond the time of actual employment.
- Other general duties can be overridden by others, such as the duty to protect innocent lives, that might occasionally require whistle-blowing.

CONFIDENTIALITY

Changing Jobs

- The obligation to protect confidential information does not cease when employees change jobs.
- If it did, it would be impossible to protect such information.
- Former employees would quickly divulge it to their new employers or, perhaps for a price, sell it to competitors of their former employers.
- Thus, the relationship of trust between employer and employee in regard to confidentiality continues beyond the formal period of employment.
- Unless the employer gives consent, former employees are barred indefinitely from revealing trade secrets.
- This provides a clear illustration of the way in which the professional integrity of engineers involves much more than mere loyalty to one's present employer.
- Yet thorny problems arise in this area as many engineers value professional advancement more than long-term ties with any one company, and so they change jobs frequently.

CONFIDENTIALITY

- Engineers in research and development are especially likely to have high rates of turnover and they are most likely to be exposed to important new trade secrets.
- When they transfer into new companies they often do the same kind of work as before— precisely the type of situation in which trade secrets of their old companies may have relevance, a fact that could have strongly contributed to their having readily found new employment.
- A high-profile case of trade secret violations was settled in January 1997 (without coming to trial) when Volkswagen AG (VW) agreed to pay General Motors Corporation (GM) and its German subsidiary Adam Opel $100 million in cash and to buy $1 billion in parts from GM over the next seven years.
- Why? Because in March 1993, Jose Ignacio Lopez, GM's highly effective manufacturing expert, left GM to join VW, a fierce competitor in Europe, and took with him not only three colleagues and knowhow, but also copies of confidential GM documents.
- A more legally important case concerned Donald Wohlgemuth, a chemical engineer once a manager of B.F. Goodrich's space suit division.

CONFIDENTIALITY

- Dissatisfied with his salary and the research facilities at B.F. Goodrich, Wohlgemuth negotiated a new job with International Latex Corporation as manager of engineering for industrial products.
- International Latex had just received a large government subcontract for developing the Apollo astronauts' space suits, and that was one of the programs Wohlgemuth would manage.
- The confidentiality obligation forbid Wohlgemuth from revealing any trade secrets of Goodrich to his new employer.
- This was easier said than done. Of course it is possible for employees in his situation to refrain from explicitly stating processes, formulas, and material specifications.
- Yet in exercising their general skills and knowledge, it is virtually inevitable that some unintended "leaks" will occur.
- An engineer's knowledge base generates an intuitive sense of what designs will or will not work, and trade secrets form part of this knowledge base.
- To fully protect the secrets of an old employer on a new job would thus virtually require that part of the engineer's brain be removed.

CONFIDENTIALITY

- Is it perhaps unethical, then, for employees to change jobs in cases where unintentional revelations of confidential information are a possibility?
- Some companies have contended that it is.
- Goodrich, for example, charged Wohlgemuth with being unethical in taking the job with International Latex.
- Goodrich also went to court seeking a restraining order to prevent him from working for International Latex or any other company that developed space suits.
- The Ohio Court of Appeals refused to issue such an order, although it did issue an injunction prohibiting Wohlgemuth from revealing any Goodrich trade secrets.
- Their reasoning was that although Goodrich had a right to have trade secrets kept confidential, it had to be balanced against Wohlgemuth's personal right to seek career advancement.

Conflict of Interest

- A person may have different types of interests.
- Such interests can be pursued according to the will, convenience and the laws prevailing.
- A person working in an organization might have multiple interests related to the job he is doing; if he does some side business which means he might be a competitor or he might work with a competitor, it might pose a problem for the employer. Such an employee is usually fired from the organization.

Conflict of Interest

- Thus, we can refine our definition of **conflicts of interest** by saying that they typically arise when the following two conditions are met –
  - The professional is in a relationship or role that requires exercising good judgment on behalf of the interests of an employer or client.
  - The professional has some additional or side interest that could threaten good judgment in serving the interests of the employer or client.

Conflict of Interest

- **Dilemma**
- There occurs a usual dilemma between **conflicts of interest** and **conflicting interests**. To get a clear understanding between both, let us consider two examples.
- **Example 1**
- Let us consider a girl who needs to choose from among her interests in order to fit in her timetable. She wants to attend the exam in college, to attend the music class, to go out for a movie, to deliver a seminar and also go visit her friend. As she is falling short of time, it is her interest to choose what to do and what not. The term used to mention this can be "**Conflicting interests**" and this cannot be morally wrong.

Conflict of Interest

- **Example 2**
- If another instance is considered where a man works for a company, being in some crucial position where he has access to all the confidential information and if he works as an unofficial adviser to his wife's company, it would be morally wrong, where a moral conflict definitely arises. This can be termed as "**Conflict in interests**".
- Hence, the two concepts are different.

Conflict of Interest – Gifts Bribes

- There arise very subtle situations with various conflicts of interests. Let us see the most common ones –
- **Gifts, bribes and kickbacks**
- The following definitions will help us understand this –
- A **bribe** is a substantial amount of money or goods offered beyond a stated business contract with the aim of winning an advantage in gaining or keeping the contract and where the advantage is unfair or otherwise unethical.
- **Gifts** can be small gratuities offered in the normal conduct of business.
- Prearranged payments made by contractors to companies or their representatives in exchange for contracts actually granted are called **Kickbacks**.

Conflict of Interest – Gifts Bribes

- At times, if the money or gifts offered are substantial enough to threaten the fairness of competitive situations, then such gifts turn out to be bribes. They cannot be accepted as simple gratuities. Hence there is a thumb rule stating such condition as, “If the offer or acceptance of a particular gift could have embarrassing consequences for your company if made public, then do not accept the gift”.

Conflict of Interest - Interest in other companies

- **Interest in other companies**
- An Employee while working in his company, if supports another company, during his leisure time to earn more or for some other career aspects, can be understood as committing an immoral act.
  - Such an act is called **Moonlighting** which usually creates conflicts of interests. Instances creating such conflicts can be working for competitors, suppliers or customers.

Conflict of Interest - Interest in other companies

- The want of additional income or the need for personal and professional growth might foster one to pursue such ideas, which usually creates problems. A special kind of conflict of interest arises, however, when moonlighting leaves one exhausted and thereby harms the job performance.

Conflict of Interest - Insider information

- The insider information might concern one's own company or another company with which one does business. Leakage of the information for the interest of some other benefits is like digging one's own pit.
- The interest in other's companies makes a person morally low and lets him to go beyond moral boundaries and this might create an impact on the confidentiality for the reception of special privileges.

Conflict of Interest - Insider information

- When a person crosses his moral grounds, even the beneficiaries stop trusting him further.

- **Employee conflicts of interest occur when employees have interests that if pursued can keep them from meeting their obligations to serve the interests of the employer or client for whom they work.**

Occupational Crime

- Occupational crimes are illegal acts made possible through one's lawful employment.
- It is the secretive violation of laws regulating work activities.
- When committed by office workers or professionals, occupational crime is called "white collar crime".
  - Theft
  - Industrial Espionage
  - Price fixing
  - Endangering lives

Occupational Crime

- **People Committing Occupational Crimes**
- Usually have high standard of education
- From a non-criminal family background
- Middle class male around 27 years of age (70% of the time) with no previous crime history
- No involvement in drug or alcohol abuse
- Those who had troublesome life experience in the childhood
- People without firm principles

Employee Rights

- The basic rights of engineers include the right to live freely and pursue their legitimate interests as any human being, along with the right to be against racial or sexual discrimination, receiving one's salary according to the work, choosing of political activities, etc., as other employees.
- Besides all of them, engineers have some special rights as professionals.

