PROFESSIONAL ETHICS – INTRODUCTION

Professional Ethics is the set of standards adopted by professionals, in so far, as they view themselves acting as professionals.

- Usually stated in the formal code (eg. ASME)
- Professional Codes of Ethics of a given profession focus on the issues that are important in that profession (differed based on the profession like medicine, law etc.,)
- Professional Ethics sometimes differ from the personal morality in its degree of restriction of personal conduct since it has both positive and negative dimensions.
- Professional Ethics is supposed to take precedence over personal morality. (eg. Doing Abortion, Taking Bribe/Gifts etc.)

PERSONAL ETHICS Vs PROFESSIONAL ETHICS

Personal Ethics deals with how we treat others in our day to day lives. Professional Ethics often involves choices in an organizational level rather than a personal level.

Many of the problems will seem different because they involve relationships between two corporations, between a corporation & government or between a corporation and group of individuals. Frequently, these types of relationships pose problems that are not encountered in personal ethics.

Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.

- ABET (Accreditation Board for Engineering & Technology)

The objectives of 'Professional Ethics in Engineering' are:

(*a*) To understand the moral values that ought to guide the Engineering profession,

(*b*) Resolve the moral issues in the profession, and
(*c*) Justify the moral judgment concerning the profession.

It is intended to develop a set of beliefs, attitudes, and habits that engineers should display concerning morality. The prime objective is to increase one's ability to deal effectively with moral complexity in engineering practice.

Alternatively, the objectives of the study on Professional Ethics may be listed as:

(A) ***Improvement of the cognitive skills*** (skills of the intellect in thinking clearly)

1. Moral awareness (proficiency in recognizing moral problems in engineering)
2. Cogent moral reasoning (comprehending, assessing different views)
3. Moral coherence (forming consistent viewpoints based on facts)
4. Moral imagination (searching beyond obvious the alternative responses to issues and being receptive to creative solutions)
5. Moral communication, to express and support one's views to others.

(B) To act in morally desirable ways, towards moral commitment and responsible conduct

6. Moral reasonableness i.e., willing and able to be morally responsible.
7. Respect for persons, which means showing concern for the well-being of others, besides oneself.
8. Tolerance of diversity i.e., respect for ethnic and religious differences, and acceptance of reasonable differences in moral perspectives.
9. Moral hope i.e., believes in using rational dialogue for resolving moral conflicts.
10. Integrity, which means moral integrity, and integrating one's professional life and personal convictions.

UNIT – I

HUMAN VALUES

MORALS

Morals are concerned with the principles of right and wrong behavior. Alternatively, ***Morals are lessons that can be derived from a story or experience.***

Morality is derived from a Latin word ***MORALITAS*** which means Manners, Customs or Proper Behavior. ***Morality is the degree to which something is right or wrong, good or bad and so on.*** Alternatively, ***Morality is the principles governing right & wrong and good & bad behavior.***

Morality is concerned with principles and practices of morals such as:

(*a*) What ought or ought not to be done in a given situation?

(*b*) What is right or wrong about the handling of a situation? and

(*c*) What is good or bad about the people, policies, and ideals involved?

Morality is a system of moral principles followed by a particular group of people. Morality is classified as follows

- ***Descriptive Morality***
- ***Normative Morality***
- ***Morality Synonymous with Ethics***

Descriptive Morality is the moral code of conduct formulated by a group of people (Religious or Otherwise). ***Normative Morality*** is the code of conduct, specifies the conditions under which it is valid and considered acceptable by all rational people. ***Morality Synonymous with Ethics*** are ethical codes required for moral behavior, is considered identical to morality.

As against morals and ethics, laws are norms, formally approved by state, power or national or international political bodies. Breaking the norms is called *crime*, and invites specific punishment.

Asotoma Satgamaya, Tamasoma Jyothirgamaya, Mrityoma Amruthamgamaya – UPANISHADS. (From Falsehood to Truth, from Darkness to Light, from Death to Eternal Life)

VALUES

Values or Human Values can be defined as the fundamental constructs, principles or standards developed over a period of time that we use as a reference base our decisions and actions.

People will act congruent with their personal values or what they deem to be important.

A value is defined as a principle that promotes well-being or prevents harm. Values are our guidelines for our success—our paradigm about what is acceptable. Values are the scales we used to weigh our choices for our actions, whether to move towards or away from something.

Personal values are defined as: ***"Emotional beliefs in principles regarded as particularly favorable or important for the individual.*** A personal value can be defined *as* ***an absolute or relative ethical value, the assumption of which can be basis for ethical actions.***

Try not to become a man of success rather become a man of value – Albert Einstein

EXAMPLES FOR HUMAN VALUES

- Travelling in Bus/ Train, giving seat to an elder person
- Following Road/ Traffic rules in a road while driving/ standing in signal.
- Buying a ticket in queue on a railway station/ theatre.
- Touching feet of their elders (Social/Cultural value in India)

Types of Values

The five core human values are: **(1) Right conduct, (2) Peace, (3) Truth, (4) Love, and (5) Non-violence.**

1. Values related to RIGHT CONDUCT are:

   SELF-HELP SKILLS: Care of possessions, diet, hygiene, modesty, posture, self-reliance, and tidy appearance

   SOCIAL SKILLS: Good behavior, good manners, good relationships, helpfulness, No wastage, and good environment, and

   ETHICAL SKILLS: Code of conduct, courage, dependability, duty, efficiency, ingenuity, initiative, perseverance, punctuality, resourcefulness, respect for all, and responsibility

2. Values related to PEACE are: Attention, calmness, concentration, contentment, dignity, discipline, equality, equanimity, faithfulness, focus, gratitude, happiness, harmony, humility, inner silence, optimism,

patience, reflection, satisfaction, self-acceptance, self-confidence, self-control, self-discipline, self-esteem, self-respect, sense control, tolerance, and understanding

3. Values related to **TRUTH** are: Accuracy, curiosity, discernment, fairness, fearlessness, honesty, integrity (unity of thought, word, and deed), intuition, justice, optimism, purity, quest for knowledge, reason, self-analysis, sincerity, sprit of enquiry, synthesis, trust, truthfulness, and determination.
4. Values related to **LOVE** are: Acceptance, affection, care, compassion, consideration, dedication, devotion, empathy, forbearance, forgiveness, friendship, generosity, gentleness, humanness, interdependence, kindness, patience, patriotism, reverence, sacrifice, selflessness, service, sharing, sympathy, thoughtfulness, tolerance and trust
5. Values related to **NON-VIOLENCE** are:
   (*a*) **PSYCHOLOGICAL:** Benevolence, compassion, concern for others, consideration, forbearance, forgiveness, manners, happiness, loyalty, morality, and universal love
   (*b*) **SOCIAL:** Appreciation of other cultures and religions, brotherhood, care of environment, citizenship, equality, harmlessness, national awareness, perseverance, respect for property, and social justice.

PERSEVERANCE is defined as persistence, determination, resolution, tenacity, dedication, commitment, constancy, steadfastness, stamina, endurance and indefatigability. To persevere is described as to continue, carry on, stick at it (in formal), keep going, persist, plug away, (informal), remain, stand firm, stand fast, hold on and hang on. Perseverance builds character.

ACCURACY means freedom from mistake or error; conformity to truth or to a standard or model and exactness. Accuracy is defined as correctness, exactness, authenticity, truth, veracity, closeness to truth (true value) and carefulness. The value of accuracy embraces a large area and has many implications. Engineers are encouraged to demonstrate accuracy in their behavior through the medium of praise and other incentives. Accuracy includes telling the truth, not exaggerating, and taking care over one's work.

DISCERNMENT means discrimination, perception, penetration, and insight. Discernment means the power to see what is not obvious to the average mind. It stresses accuracy, especially in reading character or motives. Discrimination stresses the power to distinguish or select what is true or genuinely excellent. Perception implies quick and often sympathetic discernment, as of shades of

feelings. Penetration implies a searching mind that goes beyond what is obvious or superficial. Insight suggests depth of discernment.

Evolution of Human Values

The human values evolve because of the following factors:

1. The impact of norms of the society on the fulfilment of the individual's needs or desires.
2. Developed or modified by one's own awareness, choice, and judgment in fulfilling the needs.
3. By the teachings and practice of Preceptors (Gurus) or Saviors or religious leaders.
4. Fostered or modified by social leaders, rulers of kingdom, and by law (government).

Keep your thoughts positive because your thoughts become your words,
Keep your words positive because your words become your behavior,
Keep your behavior positive because your behavior become your habits,
Keep your habits positive because your habits become your values,
Keep your values positive because your values become your destiny

– M. K. GANDHI

ETHICS

Ethics refers to moral values that are sound, actions that are morally required (right) or morally permissible (all right), policies & laws that are desirable.

Ethics is the word that refers to morals, values, and beliefs of the individuals, family or the society. The word has several meanings. Basically it is an activity and process of inquiry. Secondly, it is different from non-moral problems, when dealing with issues and controversies. Thirdly, ethics refers to a particular set of beliefs, attitudes, and habits of individuals or family or groups concerned with morals. Fourth, it is used to mean 'morally correct'.