Employee Rights - Professional

- The rights that engineers have as professionals are called Professional Rights. These professional rights include –
  - The basic right of professional conscience.
  - The right of conscientious refusal.
  - The right of professional recognition.

Right of Professional Conscience

- This is a basic right which explains that the decisions taken while carrying on with the duty, where they are taken in moral and ethical manner, cannot be opposed.
- The right of professional conscience is the moral right to exercise professional judgment in pursuing professional responsibilities.
- It requires autonomous moral judgment in trying to uncover the most morally reasonable courses of action, and the correct courses of action are not always obvious.

Right of Professional Conscience

- There are two general ways to justify the basic right of professional conscience.
  - The exercise of moral reflection and conscience that justifies professional duties is necessary, with respect to that duty.
  - The general duties to respect persons and rule-utilitarianism would accent the public good of allowing engineers to pursue their professional duties.

Right of Conscientious Refusal

- The right of conscientious refusal is the right to refuse to engage in unethical behavior. This can be done solely because it feels unethical to the doer. This action might bring conflicts within the authority-based relationships.
- The two main situations to be considered here are –
  - When it is already stated that certain act is unethical in a widely shared agreement among all the employees.
  - When there occurs disagreement among considerable number of people whether the act is unethical.
- Hence it is understood that engineers and other professionals have a moral right to refuse the unethical acts such as bribery, forging documents, altering test results, lying, padding payrolls or coercing employees into acting by threatening, etc.

Right to Recognition

- An engineer has a right to the recognition of one's work and accomplishments. An engineer also has right to speak about the work one does by maintaining confidentiality and can receive external recognition. The right for internal recognition which includes patents, promotions, raises etc. along with a fair remuneration, are also a part of it.
- The fulfillment of right to recognition motivates the employee to be a trustful member of the organization, which also benefits the employer. This makes the employee morally bound which enhances the ethical nature to be abide by the professional ethics.

Employee Rights

- An employee right can be any right, moral or legal, that involves the status of being an employee. They involve some professional rights also, such as the right to be paid according to the salary mentioned in one's contract. Privacy and equal opportunity can be considered essential rights too.

Employee Rights - Privacy

- The right to privacy refers to the right of having a private life, off the job. It is the right to control the access to and the use of information about oneself.
- The examples of situations where the functions of employers conflict the rights of employees will be
  - when the job-related queries or any other tests conducted in a job, includes questions relating to personal life such as alcohol usage or sexual conduct.
  - The instances when a supervisor unlocks and checks the desk of his subordinate in his absence or
  - when the management questions about his likes, dislikes or posts on social media regarding his personal opinions where it has nothing to do with the company.
- Employers should view the relationship with their employees concerning confidentiality that cannot break the trust. The personal information in such cases is given based on the special professional relation and trust.

Employee Rights - Equal Opportunity Non-discrimination

- The demeaning of a person based on trivial factors such as one's sex, race, skin color, age or political or religious outlook can be understood as Discrimination. Such a discrimination should never be allowed at any workplace; this is where everyone has to be treated equally. These things internally affect the person's self-identity and self-respect which is pernicious within the work environment, where the work itself should represent a person's self-image.

Employee Rights - Equal Opportunity – Non-discrimination

- "It shall be unlawful employment practice for an employer to fail or refuse to hire or to discharge any individual, or otherwise to discriminate against any individual with respect to his compensation, terms, conditions, or privileges of employment, because of such individual's race, color, religion, sex or national origin".

Employee Rights - Equal Opportunity Sexual Harassment

- In today's world, there is an increase in the number of sexual harassment cases across the world. This is quiet an unfortunate scenario.
- There were a number of cases where the charges were levied since last two decades, which kept on growing. A definition of **Sexual harassment** is, "The unwanted imposition of sexual requirements in the context of a relationship of unequal power".
- Sexual harassment is a display of power and aggression through sexual means. It takes two forms, quid pro quo and hostile work environment.

Employee Rights - Equal Opportunity Sexual Harassment

- **Quid Pro Quo** includes cases where supervisors require sexual favors as a condition for some employment benefit (a job, promotion or raise). It can take the form of a sexual threat (of harm) or sexual offer (of a benefit in return for a benefit).
- **Hostile work Environment** by contrast, is any sexually oriented aspect of the workplace that threatens employee's rights to equal opportunity. It includes unwanted sexual proposals, lewd remarks, sexual leering, posting nude photos and inappropriate physical contact.

Employee Rights - Equal opportunity Affirmative Action

- Affirmative action refers to the preference given to a person or a group who was denied equal importance in the past. For example, the women and the minority communities were not given equal treatment and were ill-treated in the past. So to compensate that, amendments were made in recent laws to provide them special quota for reservations in education, employment and social sectors.

Employee Rights - Equal opportunity Affirmative Action

- These preferential treatments are made in order to compensate the previous ill-actions. Ideally such compensation should be given to those specific individuals who in the past were denied jobs.
- But the practical possibilities of such actions are limited. Sexism and racism still permeate in our society and to counterbalance their insidious impact reverse preferential treatment is warranted in order to ensure equal opportunity for minorities and women.

INTELLECTUAL PROPERTY RIGHTS

- Intellectual Property is a product of the human intellect that has commercial value
- Many of the rights of the ownership common to real and personal property are also common to Intellectual Property
- Intellectual Property can be bought, sold, and licensed
- Similarly it can be protected against theft and infringement by others

INTELLECTUAL PROPERTY RIGHTS

- Patent,
- Design,
- Trademark,
- Copyright form

TOTAL INTELLECTUAL PROPERTY

- **Patent**
- 1. Derived from the Latin word LITTERAE PATENTES which means **Open Letters** or **Open Documents** to confer rights and privileges.
- 2. A contract between an Inventor and the Government
- 3. An exclusive privilege monopoly right granted by the Government to the Inventor
- 4. Invention may be of an Industrial product or process of manufacture

- **Patent**
- 5. Invention should be new, non-obvious, useful and patentable as per Patents Act
- 6. The right to the inventor is for limited period of time and valid only within the territorial limits of a country of grant.
- Examples: a drug compound, a tool, maybe software effects

- **Design**
- Meant for beautifying an industrial product to attract the consumer public
- Shaping, Configuration or Ornamentation of a vendible Industrial product
- Exclusive **Design Rights** to the originator for a limited term
- Patents & design embrace the production stage of an industrial activity

- **Trademark**
- Trade Mark is a name or symbol adopted for identifying goods
- Public can identify from the Trade Mark from whom the product is emanating
- Trade Marks protection is given for an industrial product by the Government

- **Copyright**
- The right to original literary and artistic works
- Literary, written material
- Dramatic, musical or artistic works
- Films and audio-visual materials
- Sound recordings
- Computer Programmes/software
- SOME databases
- Example: Picasso's Guernica, Microsoft code, Lord of the Rings

- **Need For A Patent System**
- Encourages an inventor to disclose his invention
- Encourages R & D activities as the industries can make use of the technology, & avoids redundant research
- Provides reasonable assurance for commercialisation.
- Provides an inducement to invest capital in the new lines of production and thus , help for technical development and up gradation.
- One may get a very good return of income through Patent Right on the investment made in R & D.

- **Effect of Patent**
- A patentee gets the exclusive monopoly right against the public at large to use, sell or manufacture his patented device.
- A patentee can enforce his monopoly right against any infringement in the court of law for suitable damages or profit of account.
- The Government ensures full disclosure of the invention to the public for exchange of exclusive monopoly patent right to the inventor.