Ethics is defined as the moral principles that control or influence a person's behavior or a system of moral principles or rules of behavior.

Ethics is also defined as ***the branch of philosophy that deals with moral principles.***

Ethics is also defined as ***a particular set of beliefs, attitudes & habits of individuals or family or groups concerned with morals.***

Wrong is wrong if everyone is doing it, Right is right if nobody is doing it – ARISTOTLE

Doing the right thing doesn't automatically bring success, but compromising ethics almost leads to Failure – UNKNOWN

Ethics helps to know the people's beliefs, values and morals, learn the good and bad of them & practicing them to maximise their well being & happiness. Ethics tells us how to live, to respond to issues, through the duties, rights, responsibilities and obligations. Ethics focus on studying & applying the principles and practices universally. Ethics can be categorized as

- Meta ethics
- Descriptive ethics
- Normative ethics
- Applied ethics

Meta ethics deals with the origin of ethical principles that govern the specification of right & wrong behavior.

Descriptive ethics refers to the study of moral beliefs of people or societies consider right or wrong.

Normative ethics is concerned with arriving at a set of moral conduct rules against which behaviours are judged.

Applied ethics denotes the study of ethically controversial issues such as imposition of death penalty & cloning etc., Few types of applied ethics are Bio ethics, Computer ethics, Medical ethics etc.,

Ethics is knowing the difference between what you have a right to do and what is right to do – POTTER STEWART

Morality is different from Ethics in the following ways:

MORALITY	*ETHICS*
More general and prescriptive based on customs and traditions	Specific and descriptive. It is a critical reflection on morals
More concerned with the results of wrong action, when done	More concerned with the results of a right action, when not done
Thrust is on judgment and punishment, in the name of God or by laws.	Thrust is on influence, education, training through codes, guidelines, and correction
In case of conflict between the two, morality is given top priority, because the damage is more. It is more common and basic.	Less serious, hence second priority only. Less common. But relevant today, because of complex interactions in the modern society.
Example: Character flaw, corruption, extortion, and crime.	Example: Notions or beliefs about manners, tastes, customs, and towards laws.

The first step in the evolution of ethics is a sense of solidarity with other human beings – ALBERT SCHWEITZER

Without ethical culture, there is no salvation for Humanity. Relativity applies to Physics, not Ethics – ALBERT EINSTEIN

A man without ethics is a wild beast loosed upon this world – ALBERT CAMUS

INTEGRITY

Integrity is defined as the unity of thought, word and deed (honesty) and open mindedness. Integrity is the quality of being honest & having strong moral principles.

Integrity is doing the right thing even when no one is watching – C S LEWIS

The strength of the nation derives from the integrity of the home – CONFUCIOUS

Integrity includes

- The capacity to communicate the factual information so that others can make well-informed decisions.
- Yields the person's 'peace of mind', and hence adds strength and consistency in character, decisions, and actions. This paves way to one's success. It is one of the self-direction virtues.
- Enthuse people not only to execute a job well but to achieve excellence in performance. It helps them to own the responsibility and earn self-respect and recognition by doing the job.

With Integrity, you have nothing to fear, since you have nothing to hide. With Integrity, you will do the right thing, so you will have no guilt – ZIG ZIGLAR

Integrity is choosing courage over comfort; choosing what is right over what is fun, fast or easy; choosing to practice our values rather than simply professing them – UNKNOWN

Moral integrity is defined as a virtue, which reflects a consistency of one's attitudes, emotions, and conduct in relation to justified moral values.

The integrity of men is to be measured by their conduct, not by their professions – JUNIUS

Integrity without knowledge is weak and useless, and knowledge without integrity is dangerous and dreadful – SAMUEL JOHNSON

Success without Integrity is a failure - ANONYMOUS

WORK ETHICS

Industry and Society are the two systems which interact with each other and are interdependent. Society requires industry/business system which provides manufacturing, distribution and consumption activities. It needs investment (capital input), labor (input), supply (raw materials), production (industries, business organizations), marketing and distribution (transport), and consumption (public, customer). A lot of transactions (and interactions) between these sub-systems involving people are needed for the welfare of the society. It is here, the work ethics plays an essential role.

Work ethics is defined as a set of attitudes concerned with the value of work, which forms the motivational orientation.

The first qualification for success in my view is a strong work ethic – HENRY FORD II

Work ethics eliminates fear – MICHEAL JORDAN

Work Ethics aimed at

- Ensuring the economy (get job, create wealth, earn salary)
- Productivity (wealth, profit)
- Safety (in workplace)
- Health and hygiene (working conditions)
- Privacy (raise family)
- Security (permanence against contractual, pension, and retirement benefits)
- Cultural and social development (leisure, hobby, and happiness)
- Welfare (social work)
- Environment (anti-pollution activities) and
- Offer opportunities for all, according to their abilities, but without discrimination.

Work ethic is the most important component of being successful – KLIFF KINGSBURY

No ethic is as ethical as the work ethic – JOHN KENNETH GALBRAITH

Many complex social problems exist in the industrial/business scenario, because:

1. Meaningful work is worth doing for the sense of personal identity and the self-esteem it holds.
2. Economic independence: Work is the major instrumental good in life.
3. Pay as well as the pace of work should be in commensurate with the expertise required, acquired, and utilized in the persons.
4. Privacy (personal freedom) of the employee, including women, is to be

protected. Mutual trust and loyalty both ways play major roles in this aspect.

5. Security during job and upon retirement.
6. Recognition to non-work activities, such as leisure, paid holiday on the day of visit of a dignitary, social service, and other developmental activities.
7. Hard work and productivity are very essential for the success of an industry.
8. Employee alienation: Absence of or inadequate recognition and reward system and grievance redressal system, lack of transparency in policy implementation, factions in trade unions etc. lead to ethical problems, affecting the work ethics. Participative management, quality circles, job rotation, and flexible working hours are some of the measures to counter this situation.
9. A different view of work ethics: Work is considered as a necessary evil. It is a thing one must do in order to avoid worse evils, such as dependency and poverty.
10. As per the Protestant Work Ethics, the financial success is a sign that is favored by God.

To work (job), is not for monetary considerations only. Human beings believe that it is good to work. Work is good for the body and mind. It promotes self-respect, self-esteem, good for the family, and obligation to the society and allow the world to prosper. Work lays a moral and meaningful foundation for life. That is why, work ethics affirms that, the work *perse* is worthy, admirable and valuable at personal and social levels. It improves the quality of life and makes life purposeful, successful, and happy.

Keep Integrity and your work ethic intact. So what if that means working a little harder; an honourable character is your best calling card, and that's something anyone can have – KATHY IRELAND

By work ethics, duties to the self, family, society, and nation are fulfilled. Rights of the individuals are respected and nourished. Values and virtues are cultivated and enjoyed by all human beings. Further, the quality of life is improved and the environment protected. On the other hand, unemployment and under-employment lead to frustration, social tensions, and occasional militancy. For a developing economy and society, like ours, we need to *promote work ethics*, at all levels, to flourish as developed nation.

There are 7 things that will destroy us: Wealth without Work, Pleasure without

Conscience, Knowledge without Character, Religion without Sacrifice, Politics without Principle, Science without Humanity and Business without Ethics – M. K. GANDHI

SERVICE LEARNING

Service learning refers to learning the service policies, procedures, norms, and conditions, other than 'the technical trade practices.

The best way to find yourself is to lose yourself in the service of others – M.K. GANDHI

The service learning includes

- The characteristics of the work, basic requirements, security of the job, and awareness of the procedures, while taking decisions and actions.
- Helps the individuals to interact ethically with colleagues, to effectively coordinate with other departments, to interact cordially with suppliers as well as the customers, and to maintain all these friendly interactions.
- Alternatively, the service learning may be defined as the *non-paid activity*, in which service is provided on voluntary basis to the public (have-nots in the community), non-profitable institutions, and charitable organizations.
- It is the service during learning. This includes training or study on real life problems and their possible solutions, during the formal learning, i.e., courses of study. *In the industrial scenario, adoption, study, and development of public health or welfare or safety system of a village or school is an example of service learning by the employees. The engineering student analyzing and executing a socially-relevant project is another example of service learning*.

Tell me and I forgot. Teach me and I remember. Involve me and I learn – BENJAMIN FRANKLIN

The service learning is a methodology falling under the category of experiential education. It is one of the forms of experiential learning and community service opportunities. It is distinguished in the following ways:

1. *Connection to curriculum*: Integrating the learning into a service project is a key to successful service learning. Academic ties should be clear and built upon existing disciplinary skills.
2. *Learner's voice*: Beyond being actively engaged in the project, trainees have the opportunity to select, design, implement, and evaluate their service activity.
3. *Reflection*: Structured opportunities are created to think, talk, and write about the service experience. The balance of reflection and action allows the trainee to be constantly aware of the impact of their *work*.
4. *Partners in the community*: Partnership with community agencies are used to identify genuine needs, provide mentorship, and contribute input such as labor and expertise towards completing the project.