INTELLECTUAL PROPERTY RIGHTS

INTELLECTUAL PROPERTY RIGHTS

1. INTRODUCTION

Patent is one of the Industrial Property Rights which also comprises protection for Designs and Trade Marks of any product of the industry. Together with the Industrial Property, the right to literary and artistic works, being the Copyright, forms total Intellectual Property. Patents Act, 1970 as amended from time to time imparts the legal protection to Patent Rights.

i) Patent

The term has been derived from the Latin word "LITTERAE PATENTES" which means 'Open Letters' or 'an Open Document' which was used by medieval kings to confer rights and privileges. In the modern times, patent enunciates a contract between an inventor on the one hand and the Government on the other. Thus, a Patent is an exclusive privilege monopoly right granted by the Government to the inventor for his disclosed invention of an industrial product of process of manufacture which should be new, non-obvious, useful and patentable as per the patentability criteria laid down in the Patents Act.

ii) Design

A Design is meant for beautifying an industrial product to attract the consumer public. A new or original design, adopted for the purpose of shaping, configuration or ornamentation of a vendible industrial product is produced by the Government by registering the Design, thereby conferring upon the originator the exclusive Design Rights for a limited term. Thus, patents and designs embrace the production stage of an industrial activity.

iii) Trade Marks

In order to widen the horizon of industrial activity, Trade Marks Protection is given for an industrial product by the Government so that the public can identify as to from whom the product is emanating. Such name or symbol which is adopted for identifying goods is called a Trade Mark.

2. WHY DO WE NEED A PATENT SYSTEM?

i. Patent system encourages an inventor to disclose his invention instead of keeping it secret.

ii. In encourages R & D activities as the industries can make use of the technology disclosed in the Patent literature as a stepping-stone, avoiding thereby the redundant research - "you do not have to reinvent the wheel!"

iii. It provides reasonable assurance for commercialization by exploiting the invention on the basis of a Patent.

iv. It provides an inducement to invest capital in the new lines of production and, thus, provides immense help for technological development and upgradation.

v. One may get a very good return of income through Patent Right on the investment made in R&D.

3. WHAT IS A PATENT?

A Patent is an exclusive monopoly right granted by the Government for a new invention to an inventor for his disclosed invention for a limited period of time. This exclusive monopoly right is valid only within the territorial limits of a country of grant.

4. WHAT IS AN INVENTION?

For the purpose of grant of a patent, an invention is defined in the Patents Act, 1970 as:

Invention means a new product or process involving an inventive step and capable of Industrial application.

5. WHAT IS NOT PATENTABLE?

The following subject matter is not patentable under the Patents Act, 1970:-

i. An invention which is frivolous or claims anything obviously contrary to well established natural laws;

ii. An invention the primary or intended use or commercial exploitation of which could be contrary to public order or morality or which causes serious prejudice to human, animal or plant life or health or to the environment.

iii. A mere discovery of a scientific principle or the formulation of an abstract theory; [or discovery of any living thing or non-living substances occurring in nature.

iv. A mere discovery of any new property or new use for a known substance or of the mere use of a known process, machine or apparatus unless such known process results in a new product or employs at least one new reactant;

v. A substance obtained by a mere admixture resulting only in the aggregation of the properties of the components thereof or a process for producing such substance;

vi. A mere arrangement or rearrangement or duplication of known devices, each functioning independently or one another in a known way;

vii. A method of agriculture or horticulture;

viii. Any process for the medicinal, surgical, curative, prophylactic [diagnostic therapeutic] or other treatment of human beings or any process for a similar treatment of animals to render them free of disease or to increase their economic value or that of their products.

ix. Plants or animals in whole or any part thereof other than micro organisms but including seeds, varieties and species and essentially biological processes for production or propagation of plants and animals;

x. A mathematical or business method or a computer program per se or algorithms;

xi. A literary, dramatic, musical or artistic work or any other aesthetic creation whatsoever including cinematographic works and television productions;

xii. A mere scheme or rule or method of performing mental act or method of playing game.

xiii. A presentation of information.

xiv. Topography of integrated circuits.

xv. An invention which in effect, is traditional knowledge or which is an aggregation or duplication of known properties of traditionally known component or components.

xvi. Inventions relating to atomic energy.

In the case of inventions relating to substances prepared or product by chemical processes (including alloys, optical glass, semiconductors and intermetalic compounds) or claiming substances intended for use, or capable of being used, as drug, or as food, or as medicine, no patent will be granted in respect of claims for the substances themselves, but claims for the method or processes of manufacture only will be patentable. The meaning of the word "drug" here includes agro chemicals excluding fertilizers and manure.

However, as per the Patents (Amendment) Act, 1999, it is now possible to make an application for patent claiming for a substance itself, intended for use or capable of being used as a Medicine or Drug, excepting the intermediate for the preparation of drug. However, these applications for product claims for medicine or drug will be kept as "Mailbox Applications" and will not be processed until the end of 2004.

6. Effect of Patent

A Patentee gets the exclusive monopoly right against the public at large to use, sell or manufacture his patented device, apparatus or process or assign the same to others.

i. A Patentee can enforce his monopoly right against any infringement in the Court of Law for suitable damages or profit of account.

ii. The Government ensures full disclosure of the invention to the public for exchange of exclusive monopoly patent right to the inventor.

7. Advantages of Patents

i. Patent gives the protection to the Patentee, enabling him to enjoy the right and to raise the capital for working his invention on a commercial scale.

ii. In case, the Patentee is not able to work the invention commercially, he would be able to make a profitable use of his invention by selling his patent or by granting licence to others, permitting the use of his invention.

iii. Patent System helps for industrial growth by introducing new technologies.

iv. The scientific knowledge contained in the patent specification helps as a "stepping stone" for further research.

v. Patents provide inventive and creative ideas for further R&D in the field.

vi. Patent acts as tradable industrial asset for the enterprise and, thus the strength of patent portfolio of the company is the indication of the good economic health of the company.

vii. After the term of patent is over, or patent is not kept in force, the patented invention is available to the public for free use.

PATENT INFORMATION AND SERVICES BY PATENT OFFICE

PATENT INFORMATION AND SERVICES BY PATENT OFFICE

1. PATENT INFORMATION AND ITS ADVANTAGES

Every Patent Officer throughout the world publishes the patent literature in some or the other form, which can be approached for variety of advantages. The information what one gets from the patent document is called Patent Information.

The advantages of the patent information are :

i. Patent Information source is enormous and wide.

ii. 80% of the information is first published only in the patent documents and not elsewhere.

iii. The patent information is well classified according to the International Patent Classification System to enable easy approach and use.

iv. The Patent information can be used for further research as a stepping stone.

v. The Patent information is free to be utilized after the term of the Patent expires or when the patent ceases to be in force.

vi. Patent Information plays a pivotal role in Technology Transfer.

2. AVAILABILITY OF PATENT INFORMATION

a) Forms of storage and retrieval of patent information :

The patent information is available in various media like

i. Traditional printed and copy form i.e. paper copies from Patent Office.

ii. Micro film (From PIS, Nagpur)

iii. On-line availability - Indian Patent Office Website "patentoffice.nic.in" wherefrom the public can access the details about Patents and Designs, the Application Forms and details about the Patent Procedures and Patent Office.

iv. CD ROM – Various types of CD-ROMs provide Patent Information regularly, which is updated regularly.

v. Patent Information throughout the world is available in both abridged and detailed version on various websites (e.g. uspto.gov.com etc.) and also in CD-ROM forms.

b) Who can provide Patent information?

i. The Patent Office and its Branches in India.

ii. The Patent Information System at Nagpur

iii. The Patent Inspection Centres established u/s 152 of the Patents Act, 1970 throughout India.

iv. WIPO Patent Information Services for developing countries.

v. Patent Information Services of various Patent Offices throughout the world like EPO, USPTO etc.

c) Various Storage Tools facilities available from the Patent Office :

i. The Search Files containing the printed specifications of the earlier granted patents in Hard Copy form are classified according to the Indian and International Patent Classification.

ii. Abridgements / Abstracts classified according to the International Patent Classification Systems.

iii. Extraordinary Gazette of India, Part III, Section 2, exclusively for the Patent Office, publishes the information regarding the filing and grant of Patent.

iv. The Subject Matter Index (Serial Files) classified according to the Indian Classification System.

v. Name Index List.

3) PRACAUTIONS TO BE TAKEN BY APPLICANTS

a) Before Grant of Patent

i. Do no publish the invention before anything for a Patent protection.

ii. Before you start working on a problem, consult the Patent Literature in respect of the particular field of industry to which the problem relates which would save wastage of time and money and

iii. Go through the Patent Search Files to enable you to be familiar with the intricacies of Patent Practice and to draft good Patent Specification.

iv. Decide the question of securing foreign patents before it is too late to apply for such a patent.

v. Prosecute your patent application within the time limits prescribed at various stages of the application processing.

vi. Look upon the objections raised by the Patent Office as constructive criticism offered to you for your own benefit, so that the Patent that might be granted to you could be a valid Patent.

b) After the Grant of Patent, which you become a Patentee

i. Do not fail to pay the Renewal Fee in time.

ii. Try to work on the Patent, exploiting the invention commercially or else, grant licence to a person, who has well equipped infrastructure to manufacture the patented product.

iii. Keep yourself in touch with the industrial progress by referring to the Patent Office Gazette and other publication, wherever necessary. This will be helpful for keeping you updated with the latest scientific and technological progress and provide guidance to perform new invention as advance steps to your earlier inventions.

SEARCHABLE DATABASES

HOSTED BY OTHER PATENT AND INTELLECTUAL PROPERTY OFFICES

Country/Organization	Websites
India	www.patentoffice.nic.in
India	www.ipindia.nic.in
Australia	http://www.ipaustralia.gov.au/services/S_srch.htm

Brazil	http://www.inpi.gov.br./pseq_patentes/patentes.htm
Canada	http://patents1.ic.gc.ca/intro-e.html (Patents)
	http://strategies.ic.gc.ca/cgi-bin/sc_consu/trade-marks/search e.pl (Marks)
Depatisnet	www.depatisnet.de
European Patent Office	http://www.european-patent-office.org/espacenet/info/access.htm
France	http://www.inpi.fr/brevet/html/rechbrev.htm
Germany	http://www.dpma.de/suche/suche.html
Hungary	http://www.htp.hu/English/db/
Japan	http://www.ipdl.jpo-miti.go.jp/homepg_e.ipdl
Korea	http://www.kipo.go.kr/ehtml/eLikIndex05.html
Latin America	http://www.oepm.es/bases-documentales/latipat_sp? ACTION=RETOUR
New Zealand	http://www.iponz.govt.nz/search/cad/dbssiten.main
OHIM	http://oami.eu.int/search/trademark/la/en_tm_search.cfm
Poland	http://www.arsinfo.pl/arspatent/a_info.html
Romania	http://193.230.133.4/cgi-bin/invsearch
Russian Federation	http://ww.fips.ru/ensite/
Span	http://www.oepm.es/bases-documentales/oepmpat_sp?ACTIO=RETOUR
Thailand	http://www.ipic.moc.go.th/
Trilateral Database	http://uspto.gov/web/tws.sh.htm
United Kingdom	http://www.patent.gov.uk/patent/dbase/index.htm
United States of America	http://www.uspto.gov/patft/index.html(Patents)
	http://tess.uspto.gov/bin/gate.exe?f=login&p_land=english&p_d=trmk (Marks)

Engineering Ethics – Global Issues
UNIT V

Dr. N. Karunakaran

The global issues concerning Engineering Ethics

- The concept of globalization increases with the integration of nations through trade, investment, transfer of technology and exchange of ideas and culture.
- So far as the engineers and companies are concerned, the Multinational Companies play crucial roles in promoting globalization.

Multinational Companies

- International Labor Organization (ILO) defines it as
- Multinational Companies, also called Transnational Companies are the companies that have a main branch in a country called the **Home country** and its other branches in different countries called the **Host countries.**
- Multinational Corporations can have a powerful influence in local economies, and even the world economy, and play an important role in enhancing international relations and globalization.

Multinational Companies

- These MNCs also get tax benefits, pledges of governmental assistance or improved infrastructure or lax environmental and labor standards enforcement as they help in increasing the national GDP.
- MNCs should produce high degree of operational efficiency pertaining to high standards in the jurisdiction of the place where they are. The wages, safety measures, employee benefits all should be taken care of by the MNCs.
- There have been instances of corporate and government confrontations when governments tried to force MNCs to make their intellectual property public in an effort to gain technology for local entrepreneurs.

Multinational Companies

- Such an idea paves way for conflicts where either the government has changed its rules or the companies have withdrawn their investments. Multinational corporate lobbying is directed at a range of business concerns, from tariff structures to environmental regulations. The threat of nationalization or changes in local business laws and regulations can limit a MNCs power.

International Rights

- "Be a Roman in Rome" – Adaptability

- Apartheid in South Africa

- International Rights
  - Proposed by Donaldson – 10 Rights

International Rights

1. **Freedom of physical movement**

   Should not chain workers to machines or lock them inside sweat shops

2. **Ownership of property**
3. **Freedom from torture**
4. **Fair trial**

International Rights

5. **Non-discrimination**

   a. By race, sex, caste, family affiliation

   b. Can't go along with nepotism common in many countries?

6. **Physical security**

   E..g., provide protective goggles, even if local law doesn't require it; to not do so is to violate rights even though didn't inflict injury directly

7. **Freedom of speech and association**

   a. Corporation obligated not to prevent emergence of **labor unions** by coercive tactics

   b. Refrain from lobbying host government for restrictions that violate this right

   c. Perhaps protest host governments practices that do this

International Rights

8. **Minimal education**

   a. MNC not entitled to hire a 10 year old child for full time work

   b. For among other reasons, this blocks child's ability to receive a minimally decent education

   c. Any MNC action that blocks child's ability to read/write, violates this right of hers

9. **Political participation**

   a. In 1950s, MNC helped overthrow regime in Honduras

   b. Corps that support dictatorships in countries with growing democracies

   c. Corp that bribe public officials:

      i. Lockheed bribed prime minster of Japan for $7 million to get a jet contract; undermines democratic system

      ii. Not an objection to payments generally

   d. Foreign ownership of property at some point violates right to national self-determination; e.g., owning major segments of land and industry

International Rights

10. **Subsistence**

a. Example of MNC violating this right

i. Buying land can contribute to starvation

ii. MNC goes to a country where malnutrition is rampant

iii. Buys parcel of land that used to be farmed by sharecroppers who were given a portion of the crops by the land owner

iv. Converts the land from black beans to coffee; stable local food source to cash crop for export

v. Result is local folks are malnourished

vi. MNC violated the right to adequate food

Business Ethics

- Ethics are the set of rules of conduct that the concerning persons need to abide by.
- These ethics when related to the field of business, are called Business Ethics.
- Business ethics are similar to professional ethics. Business ethics are related to the aspects of business dealing with all employees in an ethical manner.