Community service provided to the curriculum is referred to as service learning, which enriches students by providing opportunities to use their academic knowledge and skills in real – life – UNKNOWN

VIRTUES

Virtues are positive and preferred values (Good qualities or Assets of Life).

Liberty without virtue would be no blessing for us – BENJAMIN RUSH

Virtues are desirable attitudes or character traits, motives and emotions that enable us to be successful and to act in ways that develop our highest potential. They energize and enable us to pursue the ideals that we have adopted.

Virtues are tendencies which include, solving problems through peaceful and constructive means and follow the path of the golden mean between the extremes of 'excess and deficiency'. They are like habits, once acquired, they become characteristics of a person.

Be virtuous and you will be happy. Do not sell virtue neither for wealth, nor freedom, nor wealth – BENJAMIN FRANKLIN

Moreover, a person who has developed virtues will naturally act in ways consistent with moral principles. ***The virtuous person is the ethical person. Honesty, courage, compassion, generosity, fidelity, integrity, fairness, transparency, self-control, and prudence*** are all examples of ***virtues.***

There is no greater wealth than virtue, and no greater loss than to forget it.

Virtue alone is happiness; all else is else, and without praise – THIRUVALLUVAR

CIVIC VIRTUES

Civic virtues are the moral duties and rights, as a citizen of the village or the country or an integral part of the society and environment.

It is the state which educates its citizens in civic virtue, gives them a consciousness of their mission and welds them into unity – BENITO MUSSOLINI

An individual may exhibit civic virtues by voting, volunteering, and organizing welfare groups and meetings.

The duties are:

1. To pay taxes to the local government and state, in time.
2. To keep the surroundings clean and green.
3. Not to pollute the water, land, and air by following hygiene and proper

garbage disposal.

For example, not to burn wood, tyres, plastic materials, spit in the open, even not to smoke in the open, and not to cause nuisance to the public, are some of the civic (duties) virtues.

4. To follow the road safety rules.

On the other hand, the rights are:

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

If parents instill a sense of civic mindedness – and there is no better way to do that than by example – their children will probably follow – SANDRA DAY O'CONNOR

George Washington embodied the civic virtues as indispensable for a self-governing administration. These virtues are divided into four categories:

1. Civic Knowledge

Citizens must understand what the Constitution says about how the government is working, and what the government is supposed to do and what not to do.

2. Self-Restraint

For citizens to live in a free society with limited government each citizen must be able to control or restrain himself; otherwise, we would need a police state—that is, a dictatorial government to maintain safety and order.

3. Self-Assertion

Self-assertion means that citizens must be proud of their rights, and have the courage to stand up in public and defend their rights.

4. Self-Reliance

Self-reliant citizens are free citizens in the sense that they are not dependent on others for their basic needs. Only a strong self-reliant citizenry will be able to enjoy fully the blessings of liberty. These civic virtues, applicable to local, state, and central governments, nourish freedom and civil liberty at the root of democracy.

Without civic morality communities perish; without personal morality their survival has no value – BRETRAND RUSSELL

A constitutional democracy is in serious trouble if its citizenry does not have a certain degree of education and civic virtue – PHILLIP E. JOHNSON

RESPECT FOR OTHERS

Respect for Others is a basic requirement for nurturing friendship, team work, and for the synergy it promotes and sustains.

A child who is allowed to be disrespectful to his parents will not have true respect for anyone – BILLY GRAHAM

The principles enunciated in this regard are:

1. Recognize and accept the existence of other persons as human beings, because they have a right to live, just as you have.
2. Respect others' ideas (decisions), words, and labor (actions). One need not accept or approve or award them, but shall listen to them first. One can correct or warn, if they commit mistakes. Appreciate colleagues and subordinates on their positive actions, Criticize constructively and encourage them, are bound to improve their performance, by learning properly and by putting more efforts.
3. Show goodwill on others. Love others. Allow others to grow which will facilitate collinearity, focus, coherence, and strength to achieve the goals.

Treat people the way you want to be treated, talk to the people the way you want to be talked to. Respect is earned not given – UNKNOWN

Respect is for those who deserve it, not for those who demand it – UNKNOWN

LIVING PEACEFULLY

To live peacefully, one should start install peace within (self).

Peace comes from within. Do not seek it without – BUDDHA

When you find peace within yourself, you become the kind of person who can live at peace with others – UNKNOWN

Charity begins at home. Then one can spread peace to family, organisation where one works, and then to the world, including the environment. Only who are at peace can spread peace. You cannot gift an article which you do not possess. The essence of oriental philosophy is that one should not *fight* for peace. It is oxymoron. War or peace can be won only by peace, and *not by wars!*

If we are to have peace on earth... our loyalties must transcend our race, our tribe, our class and our nation; and this means we must develop a world perspective – MARTIN LUTHER KING

One should adopt the following means to live peacefully, in the world:

Nurture

1. Order in one's life (self-regulation, discipline, and duty).
2. Pure thoughts in one's soul (loving others, blessing others, friendly, and not criticizing or hurting others by thought, word or deed).
3. Creativity in one's head (useful and constructive).
4. Beauty in one's heart (love, service, happiness, and peace).

Get

5. Good health/body (physical strength for service).

Act

6. Help the needy with head, heart, and hands (charity). Service to the poor is considered holier than the service to God.
7. Not hurting and torturing others physically, verbally, or mentally.

Peaceful coexistence cannot be limited to the powerful countries if want to ensure world peace – CHE GUEVARA

The factors that promote living, with internal and external peace:

1. Conducive environment (safe, ventilated, illuminated and comfortable).
2. Secured job and motivated with 'recognition and reward'.
3. Absence of threat or tension by pressure due to limitations of money or time.
4. Absence of unnecessary interference or disturbance, except as guidelines.
5. Healthy labor relations and family situations.
6. Service to the needy (physically and mentally-challenged) with love and sympathy.

Peace is not absence of conflict; it is the ability to handle conflict by peaceful means – RONALD REAGAN

CARING

Caring is feeling for others. ***Caring is nothing but showing respect to the feelings of others. Caring is respecting and preserving the interests of all others concerned.***

Live so that when your children think of fairness, caring and integrity, they think of you – H. JACKSON BROWN

- Caring is a process which exhibits the interest in, and support for, the welfare of others with fairness, impartiality and justice in all activities,

among the employees, in the context of professional ethics.

- Caring includes showing respect to the feelings of others, and also respecting and preserving the interests of all others concerned.
- Caring is reflected in activities such as friendship, membership in social clubs and professional societies, and through various transactions in the family, fraternity, community, country and in international councils.

We make a living by what we get, but we make a life by what we give – WINSTON CHURCHILL

In the present day context, ***caring for the environment*** (including the *fauna and flora*) ***has become a necessity for our very survival.*** If we do not care for the environment, the environment will scare us. ***Caring influences Sharing.***

Three keys to more abundant living: Caring about others, daring for others, sharing with others – WILLIAM ARTHUR WARD

SHARING

Sharing is a process that describes the transfer of knowledge (teaching, learning, and information), experience (training), commodities (material possession) and facilities with others. The transfer should be genuine, legal, positive, voluntary, and without any expectation in return. However, the proprietary information it should not be shared with outsiders.

Sharing is caring – Teaching our children to share is teaching them compassion and love – KEVIN HEATH

Shared joy is a double joy; shared sorrow is half a sorrow – UNKNOWN

Gaining knowledge is the first step to wisdom. Sharing it, is the first step to humanity – UNKNOWN

Through this process of sharing, experience, expertise, wisdom and other benefits reach more people faster. In short, ***sharing is charity***.

- Sharing is voluntary
- Sharing cannot be driven by force
- Sharing also motivated successfully through ethical principles
- Sharing must be practiced from childhood onwards.

The more we share, the more we have – LEONARD NANCY

Sharing knowledge is the most fundamental act of friendship, because it is a way you can give something without losing something – ANONYMOUS

For the humanity, sharing is a ***culture.*** The happiness and wealth are multiplied and the crimes and sufferings are reduced, by sharing. It paves the

way for peace and obviates militancy.

Philosophically, the sharing maximizes the happiness for all the human beings.

In terms of ***psychology,*** the fear, divide, and distrust between the 'haves' and 'have-nots' disappear. Sharing not only paves the way to prosperity, early and easily, and sustains it.

Economically speaking, benefits are maximized as there is no wastage or loss, and everybody gets one's needs fulfilled and satisfied. Commercially speaking, the profit is maximized.

Technologically, the productivity and utilization are maximized by sharing. *In the industrial arena, code-sharing in airlines for bookings on air travels and the common Effluent Treatment Plant constructed for small-scale industries in the industrial estates, are some of the examples of sharing. The co-operative societies for producers as well as consumers are typical examples of sharing of the goods, profit and other social benefits.*

Thousands of candles can be lighted from a single candle, and the life of the candle will not be shortened. Happiness never decreases by being shared – BUDDHA

HONESTY

Honesty refers to a facet of moral character and connotes positive and virtuous attributes such as integrity, truthfulness, straightforwardness, including straightforwardness of conduct, along with the absence of lying, cheating, theft, etc. Honestly also includes being trustworthy, loyal, fair, and sincere.