Business Ethics

- An organization is expected to follow certain ethical values in its functioning, establishment, employee welfare, operations, environmental factors, waste management and the issues related to the people living around, etc.
- These factors affect the reputation of the company and indirectly affect the value of its shares in the global market.
- The main principles of admirable business ethics can be - being trustful, open minded, meeting obligations, having the documents clear with good accounting control, etc.

Business Ethics

- The general business ethics include the following aspects –
  - Be it any industry or a corporate office, the infrastructure and the working environment should be comfortable and encouraging.
  - The safety precautions and maintenance of the organization are to be taken care of.
  - The work and the skills of the employees are to be identified and encouraged for the development of the organization.

Business Ethics

- A hierarchical procedure is to be followed, maintaining the ethical standards for the execution of work.
- The product maintenance right from the procurement raw material to the dispatch of product should be done in a standard procedure uninfluenced by any unethical issues.
- No tolerance should be there for any kind of unethical behavior or influences that affect the production and organizational standards.
- To encourage the activities that promote social good and are environment-friendly.

Environmental Ethics

- Globalization and industrialization have impacted the environment on a very large scale. The long term effects of the environment are usually neglected unless it is gross and immediate effect.

Environmental Ethics

- We are getting habituated to the ill-effects of pollution and industrial negligence shows on our environment.
- The aftermath can be seen in acid rains, water and land contamination, effect on crops and food sources, the cattle getting affected, the drying of lakes and canals, floods, drought, tsunamis and earthquakes due to drilling of underground wealth, the effect on marine being, the effect on ozone and the melting of snow mountains due to global warming, etc.
- The aftermath can be an alarming call for the required environmental changes.

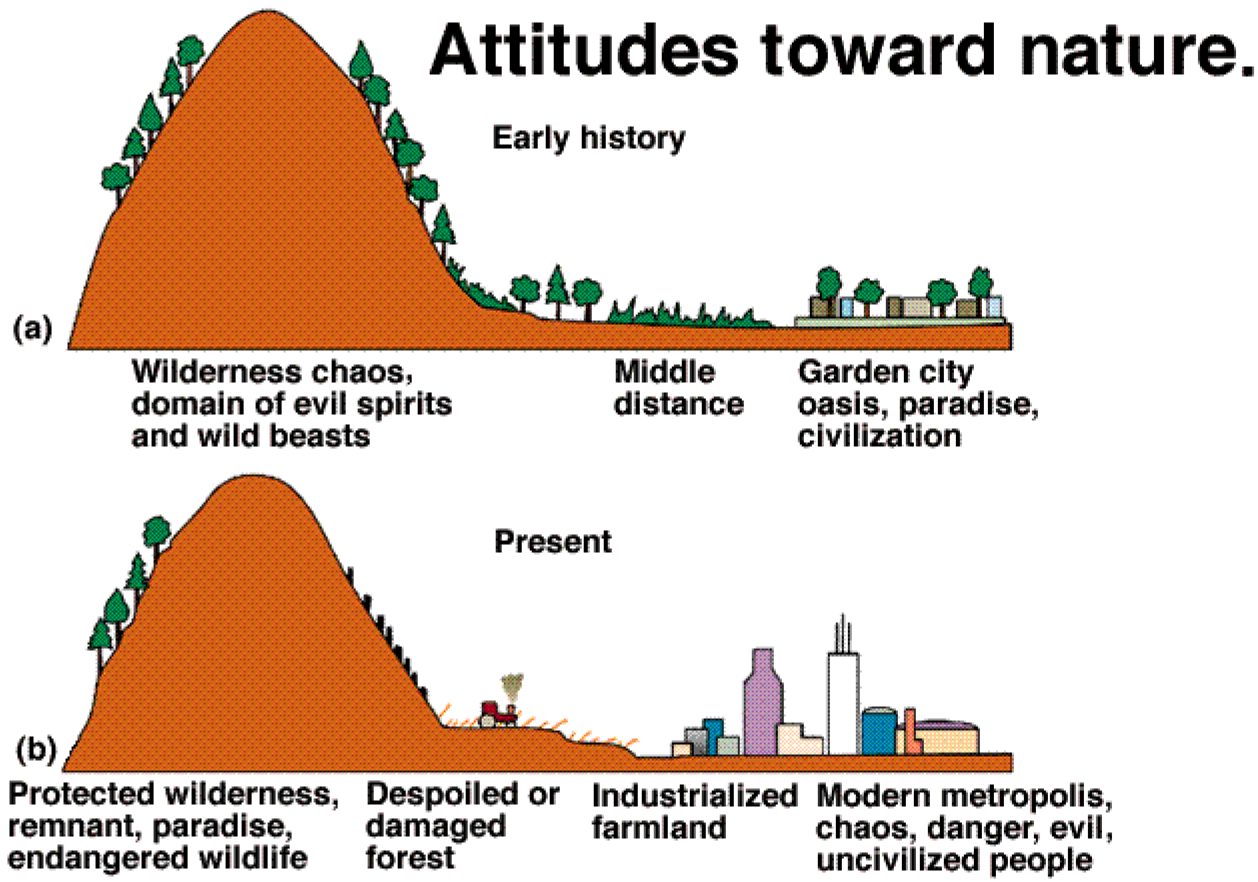
Environmental Ethics

- Engineers need to show some responsibility towards the environment and should be ethical in their approach and find mitigating solutions for the protection of environment. Organizations should support the activities that promote environment protection. The **environment ethics** include −
  - The study of moral issues concerning the environment
  - Moral perspectives, beliefs and attitudes concerning those issues.

Environmental Ethics

- In addition to global warming, environmental challenges confront us at every turn, including myriad forms of pollution, human-population growth, extinction of species, destruction of ecosystems, depletion of natural resources, and nuclear waste.
- Today there is a wide consensus that we need concerted environmental responses that combine economic realism with ecological awareness.

Environmental Ethics - Engineering Ecology and Economics



Environmental Ethics - Engineering Ecology and Economics

- Two powerful metaphors have dominated thinking about the environment: the invisible hand and the tragedy of the commons.
- The first metaphor was set forth by Adam Smith in 1776 in The Wealth of Nations, the founding text of modern economics. Smith conceived of an invisible (and divine) hand governing the Market place in a seemingly paradoxical manner.

Environmental Ethics - Engineering Ecology and Economics

- According to Smith,
- Businesspersons think only of their own self-interest: "It is not from the benevolence of the butcher, the brewer, or the baker, that we expect our dinner, but from their regard to their own interest". Yet, although "he intends only his own gain" he is "led by an invisible hand to promote an end which was no part of his intention".
- By pursuing his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.

Environmental Ethics - Engineering Ecology and Economics

- Professionals and many businesspersons do profess to "trade for the public good" claiming a commitment to hold paramount the safety, health, and welfare of the public.
- Although they are predominantly motivated by self-interest, they also have genuine moral concern for others.
- Nevertheless, Smith's metaphor of the invisible hand contains a large element of truth.
- Despite its large element of truth, the invisible hand metaphor does not adequately take account of damage to the environment.
- Writing in the eighteenth century, with its seemingly infinite natural resources, Adam Smith could not have foreseen the cumulative impact of expanding populations, unregulated capitalism, and market "externalities"

Environmental Ethics - Engineering Ecology and Economics

- Regarding the environment, most of these are negative externalities "pollution, destruction of natural habitats, depletion of shared resources, and other unintended and often unappreciated damage to "common" resources.
- This damage is the topic of the second metaphor, which is rooted in Aristotle's observation that we tend to be thoughtless about things we do not own individually and which seem to be in unlimited supply.
- William Foster Lloyd was also an astute observer of this phenomenon.

Environmental Ethics - Engineering Ecology and Economics

- In 1833 he described what the ecologist Garrett Hardin would later call "the tragedy of the commons".
- Lloyd observed that cattle in the common pasture of a village were more stunted than those kept on private land. The common fields were themselves more worn than private pastures.
- His explanation began with the premise that individual farmers are understandably motivated by self-interest to enlarge their common-pasture herd by one or two cows, especially given that each act taken by itself does negligible damage.
- Yet, when all the farmers behave this way, in the absence of laws constraining them, the result is the tragedy of overgrazing that harms everyone.

COMPUTER ETHICS

- Computers have become the technological backbone of society. Their degree of complexity, range of applications, and sheer numbers continue to increase.
- Through telecommunication networks they span the globe. Yet electronic computers are still only a few decades old, and it is difficult to foresee all the moral issues that will eventually surround them.
- The present state of computers is sometimes compared to that of the automobile in the early part of this century. At that time the impact of cars on work and leisure patterns, pollution, energy consumption, and sexual mores was largely unimagined.

COMPUTER ETHICS

- If anything, it is more difficult to envisage the eventual impact of computers because they are not limited to any one primary area of use as is a car's function in transportation.
- It is already clear, however, that computers raise a host of difficult moral issues, many of them connected with basic moral concerns such as free speech, privacy, respect for property, informed consent, and harm.
- To evaluate and deal with these issues, a new area of applied ethics called computer ethics has sprung up.

COMPUTER ETHICS

- Computer ethics has special importance for the new groups of professionals emerging with computer technology, for example, designers of computers, programmers, systems analysts, and operators.
- To the extent that engineers design, manufacture, and apply computers, computer ethics is a branch of engineering ethics.
- But the many professionals who use and control computers share the responsibility for their applications.

COMPUTER ETHICS

- Some of the issues in computer ethics concern shifts in power relationships resulting from the new capacities of computers.
- Other issues concern property, and still others are about invasions of privacy. All these issues may involve "computer abuse": unethical or illegal conduct in which computers play a central role (whether as instruments or objects).

COMPUTER ETHICS

- The Internet and Free Speech:
- The Internet has magnified all issues in computer ethics. The most powerful communication technology ever developed, and a technology used daily by hundreds of millions of people, the Internet gained widespread use only during the 1990s.
- Its modest beginning, or forerunner, came from a simple idea of J. C. R. Licklider

COMPUTER ETHICS

- Licklider was a psychologist who had wide interests in the newly emerging computer technology.
- In 1960 he conceived of a human computer symbiosis in which the powers of humans and computers were mutually enhancing.
- The breadth of his vision, together with his administrative skills, led to his appointment a few years later as the director of the Advanced Research Projects Agency (ARPA) of the U.S. Department of Defence.

COMPUTER ETHICS

- He quickly saw that the variety of computer-involved military projects was becoming a Tower of Babel, and he wrote a revolutionary memo calling for a move toward a unified communication system.
- In 1969, ARPA funded projects in universities and corporations that created an ARPA network, or ARPANET.

COMPUTER ETHICS

- In the 1980s, some universities developed their own communications networks, and their eventual merging with ARPANET became the Internet, which is now a global network of networks, initially using the infrastructure of the telephone system and now carried by many telecommunication systems by wire, fibre, or wireless systems.
- The World Wide Web (Web), which is a service run on the Internet, emerged from the Hypertext Mark-up Language and transfer protocol developed at the European particle physics lab and is used in a multimedia format of text, pictures, sound, and video.
- During the early 1990s, the Web was opened to business, e-mail, and other uses that continue to expand.

COMPUTER ETHICS

- It is now clear to all that the Internet provides a wellspring of new ways to be in contact with other people and with sources of information.
- It has also created greater convenience in ordering consumer items, paying bills, and trading stocks and bonds.
- Like other major "social experiments," it also has raised a host of new issues.
- One set of issues centres on free speech, including control of obscene forms of pornography, hate speech, spam (unwanted commercial speech), and libel.

COMPUTER ETHICS

- In a wide sense, pornography is sexually explicit material intended primarily for sexual purposes (as distinct, say, from medical education).
- Obscene pornography is pornography that is immoral or illegal in many countries, and is not protected in many countries.

COMPUTER ETHICS

- The ten commandments of Computer Ethics, created in 1992 by the Computer Ethics Institute consists of the following
- One should **never** use a computer –
- To harm the people (anti-social activities)
- To interfere with other's work (illegal manipulations)
- To snoop into other's files (malware)
- To steal a computer/data (hacking)

COMPUTER ETHICS

- To bear false witness (manipulation and morphing)
- To use/ copy a software you didn't pay for (like illegal downloads and usages)
- To use or copy other's software without compensations (illegal pirated versions)
- To use other's intellectual output inappropriately (violating IPR)
- Doing without thinking of social consequences of the program being written (libeling)
- Always use a computer ensuring consideration and respect towards fellow beings.

Weapons Development

- Historically, a quick death in battle by sword was considered acceptable, whereas the use of remote weapons (from bow and arrow to firearms) was frequently decried as cowardly, devoid of valour, and tantamount to plain murder.
- As modern weapons of war progressed through catapults, cannons, machine guns, and bombs released from airplanes and missiles to reach further and further, the soldiers firing them were less likely to see the individual human beings - soldiers as well as civilians - they had as their general target.

Weapons Development

- The continuing automation of the battle scene tends to conceal the horrors of war and thus makes military activity seem less threatening and high-tech wars more appealing.
- How might the men and women who design weapons, manufacture them, and use them feel about their work?
- For some engineers, involvement in weapons development conflicts with personal conscience; for others, it is an expression of conscientious participation in national defense.

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Weapons Development

- Based on the size of expenditures, direct or indirect involvement of engineers and innovative developments, military technology is an area that calls for serious discussion on engineering ethics.
- For some engineers, their involvement with weapons development conflicts with personal conscience, such as knowing that making weapons in a company, is the job which would be done by someone else if he doesn't do and that cannot change the results.

Weapons Development

- Though working in a toxic chemical manufacturing plant can make you feel guilty, the idea abolishing this disastrous thing once you become the CEO of the company, makes you get the feeling of being in good books, though you might or might not do that when the time comes.
- There can also be instances where an engineer can feel that the development of weapons is an expression of conscientious participation in national defense.

Weapons Development

- An engineer who is a specialist in missile control and guidance, can feel proud that he is being able to help his country through his efforts in the defense industry, especially as part of the "War on terrorism"
- In a broader context, weapons include anything used to gain an advantage over an adversary or to place them at a disadvantage. Examples include the use of sieges, tactics, and psychological weapons which reduce the morale of an enemy.

Engineers as Managers

- An engineer, whether he works individually or works for a company, has to go through some ethical issues, mostly under conditions such as, conceptualization of a product, issues arising in design and testing departments, or may be on the issues involving the manufacturing, sales and services.
- An Engineer is responsible in promoting ethics in an organization, through framing organizational policies, responsibilities and by personal attitudes and obligations.