Honesty is the first chapter of book wisdom – THOMAS JEFFERSON

No legacy is so rich as Honesty – WILLIAM SHAKESPEARE

Honesty is a virtue, the quality of being truthful and it is exhibited in two aspects namely, (*a*) Truthfulness and (*b*) Trustworthiness.

Truthfulness is to face the responsibilities upon telling truth. One should keep one's word or promise. By admitting one's mistake committed (one needs courage to do that!), it is easy to fix them. Reliable engineering judgment, maintenance of truth, defending the truth, and communicating the truth, only when it does 'good' to others, are some of the reflections of truthfulness.

But, ***Trustworthiness is maintaining integrity and taking responsibility for personal performance.*** People abide by law and live by mutual trust. They play the right way to win, according to the laws or rules (legally and morally). They build trust through reliability and authenticity. They admit their own mistakes and confront unethical actions in others and take tough

and principled stand, even if unpopular.

We must make the world honest before we can honestly say to our children that Honesty is the best policy – GEORGE BERNARD SHAW

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

(*a*) Beliefs (intellectual honesty).

(*b*) Communication (writing and speech).

(c) Decisions (ideas, discretion).

(d) Actions (means, timing, place, and the goals). And

(e) Intended and unintended results achieved

A lie can travel halfway around the world while the truth is putting on its shoes. If you tell the truth, you don't have to remember anything – MARK TWAIN

As against this, some of the actions of an engineer that leads to dishonesty are:

1. ***Lying***: Honesty implies avoidance of lying. An engineer may communicate wrong or distorted test results intentionally or otherwise. It is giving *wrong* information to the *right* people.
2. ***Deliberate deception***: An engineer may judge or decide on matters one is not familiar or with insufficient data or proof, to impress upon the customers or employers. This is a self-deceit.
3. ***Withholding the information***: It means hiding the facts during communication to one's superior or subordinate, intentionally or otherwise.
4. ***Not seeking the truth***: Some engineers accept the information or data, without applying their mind and seeking the truth.
5. ***Not maintaining confidentiality***: It is giving *right* information to *wrong* people. The engineers should keep information of their customers/clients or of their employers confidential and should not discuss them with others.
6. Giving professional judgment under the influence of extraneous factors such as personal benefits and prejudice. The laws, experience, social welfare, and even conscience are given a go-bye by such actions. Certainly this is a higher-order crime.

Anyone who doesn't take truth seriously in small matters cannot be trusted in large one either – ALBERT EINSTEIN

COURAGE

Courage is the tendency to accept and face risks and difficult tasks in rational ways.

Self-confidence is the basic requirement to nurture courage. Courage is classified into three types, based on the types of risks, namely

(*a*) Physical courage,

(*b*) Social courage, and

(*c*) Intellectual courage.

All our dreams can come true, if we have the courage to pursue them – WALT DISNEY

In physical courage, the thrust is on the adequacy of the physical strength, including the muscle power and armaments. People with high adrenalin, may be prepared to face challenges for the mere 'thrill' or driven by a decision to 'excel'.

The social courage involves the decisions and actions to change the order, based on the conviction for or against certain social behaviors. This requires leadership abilities, including empathy and sacrifice, to mobilize and motivate the followers, for the social cause.

The intellectual courage is inculcated in people through acquired knowledge, experience, games, tactics, education, and training. In professional ethics, courage is applicable to the employers, employees, public, and the press.

Have the courage to follow your heart & intuition, they somehow know you truly want to become – STEVE JOBS

Look before you leap. One should perform **Strengths, Weakness, Opportunities, and Threat (SWOT) analysis.** Calculate (estimate) the risks, compare with one's strengths, and anticipate the end results, while taking decisions and before getting into action. Learning from the past helps. Past experience (one's own or borrowed!) and wisdom gained from self-study or others will prepare one to plan and act with self-confidence, succeed in achieving the desired ethical goals through ethical means. Opportunities and threat existing and likely to exist in future are also to be studied and measures to be planned. This anticipatory management will help anyone to face the future with courage.

Success is never final, Failure is never fatal, it's the courage that counts – JOHN WOODEN

The expressions of courage are

- *Facing the criticism*
- *Owning responsibility, and*
- *Accepting the mistakes or errors when committed and exposed*

Courage is resistance to fear, mastery of fear, not absence of fear – MARK TWAIN

He who is not courageous enough to take risks will accomplish nothing in life – MUHAMMAD ALI

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

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

I learned that courage was not the absence of fear, but the triumph over it – NELSON MANDELA

VALUING TIME

Time is rare resource. Once it is spent, it is lost forever. It cannot be either stored or recovered. Hence, time is the most perishable and most valuable resource too. This resource is continuously spent, whether any decision or action is taken or not.

The history of great reformers and innovators have stressed the importance of time and valuing time. The proverbs, **Time and tide wait for nobody** and **Procrastination is the thief of time** amply illustrates this point.

The two most powerful warriors are patience and time – LEO TOLSTOY

The trouble is, you think you have time – BUDDHA

An anecdote to highlight the value of time is as follows:

To realize the value of one year, ask the student who has failed in the examinations

To realize the value of one month, ask the mother who has delivered a premature baby

To realize the value of one week, ask the editor of weekly; to realize the value of one day, ask the daily-wage laborer

To realize now the value of one hour, ask the lovers longing to meet

To realize the value of one minute, ask a person who has missed the train

To realize the value of one second, ask the person who has survived an accident

To realize the value one milli second, ask the person who has won the bronze medal in Olympics

To realize the value of one micro second, ask the ISRO team of scientists

To realize the value of one nano-second, ask a Hardware engineer!

If you have still not realized the value of time, wait; are you an Engineer?

Until you value yourself, you won't value your time; Until you value your time, you won't do anything with it – M.SCOTT PECK

DON'T SAY THERE IS STILL TIME or MAYBE NEXT TIME because there is also the concept of IT'S TOO LATE – UNKNOWN

Time is really the only capital that any human being has, and the only thing he can't afford to lose – THOMAS ALVA EDISON

COOPERATION

Co-operation is activity between two persons or sectors that aims at integration of operations (synergy), while not sacrificing the autonomy of either party. Cooperation is the willingness to understand others, think and act together and putting this into practice.

It is a team-spirit present with every individual engaged in engineering. Further, working together ensures, coherence, i.e., blending of different skills required, towards common goals.

I suppose leadership at one time means muscles, but today it means getting along with the people – M. K. GANDHI

It is literally true that you can succeed best and quickest by helping others to succeed – NAPOLEAN HILL

Cooperation promotes

- ***Collinearity***
- ***Coherence (blend)***
- ***Co-ordination (activities linked in sequence or priority) and***
- ***The synergy (maximizing the output, by reinforcement).***

The whole is more than the sum of the individuals. ***It helps in minimizing the input resources (including time) and maximizes the outputs, which include quantity, quality, effectiveness, and efficiency.***

According to professional ethics, cooperation should exist or be developed, and maintained, at several levels; between the employers and employees, between the superiors and subordinates, among the colleagues, between the producers and the suppliers (spare parts), and between the organisation and its customers.

The codes of ethics of various professional societies insist on appropriate cooperation to nourish the industry. The absence of cooperation leads to lack of communication, misinformation, void in communication, and undue delay

between supply, production, marketing, and consumption. This is likely to demoralize and frustrate the employees, leading to collapse of the industry over time and an economic loss to the society.

Coming together is a beginning, keeping together is progress, working together is success – HENRY FORD

The impediments to successful cooperation are:

1. Clash of ego of individuals.
2. Lack of leadership and motivation.
3. Conflicts of interests, based on region, religion, language, and caste.
4. Ignorance and lack of interest.

Competition – Law of Jungle, Cooperation – Law of Civilization – PETER KROPOTKIN

Mutual understanding cooperation can be developed and also sustained by careful planning, motivation, leadership, fostering and rewarding team work, professionalism and humanism beyond the divides, training on appreciation to different cultures

Cooperation is about unity, joining force, willing to share experience and learning – BHAGAVAD GITA

COMMITMENT

Commitment means alignment to goals and adherence to ethical principles during the activities.

To succeed in your mission, you must have single – minded devotion to your goal – A.P.J. ABDUL KALAM

There's a difference between Interest & Commitment. When you're interested in doing something, you do it only when it's convenient. When you're committed to something, you accept no excuses, only results – KENNETH BLANCHARD

Commitment as the driving force to realize success is attained by

- Believing in one's action performed
- Expected end results (confidence)
- Holding sustained interest and firmness
- Fervent attitude and hope that one will achieve the goals

Commitment is that transforms a promise into reality – ABRAHAM LINCOLN

This is a basic requirement for any profession. For example,

- A design engineer shall exhibit a sense of commitment, to make his product or project designed a beneficial contribution to the society.
- Only when the teacher (Guru) is committed to his job, the students will succeed in life and contribute 'good' to the society.