Engineers as Managers

- Suppose, an issue occurs which might lead to a conflict, an engineer or say a professional should respond pertaining to specific morals and professional ethics.
- An engineer should be able to work as a manager in such situations, resolving conflicts according to priorities, keeping the organizational benefits in mind.
- The issue must be resolved without hurting anyone's feelings and by developing a mutual understanding with subtlety.
- Not only the engineers who act as managers or the managers alone will share the responsibility, but there lies some social responsibility to stakeholders, customers and employers of a company.

Engineers as Managers

- They act to develop wealth as well as the welfare of the society.
- Ethicists project the view that the manager's responsibility is only to increase the profit of the organization, and only the engineers have the responsibility to protect the safety, health, and welfare of the public.
- But the manager, though an engineer or not, has the ethical responsibility to produce safe and good products (or useful service), while showing respect for fellow human beings including his employees, customers and the public.
- Hence, the objective for the managers and engineers is to produce valuable products that are also profitable.

Engineers as Managers

- Conflict Resolution
- A conflict is a result of differences in opinions. Conflicts generally arise where the work is shared among more than one members. In fact, the situations of conflicts should be tolerated with patience, understood impartially and resolved by the participation by all the concerned.

Engineers as Managers

- When a project is distributed among a few members, the conflicts that generally occur are −
  - The schedule based conflicts might occur at different levels of execution of a project, depending upon the priorities and limitations at each level.
  - The prioritizing of projects or departments which can be arrived from end requirements may change from time to time.
  - The deficiency of personnel availability for certain project completion in due time may also lead to a conflict.
  - Conflicts that occur over technical, economic, and time factors such as cost, time, and performance level.

Engineers as Managers

  - Conflict arising in administration such as authority, responsibility, accountability, and logistics required.
  - Conflicts of personality, human psychology and ego problems.
  - Conflict over expenditure and its deviations.
- Picking out on the personnel creating may keep others away from the problem and doesn't affect everyone.
- Such personnel can be trained again or given precautions.
- The interest of the personnel doing a project should be focused on the ethical attitudes and morals but not on their positions. In addition, the conflicts between the personnel, can be solved by the manager who has more ways to solve it.
- The evaluation of the results should be based on certain specified objectives such as efficiency, quality, and customer satisfaction.

Consulting Engineers

- The consulting engineers differ from the salaried engineers of an organization. These consulting engineers work in private and are paid per advice they offer or for the service they provide in a field of specialized knowledge or training. Consultants are individuals who typically work for themselves but may also be associated with a consulting firm.

Consulting Engineers

- Consultants can play a multi-faceted role; for example, they function as advisors, fixers, bosses, generalists, stabilizers, listeners, advisors, specialists, catalysts, managers or quasi-employees.
- Bringing in an expert can save time, effort and money. It has been estimated that approximately 3/4 of all companies call upon consultants at one time or another. Many companies claim that they receive a higher return for their invested dollars by using consultants for specific tasks.

Consulting Engineers

- A Consulting Engineer should maintain the ethical values in the profession, such as giving proper information without any ambiguities for advertisements, the allowance of small individual companies to participate in bidding and also maintaining clarity in the contingency fee which is previously agreed.
- The greater amount of job freedom enjoyed by consulting engineers as opposed to salaried engineers leads to wider areas of responsible decision making concerning safety.

Engineers as Advisors

- Engineers may accept an assignment requiring education and/or experience outside of their own fields of competence, but their services shall be restricted to other phases of the project in which they are qualified. All other phases of such project shall be performed by qualified associates, consultants, or employees.

Engineers as Advisors

- For an engineer to be an advisor, should study the costs and benefits of all alternatives in objective manner, study economic viability, technical feasibility, operational feasibility and social acceptability, follow honesty, and technical complicity leading to moral complicity.
- Then after analyzing the factors that lead to such things and also the consequences that occur, engineers can work as an advisor.

Engineers as Advisors

- There may be various roles or models played by engineers who work as advisors. Let us now see what the roles or models are
- **Hired Guns**
  - This model highlights the client's wishes and acts accordingly. All the other factors are given less priority. Assumptions about uncertainties are inclined in a direction favorable to the client's case.
- **Value-Neutral Analysts**
  - This model expresses the idea of being neutral and the avoidance of any form of advocacy towards anyone. The cost-benefit analyses if made, are to be done according to the value criteria, explicitly.

Engineers as Advisors

- **Value-Guided Advocates**
  - This model advocates the idea that it is the responsibility of engineers to keep the public good in mind and maintain honesty about both technical facts and the values that guide their studies.
  - Rosemary Tong defends this model noting, "Honesty is essential, both in negative sense of avoiding deception and in the positive sense of being candid in stating all relevant facts and in being truthful in how the facts are interpreted."

Honesty

- Honesty means expressing your true feelings. To be able to be emotionally honest we must first be emotionally aware. This emotional awareness is related to our emotional intelligence.
- It is our emotional intelligence, which gives us the ability to accurately identify our feelings.
- Emotional intelligence may also give us the ability to decide when it is in our best interest to be emotionally honest by sharing our real feelings.
- We would be better off individually and as a society if we would be more honest.

Honesty

- If we are more honest with ourselves we will get to know our “true selves” on a deeper level. This could help us become more self-accepting. It could also help us make better choices about how to spend out time and who to spend it with.

- If we are honest with other, it may encourage them to be more emotionally honest. When we are emotionally honest we are more likely not to be asked or pressured to do things which we do not want to do. We will also find out sooner who respects our feelings.

Honesty

- **How society discourages honesty?**
- It takes awareness, self-confidence, even courage to be emotionally honest. This is because, in many ways, society teaches us to ignore, repress, deny and lie about our feelings.
- For example, when asked how we feel, most of us will reply "fine" or "good", even if that is not true. Often, people will also say that they are not angry or not defensive, when it is obvious that they are.

Honesty

- Children start out emotionally honest. They express their true feelings freely and spontaneously. But the training to be emotionally dishonest begins at an early age. Parents and teachers frequently encourage or even demand that children speak or act in ways which are inconsistent with the child's true feelings. The child is told to smile when actually she is sad.
- He /She is told to apologize when she feels no regret. She is told to say "thank you", when she feels no appreciation. She is told to "stop complaining" when she feels mistreated.

Honesty

- As children become adolescents they begin to think more for themselves. They begin to speak out more, "talk back" more and challenge the adults around them. If these adults feel threatened they are likely to defend themselves by invalidating the adolescent's feelings and perceptions. There is also peer pressure to conform to the group norms.
- Through all of this the child and adolescent learns they can't be honest with their feelings. They gradually stop being emotionally honest with their parents, their teachers, their friends and even themselves. They learn it just doesn't pay to be express one's true feelings.

Honesty

- **A Few More Thoughts On Emotional Honesty**
- Dishonesty requires more energy than emotional honesty.
- When we are emotionally dishonest we lose out on the value of our natural feelings.
- When we are emotionally dishonest we are going against the forces of evolution rather than in harmony with them.
- It takes energy to oppose reality, nature and evolution.
- Emotional dishonesty, in authenticity and falseness create distrust and tension in society.

Honesty

- Honesty is one of the prized values of mankind. Honesty is an insurance against failure and defame.
- An honest man is a big asset to the family, to the organization and to the society in general.
- The honest person may not earn riches but he will certainly earn name and satisfaction of living a good life.

Moral Leadership

- Engineers, within their communities and professions contribute to technological process, as managers, business entrepreneurs, corporate consultants, academics and government officials they provide many forms of leadership in developing and implementing technology.
- Leadership can be understood as success in moving a group collectively, towards goals.

Moral Leadership

- Moral leaders, are the individuals who direct, motivate, organize, creatively manage, or in other ways move groups towards morally valuable goals.
- Leaders might be in position of authority within a corporation, or they might not be.
- Leadership can be shown by individuals participating at all levels of organizations.

Moral Leadership

- **Morally creative leaders**
- Moral leaders are morally creative. This does not mean that they discover or improvise new moral values from scratch.
- Moral values are the product of centuries and millennia of gradual development, not instantaneous invention.
- Moral creativity consists in identifying the most important values that apply in a particular situation, bringing them into focus through effective communication within groups and forming workable commitments to implement them.

Moral Leadership

- Moral creativity is achieving success through new ways of thinking with standard moral values.
- This is achieved by identifying new possibilities for applying, extending and putting values into practice rather than inventing new values for temporary comforts.
- But, this requires fresh moral insights with deeper commitments grounded in integrity.

Moral Leadership

- **Participation in Professional Societies**
- Professional Societies do more than just promoting continuing education for their members. They also serve to unify a profession, and to speak and act on behalf of it. Professional societies provide a forum for communicating, organizing and mobilizing change within and by large groups, which has a moral dimension.

Moral Leadership

- **Participation in Professional Societies**
- Effective professional activity whether in Engineering or any other profession, requires a substantial degree of trust from clients and the public. Total absence of such trust would undermine the possibility of making contracts, engaging in cooperative work, exercising professional autonomy free of excessive regulation and working under humane conditions. Building and sustaining that trust is an important responsibility shared by all engineers. It is also an area where moral leadership within professional societies is really important.

Moral Leadership

- **Leadership in Communities**
- In communities and groups, the issues that bother and that are important should be informed to everyone. But the stronger obligations arise for those who by professional background are well grounded in specific issues as well as for those who have time to train themselves as Public advocates. It shows that there is certainly a need for moral leadership in identifying and expanding the areas of possible good that can be achieved.

Moral Leadership

- **Ideals of Voluntary service**
- The need for moral leadership in Engineering, emphasizes the need for involvement in professional societies and in community service. The leadership should have substantial involvement in professional societies which, in addition to furthering technical knowledge and representing engineers collectively, help establish high standards of moral integrity within the profession. The moral leadership should also have some involvement in community service. Moral leadership does not consist of moral elitism and dominance, but instead moral creativity in helping to guide, organize and stimulate groups toward morally desirable goals.

Sample Code of Conduct

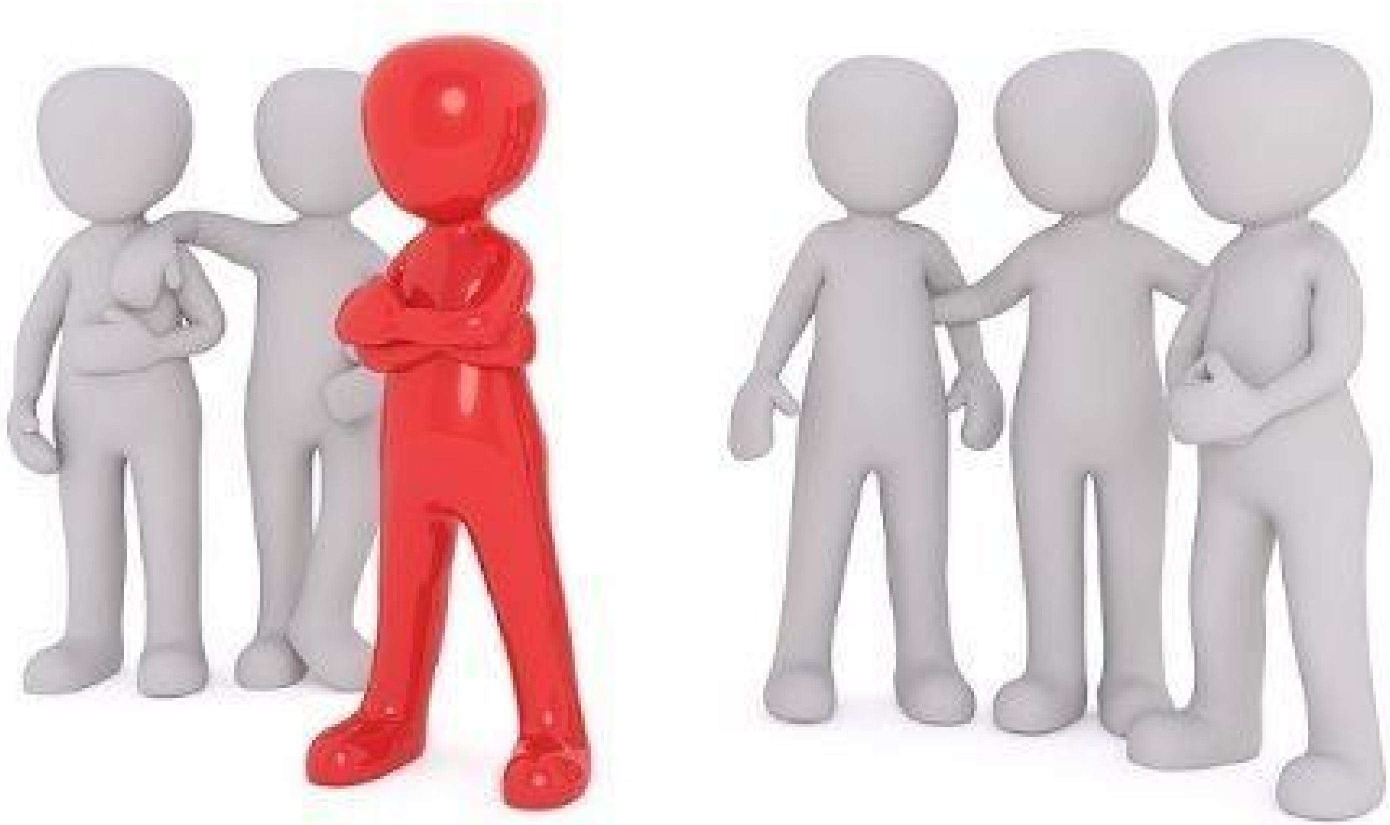
- The professional societies for engineers have formulated few codes of ethics which are expected to be followed by an engineer of the particular discipline. Following are a few societies that look into the discipline in Engineering
  - **NSPE** – National Society of Professional Engineers
  - **IEEE** – The Institute of Electrical and Electronics engineering
  - **AIChE** – American Institute of Chemical Engineers
  - **ASCE** – American Society of Civil Engineers
  - **ASME** – American Society of Mechanical Engineers
  - **ACM/IEEE/CS** – Joint Task Force on Software Engineering Ethics and Professional Practices

Sample Code of Conduct

- All these societies have proposed different codes of ethics expecting adherence from the Engineers, to the highest standard of ethical conduct. This not only helps the societies but also the Engineers.
- The **NSPE** (National Society of Professional Engineers) has formulated codes as engineering has a direct and vital impact on the quality of life for all the people. Accordingly, the services provided by engineers require honesty, impartiality, fairness and equity and must be dedicated to the protection of the public health, safety and welfare.

Sample Code of Conduct

- The fundamental things to be kept in mind, while engineers fulfill their professional duties are the following –
  - Hold paramount the safety, health and welfare of the public.
  - Perform services only in area of their competence.
  - Issue public statements only in an objective and truthful manner.
  - Act for each employer or client as faithful agents or trustees.
  - Avoid deceptive acts.
  - Conduct themselves honorably, responsibly, ethically and lawfully so as to enhance the honor, reputation and usefulness of the profession.



THE END

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