- The commitment of top management will naturally lead to committed employees, whatever may be their position or emoluments. This is bound to add wealth to oneself, one's employer, society, and the nation at large.

Education is a shared commitment between dedicated teachers, motivated students and enthusiastic parents with high expectations – BOB BEAUPREZ

Our greatest weakness lies in giving up. The most certain way to succeed is always to try just one more time – THOMAS ALVA EDISON

EMPATHY

Empathy is social radar, sensing what others feel about, without their open talk. *Empathy begins with showing concern, and then obtaining and understanding the feelings of others, from others' point of view.*

Empathy is about finding echoes of another person in yourself – MOHSIN HAMID

Empathy is also defined as the ability to put one's self into the psychological frame or reference or point of view of another, to know what the other person feels.

Imaginative projection into other's feelings and understanding of other's background such as parentage, physical and mental state, economic situation, and association includes EMPATHY to develop good human relations and transactions.

Empathy is about standing in someone else's shoes, feeling with his or her heart, seeing with his or her eyes. Not only is empathy hard to outsource and automate, but it makes the world a better place – DANIEL H. PINK

To practice 'Empathy', a leader must have or develop in him, the following characteristics

1. ***Understanding others*****:** It means sensing others feelings and perspectives, and taking active interest in their welfare.
2. ***Service orientation*****:** It is anticipation, recognition and meeting the needs of the clients or customers.
3. ***Developing others*****:** This means identification of their needs and bolstering their abilities. In developing others, the one should inculcate in him the 'listening skill' first. Communication = 22% reading and writing + 23% speaking + 55% listening.

   One should get the feedback, acknowledge the strength and accomplishments, and then coach the individual, by informing about what was wrong, and giving correct feedback and positive expectation

of the subject's abilities and the resulting performance.

4. ***Leveraging diversity*** **(opportunities through diverse people)**: This leads to enhanced organizational learning, flexibility, and profitability.
5. ***Political awareness*****:** It is the ability to read political and social currents in an organization.

Anyone who has experienced a certain amount of loss in their life has empathy for those who have experienced loss – ANDERSON COOPER

The benefits of empathy include:

1. Good customer relations (in sales and service, in partnering).
2. Harmonious labour relations (in manufacturing).
3. Good vendor-producer relationship (in partnering.)

The path to gaining respect is paved with knowledge and empathy – EVAN BROWN

Through the above three, we can maximize the output and profit, as well as minimizing the loss. While dealing with customer complaints, empathy is very effective in realising the unbiased views of others and in admitting one's own limitations and failures. According to **Peter Drucker**, purpose of the business is not to ***make a sale***, but to ***make and keep a customer***. Empathy assists one in developing courage leading to success!

Empathy is a quality of character that can change the world – BARACK OBAMA

SELF-CONFIDENCE

Certainty in one's own capabilities, values, and goals, is self-confidence. These people are usually positive thinking, flexible and willing to change. They respect others so much as they respect themselves.

Self-confidence is positive attitude, wherein the individual has some positive and realistic view of himself, with respect to the situations in which one gets involved.

All power is within you, you can do anything & everything – SWAMI VIVEKANANDA

Mastering others is strength, Mastering yourself is true power – LAOTZU

The people with self-confidence exhibit courage to get into action and unshakable faith in their abilities, whatever may be their positions. They are not influenced by threats or challenges and are prepared to face them and the natural or unexpected consequences.

Self-confidence in a person develops a sense of partnership, respect, and accountability, and this helps the organization to obtain maximum ideas, efforts, and guidelines from its employees.

Confidence and hard work is the best medicine to kill the disease called Failure. It will make you a successful person – APJ ABDUL KALAM

The best way to gain self confidence is to do what you are afraid to do - ANONYMOUS

The people with self-confidence have the following characteristics:

- Positive thinking, flexible (adopt) & willing to change
- Respect others efforts and willing to listen & learn from others to give due credits
- Exhibit courage to get into action & Frank to speak the truth
- Unshakable faith in their abilities regardless of their positions
- Not influenced by threats/challenges & prepared to face the natural/unexpected consequences
- Self-assured standing

Do the best you can until you know better. Then when you know better, do better – MAYA ANGELOU

On the contrary, some leaders expose others when failure occurs, and own the credit when success comes.

The factors that shape self-confidence in a person are:

1. Heredity (attitudes of parents) and family environment (elders),
2. Friendship (influence of friends/colleagues),
3. Influence of superiors/role models, and
4. Training in the organization (e.g., training by Technical Evangelists at Infosys Technologies).

One important key to success is self – confidence. An important key to self – confidence is preparation – ARTHUR ASHE

The following methodologies are effective in developing self-confidence in a person:

1. Encouraging SWOT analysis. By evaluating their strength and weakness, they can anticipate and be prepared to face the results.
2. Training to evaluate risks and face them (self-acceptance).
3. Self-talk: It is conditioning the mind for preparing the self to act, without any doubt on his capabilities. This make one accepts himself while still striving for improvement.
4. Study and group discussion, on the history of leaders and innovators (e.g., Sam Walton of Wal-Mart, USA)

Self – confidence is the first requisite to great undertakings – SAMUEL JOHNSON

CHALLENGES IN THE WORK PLACE

The biggest workplace challenge is said to be the employee's work ethics:

- Showing up to work every day (interest in work and attendance),
- Showing up to work on time (punctuality),
- Taking pride in the quality of their work,
- Commitment to the job, and
- Getting along with others.

This situation demands inculcation of good character in the workplace by employees.

CHARACTER

Character is the expression of the personality of a human being. Character is a characteristic property that defines the behavior of an individual.

Character is determined by the expectations of society which are directed by prevailing habits, fashions, beliefs, attitudes, opinions and values of the society.

Nearly all the men can stand adversity, but if you want to test a man's character, give him power – ABRAHAM LINCOLN

Character implies certain unity of qualities with a recognizable degree of constancy in mode of action. Character includes

- Pattern of virtues (morally-desirable features)
- Attributes that determine a person's moral and ethical actions and responses.
- Conduct exhibit on which morals and values blossom.

Watch people do their most common actions; these are indeed the things that will tell you the real character of a great person – SWAMI VIVEKANANDA

People are divided into several categories, according to common tendencies such as

- Ruthless,
- Aggressiveness, and ambition,
- Constricting selfishness,
- Stinginess, or cheerfulness,
- Generosity and
- Goodwill.

Most people say that it is the intellect which makes a great scientist. They are wrong; it is character – ALBERT EINSTEIN

Individuals vary not only in the type of their character but also in the degree. Those whose lives are determined and directed by the prevailing habits, fashions, beliefs, attitudes, opinions and values of the society in which they live have at best a developed *social* as opposed to an *individual* character.

Character is how you treat those who can do nothing for you – ABRAHAM LINCOLN

The character is exhibited through conduct. Character is determined by the expectations of society. Many act and live within its norms, refusing to fall below the required social minimum, failing to rise above the maximum expected of a normal member of the group.

Character is like a tree & Reputation is like a shadow. The shadow is what we think of it; the tree is the real thing – ABRAHAM LINCOLN

Character is the expression of the personality of a human being, and that it reveals itself in one's conduct. In this sense every human has a character. At the same time only human beings, not animals have character: it implies rationality.

Every man has three characters, which he exhibits, which he has and that which he thinks he has – ANONYMOUS

Character has been defined as natural temperament completely fashioned by the will; in fact it is a resultant of our acquired habits with our original disposition. Temperaments are the early indications of personality.

Weakness of attitude becomes weakness of character – ALBERT EINSTEIN

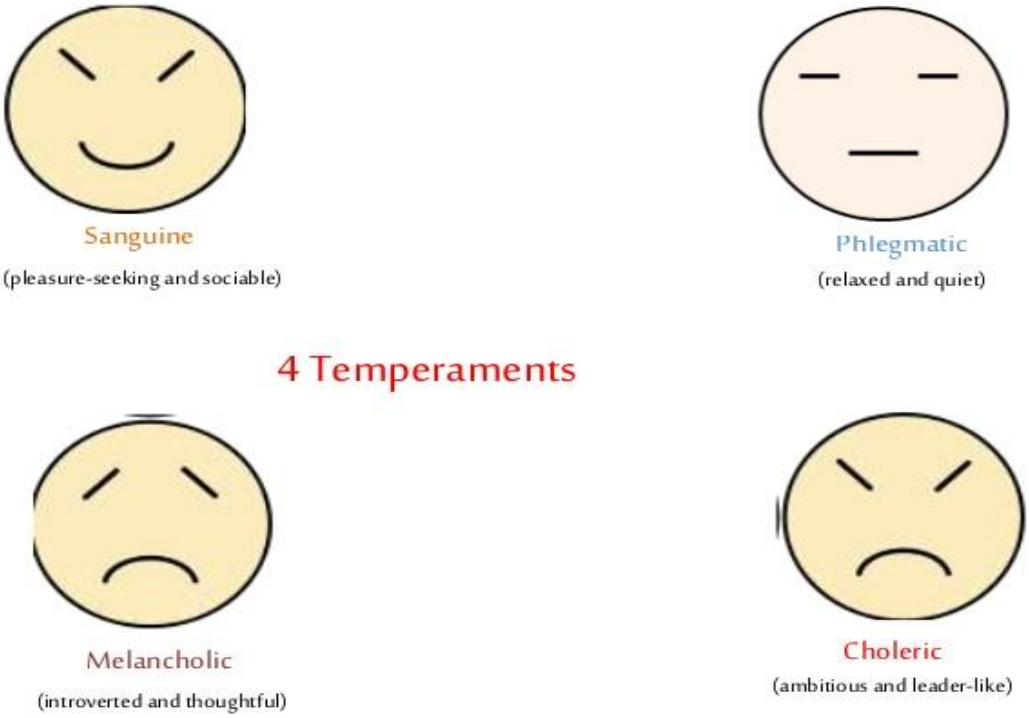
Temperament is an individual's characteristic level of emotional excitability or intensity & is typically recognized within the first few weeks after birth. Temperament or personalities/person's overall personality born with genetically inherited behavioural tendencies, part of DNA combinations forming basic behavioural disposition.

From the times of Hippocrates, they distinguished four main types of temperaments: ***the Sanguine, the Choleric, the Phlegmatic, and the Melancholic.***

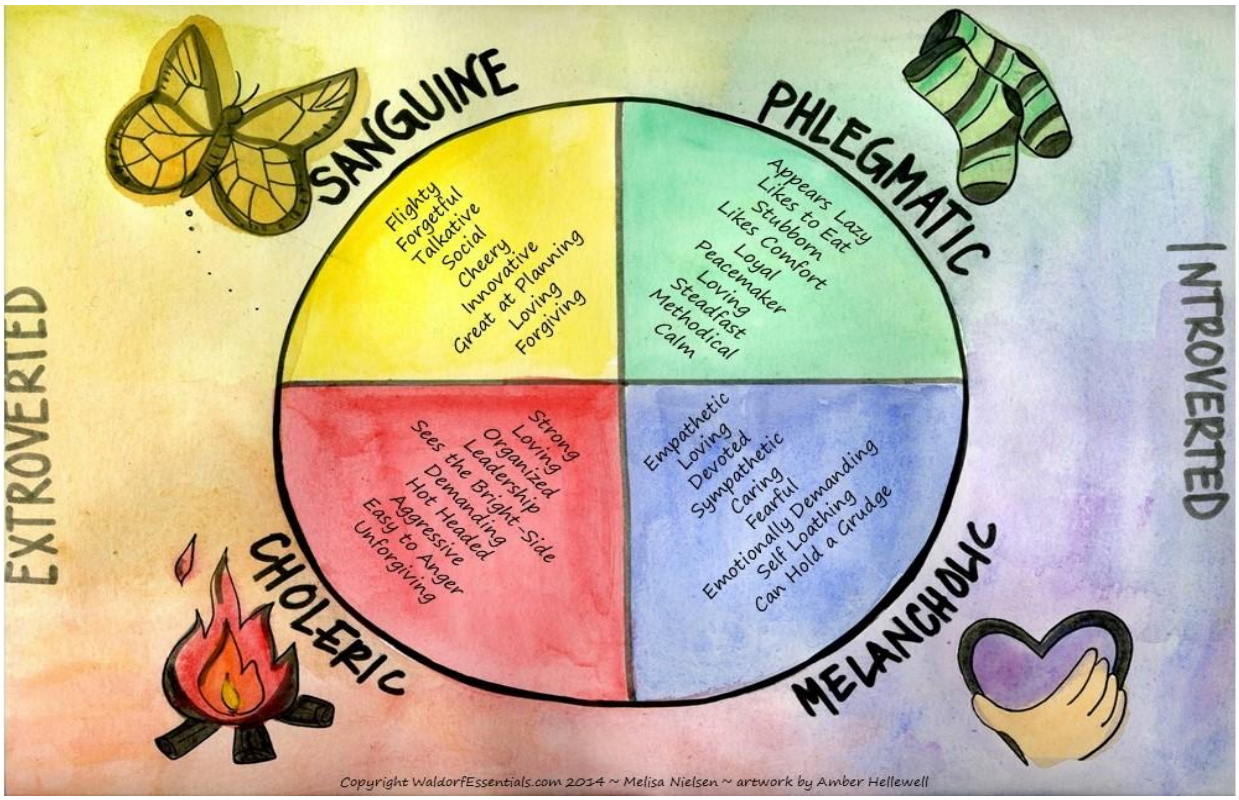
Character is in fact the outcome of a series of volitions, and it is for this reason we are responsible for our characters, as we are for the individual habits which go to constitute them.

Personality begins where compassion ends – KARL LAGERFELD

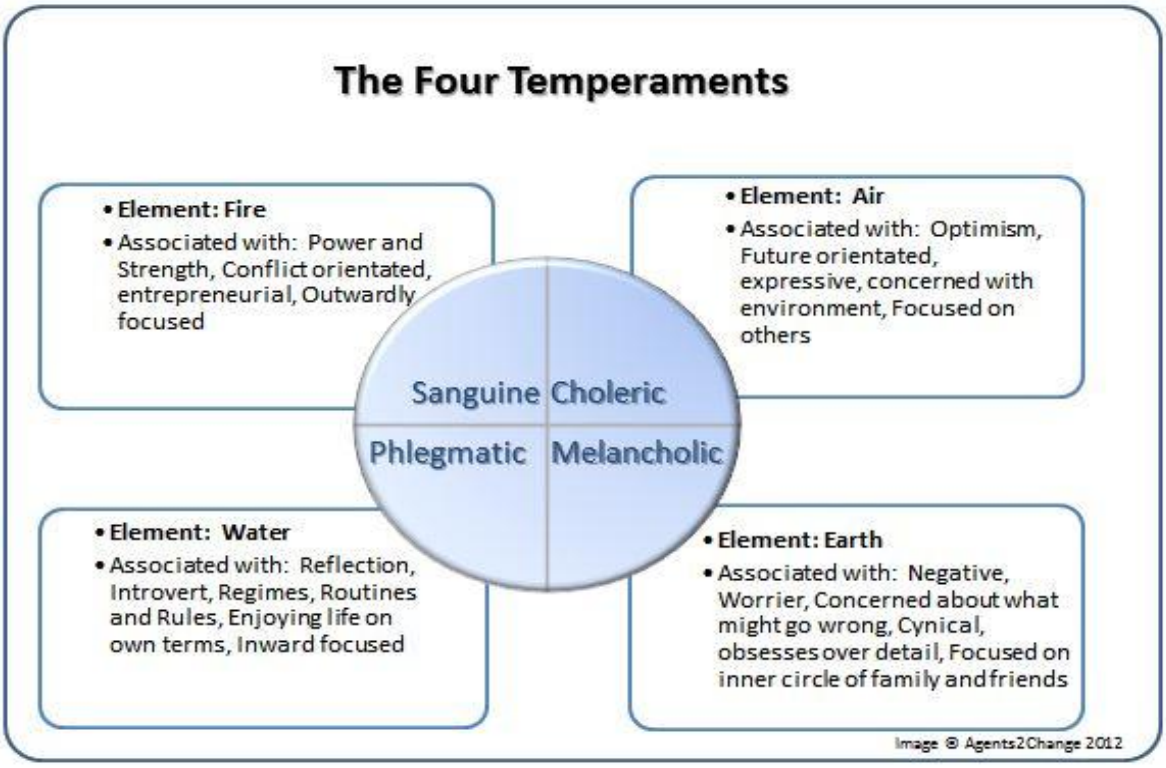
Humility is no substitute for a good personality – FRAN LEBONITZ



Personality is Who we are & What we do, when everybody is watching; Character is Who we are & what we do, when nobody is watching – J C WATTS



You express the truth of your character with the choice of your actions – Dr. STEVE MARABOLI



TYPES OF CHARACTER

From the four fundamental temperaments, various classifications of character have been adopted by different psychologists. The intellectual, the emotional, and the volitional or energetic are the chief types with A. Bain. M. Pérez, based on the phenomenon of movement, distinguishes characters as lively, slow, ardent, and well-balanced. M. Ribot, with more subjective division and excluding indefinite types as 'characterless', recognizes the forms as:

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

Ethics and Character

Whilst psychology investigates the growth of different types of character, ethics considers the relative value of such types and the virtues which constitute them. The problem of the true moral ideal is a question of the relative value of different types of character. The effect on the person's character of a particular form of conduct is a universally accepted as a test of its moral quality. Different systems of ethics emphasize different virtues in constituting the ideal moral character. With the utilitarian, who places the ethical end in the maximum

happiness for the whole community, *benevolence* will form the primary element in the ideal character. For the stoic, fortitude and *self-control* are the chief excellences.

In all conceptions of ideal character, firmness of will, fortitude, constancy in adhering to principle or in pursuit of a noble aim are held important. A man of character is frequently equivalent to being capable of adhering to a fixed purpose. Another essential is the virtue of justice, the recognition of the rights, duties, and claims of others. The richer the culture of the mind, the larger the intellectual horizon, the broader the sympathies, the more will the character approximate to the ideal of human perfection.

When wealth is lost, nothing is lost; when health is lost, something is lost; when character is lost, all is lost – BILLY GRAHAM

Education and Character

The aim of education is not only the cultivation of the intellect but also the formation of moral character. Increased intelligence or physical skill may as easily be employed to the detriment or benefit of the community, if not accompanied by improved will. It is the function of ethics to determine the ideals of human character. The theory and science of education are to study the processes by which that end may be attained.

Knowledge will give you power, but character respect – BRUCE LEE

BUILDING CHARACTER IN THE WORKPLACE

Managers have to influence and employ creative means of stressing the importance of good character in the workplace, in the following ways:

1. Employee Hiring, Training, and Promotion Activities

(*a*) Institute and adopt an organization policy statement to positive character in the workplace. For example, commitment to civility pledges. This may be communicated through printing on the back of the business cards of the employees.

(b) Prominently and explicitly include character considerations in recruiting procedures, during interviews and in the hiring deliberations.

(c) Emphasize the importance of character and adherence to the 'six pillars' of character in orientation, initial job training, and during in-service training. The six pillars of character are the ethical values, such as: trustworthiness, respect, responsibility, fairness, caring and citizenship. Respect means showing high regard for self, others, authority, property and country. It includes showing appreciation for cultural diversity by valuing all people as

human beings.

Responsibility is being accountable for one's actions, being dependable in carrying out obligations and duties, being reliable and consistent in word and action, and being committed to community development.

Integrity or fairness means showing the inner strength and courage to be truthful, trustworthy, fair and honest in all things. It includes acting justly and honourably. Caring means being kind, considerate, courteous, helpful, friendly and generous to others, and being compassionate by treating others as you would like to be treated. Citizenship means accepting and adopting civic rights and duties as a citizen of the country.

(d) Include evaluation of fundamental character values such as honesty, promise keeping, accountability, fairness, and caring, in appraisals/reviews.

(e) Institute recognition and reward system for the employees who exemplify the positive character. For example, awards and medals.

(f) Think of your employees, especially the younger ones, as people whose personal and work values will be influenced by what you expect of them and how you treat them.

(g) Think of your employees as present or future mentors, coaches, and volunteers.

The content of your character is your choice day by day, what you choose, what you think & what you is who you become – HERACLITUS

2. Internal Communication

Use internal communication channels to create a friendly environment that praises positive role modeling at the workplace and in the community by encouraging voluntarism, and mentoring, e.g., through Internal newsletters, Workplace posters in canteens and recreation rooms, Mailers, and Electronic mails.

How a person treats their family says a lot about their character – UNKNOWN

3. External Communication

In relations with customers, vendors and others, consciously communicate affirming messages about character and ethics, such as Advertise and market honouring consensual values (the six pillars), Assure that none of your products and services undermines character building, Include positive messages about voluntarism and celebrate, and 'Character counts' week in advertising, billings and other mailers.

Character is the result of two things: mental attitude & the way we spend our time – ELBERT HUBBARD

4. Financial and Human Resources

(i) Support local and national 'character' projects and the activities of the members by encouraging staff members to get involved. Offer incentives such as paying employees for the time they contribute at a local youth-service organization.

(ii) Sponsor 'character' movement through financial support.

Habits change into character – OVID

5. Community Outreach

(i) Use public outreach structures to encourage mentoring and other character-building programs.

(ii) Encourage educational and youth organizations to become active in character building.

(iii) Use corporate influence to encourage business groups (chambers of commerce, conference boards, and Rotary clubs) and other companies to support 'character' building.

Character is a journey, not a destination – BILL CLINTON

Remember that your character is your destiny – ANONYMOUS

SPIRITUALITY

Spirituality is a way of living that emphasizes the constant awareness and recognition of the spiritual dimension (mind and its development) of nature and people, with a dynamic balance between the material development and the spiritual development.

Spirituality is motivation as it encourages the colleagues to perform better. Spirituality functions as a fertilizer for the soil 'character' to blossom into values and morals. Spirituality is also energy and flexibility as well.

Spirituality includes

- Creativity,
- Communication,
- Recognition of the individual as human being (as opposed to a life-less machine),
- Respect to others, acceptance (stop finding faults with colleagues and accept them the way they are),
- Vision (looking beyond the obvious and not believing anyone blindly), and
- Partnership (not being too authoritative, and always sharing responsibility with others, for better returns).

You have to grow from the inside out. None can teach you, none can make you spiritual.

There is no other teacher but your own soul – SWAMI VIVEKANANDA

Spirituality doesn't come from the religion, it comes from the soul – UNKNOWN

Spirituality in the Workplace

Building spirituality in the workplace: Spirituality is promoted in the workplace by adhering to the following activities:

1. Verbally respect the individuals as humans and recognize their values in all decisions and actions.
2. Get to know the people with whom you work and know what is important to them. Know their goals, desires, and dreams too.
3. State your personal ethics and your beliefs clearly.
4. Support causes outside the business.
5. Encourage leaders to use value-based discretion in making decisions.
6. Demonstrate your own self-knowledge and spirituality in all your actions.
7. Do unto others as you would have them do unto you.

You are a spiritual being with human experience. You're are not a human being with spiritual experience – DEEPAK CHOPRA

Spirituality for Corporate Excellence

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

1. ***Self-awareness*** **—** Realization of self-potential. A human has immense capability but it needs to be developed.
2. ***Alertness in observation and quickness in decision making***, i.e., spontaneity which includes quick reflexes, no delay but also no hasty decisions.
3. ***Being visionary and value based*** **—** this includes an attitude towards future of the organization and the society, with clear objectives.
4. ***Holism*** **—** Whole system or comprehensive views and interconnected with different aspects. Holistic thinking, which means the welfare of the self, family, organization and the society including all other living beings and environment.
5. ***Compassion*** **—** Sympathy, empathy and concern for others. These are essential for not only building the team but also for its effective functioning.
6. ***Respect for diversity*** **—** it means search for unity in diversity i.e., respect others and their views.
7. ***Moral Autonomy*** **—** it means action based on rational and moral

judgment. One need not follow the crowd or majority i.e., band-wagon effect.

8. *Creative thinking and constant reasoning* — think if we can do something new and if we can improve further?
9. *Ability to analyse and synthesize* — Refrain from doing something only traditional.
10. *Positive views of adversity* — Make adversities one's source of power—a typical Karma yogi's outlook! Every threat is converted into opportunity.
11. *Humility* — the attitude to accept criticism (it requires courage!) and willing to correct. It includes modesty and acknowledging the work of colleagues.
12. *Sense of vocation* — Treat the duty as a service to society, besides your organization.

Your profession is not what brings home your weekly paycheck, your profession is what you're put here on earth to do, with such passion & such intensity that it becomes spiritual in calling – VINCENT VANGOGH

YOGA FOR PROFESSIONAL EXCELLENCE

Yoga is one of the six foundations of Indian philosophy & has been used for millennia to study, explain and experience the complexities of the mind & human existence. The yoga way of life encompasses the philosophy of

- **Karma yoga** (path of detached action)
- **Janana yoga** (knowledge of self)
- **Bhakthi yoga** (trust in supreme order)
- **Raja yoga** (asana, pranayama, kriyas, mudras, bandhas, meditation etc.,)

Hatha yoga practices like asanas (i.e., posture), pranayama (i.e., breathing practices intended to influence vital forces), kriyas (i.e., cleaning process), mudras (i.e., certain internal attitudes) and bandhas (i.e., neuro muscular locks) are mostly taught as physical practices.

Originally developed for personal spiritual growth, yoga offers a well formulated approach to planned changes and the emperical studies revealed that the long-term practitioners of yoga had acquired a remarkable voluntary control over there autonomic process which helped them in coping with psychological stress.

Yoga has significant effect on managing stress and enhance work performance by boosting health, harmony, morale, work motivation,

commitment, performance and productivity at individual and organizational levels.

From the centre of mindfulness in medicine, health care and society at the university of Massachusetts Medical schools, a yoga based program named mindfulness based stress reduction program (MBSR) used for stress reduction which also enhance functional status and well being with reduced physical symptoms and psychological distress which helps to have long term beneficial effects.

In today stress prone environment, these techniques will be highly effective for enhancing the effectiveness, efficiency, performance and cultivating right attitude among employees (professional excellence) and reducing workplace stress

MEDITATION FOR PROFESSIONAL EXCELLANCE

Meditation is also a form of yoga dealing mentally to combat stress and revitalize the mind. Meditation is a skill tool for life enhancement, work place efficiency, and stress management, emotional and spiritual fulfillment.

Meditation procedure:

- Choose a word or phrase (such as peace, om, amen)
- Sit in a comfortable position
- Close your eyes, relax your muscles and allow yourself to breath slowly and naturally
- As you exhale, repeat the word or phrase
- Do this for 10 to 20 minutes once or twice a day

Once you follow this procedure, you may notice that your stress drifting away along with your exhalation. Meditation that cultivates mindfulness is particularly effective at reducing stress, anxiety, depression and other negative emotions. It helps in balancing mind and body and increasing mental alertness, concentration resulting in clarity of decision making

The act of meditation has made its way into the corporate environment and is one of the best ways to reduce stress in the workplace. It is a skill that can be easily learning and can be anywhere, anytime stress occurs walking down the hall, at a workers desk or in a stressful meeting

Meditation is a useful and practical relaxation technique to continuously relax your body and focus your thoughts on one thing for a sustained period. This occupies your mind, diverting it from the problems that are causing you stress and gives your body a time to relax and recuperate and to clear way stress hormones.

Even a few minutes of meditation done throughout the day can make a

huge difference in a workers attitude, productivity and effectiveness.

STRESS MANAGEMENT

S no	Causes	Consequences of distress
1.	Work related stressors • Interpersonal stressors • Role related stressors • Task control stressors • Organizational-physical environment stressors	Physiological • Heart diseases • Ulcers • High blood pressure • Head aches • Sleep disturbances • Increased illness
2.	Non work stressors • Time-based • Strain based • Role based conflict	Psychological • Job dissatisfaction • Low commitment • Exhaustion • Depression • Moodiness • burnout
3.	Individual differences • Personal health • Knowledge skills • Coping skills • Reliance work holism	Behavioural • More accidents • Faculty decisions • Higher absenteeism • Workplace aggression • Turnover/absenteeism

Causes and consequences of workplace stress

Stress management is important for both individual and from the point of view of the organization. Effective management of job stress can only be achieved under two conditions:

- ❖ Individual workers must be able to recognize stressor and understand their consequences.
- ❖ Organizations must develop stress prevention, as well as stress reduction techniques

Organisations have to arrange a stress management program that focuses on different categories of employees at all hierarchical levels. Stress management is important for both individual and from the point of view of the organisation. There are two basic approaches to cope with stress i.e., individual oriented approach and organisational oriented approach

INDIVIDUAL ORIENTED STRATEGIES FOR COPING WITH STRESS

- ***Sole active –*** reading, writing, photography, art, playing a musical instrument, collection of different things, running, hobbies, vacation
- ***Group activities –*** sports, games, eating out, vacations
- ***Solo-passive/group-passive –*** television, movies, shows and theatres, listening to music, concerts, operas, sporting events and vacations
- ***Yoga and meditation***

ORGANISATIONAL ORIENTED STRATEGIES FOR COPING WITH STRESS

The corporate body has also a moral responsibility to practice healthy work culture and environment. Each corporate policy makers must analyze their environments. Evaluate alternative contingency strategies for likely future scenario. *Yoga, meditation and humour are the best antidote for workplace stress.*

UNIT – II

ENGINEERING ETHICS

Engineering Ethics is the study of the decisions, policies and values that are morally desirable in engineering practice and research.

Engineering ethics consists of the responsibilities and rights that ought to be endorsed by those engaged in engineering, and also of desirable ideals and personal commitments in engineering.

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

Engineering ethics is the study of moral decisions that must be made by engineers in the course of engineering practice. Engineering is the largest profession and the decisions and actions of engineers affect all of us in almost all areas of our lives, namely public safety, health, and welfare.

It is important for engineering students to study ethics so that they will be prepared to respond appropriately to ethical challenges during their careers.

SCOPE OF ENGINEERING ETHICS

- Engineering projects are social experiments that generate both new possibilities and risks, and engineers share responsibility for creating benefits, preventing harm & pointing out dangers.
- Moral values permeate all aspects of technological development, and hence ethics and excellence in engineering go together.
- Personal meaning and commitments matter in engineering ethics, along with the principles of responsibility that are stated in codes of ethics and are incumbent on all engineers.
- Promoting responsible conduct is even more important than punishing wrong – doing.
- Ethical dilemmas arise in engineering, as elsewhere, because moral values are myriad and can conflict.
- Engineering ethics should explore both micro &macro issues, which are often connected.
- Technological development warrants cautious optimism.

SENSES OF ENGINEERING ETHICS

The senses of engineering ethics are

- Normative sense
- Descriptive sense

In ***Normative sense***, engineering ethics refers to justified moral values in engineering. In ***Descriptive sense***, social scientists study ethics when they describe and explain what people believe & how they act; they conduct opinion polls, observe behavior, examine documents written by professional societies & uncover the social forces shaping engineering ethics.

VARIETY OF MORAL ISSUES

To some extent, we also need to consider his/her personal life from a moral perspective, as personal & professional lives are interlinked. A person who thinks rationally and wants a clear conscience will face many situations in his/her professional life that would make him/her think about the ethicality of his/her actions.

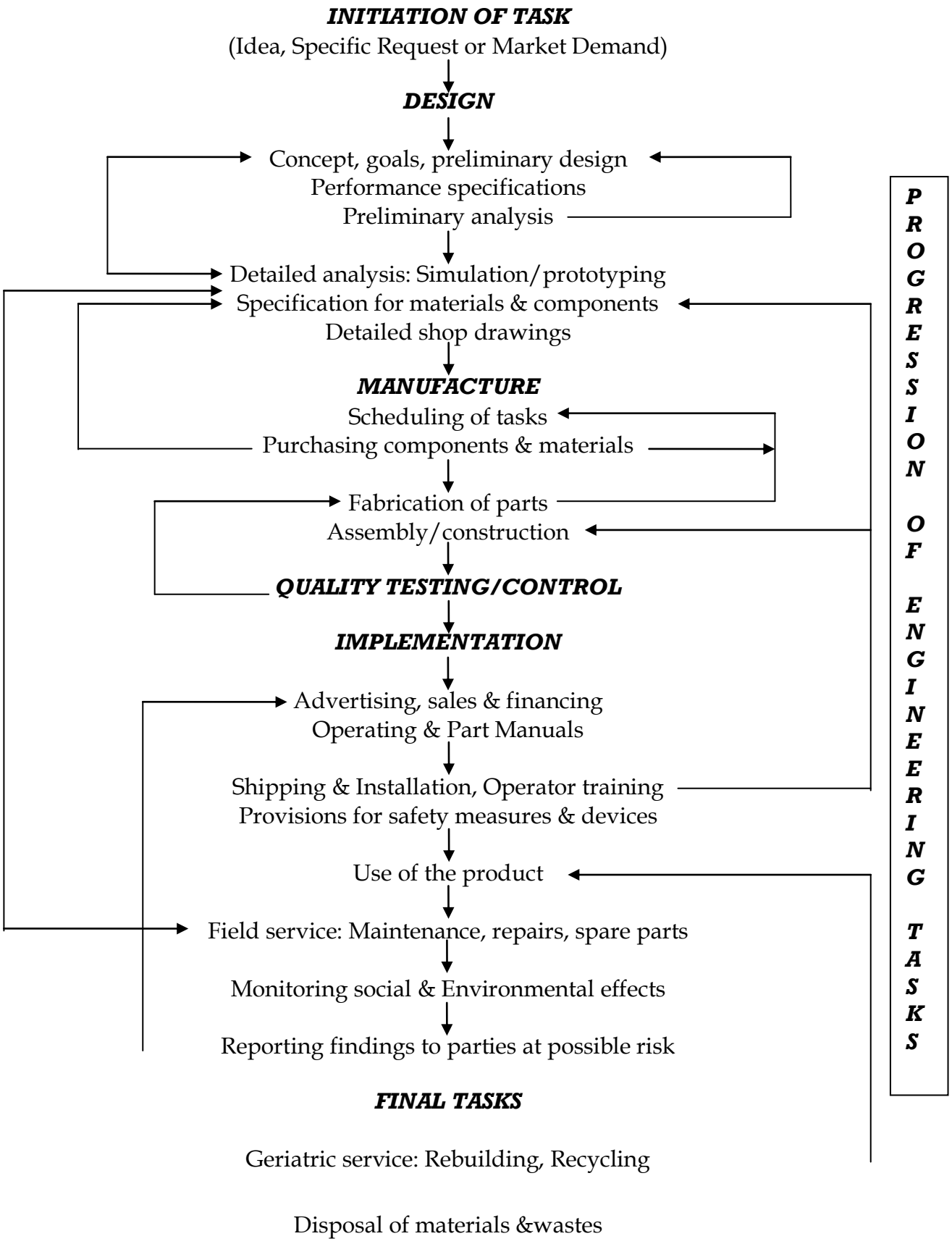
We can classify the moral issues faced by a professional into two major classes namely, ***Micro – ethical issues & Macro – ethical issues***.

MICRO ETHICAL ISSUES These are problems frequently faced by a person in his/her day to day functioning. The issues maybe small but can nag a rational person's mind and give him/her sleepless nights. These are issues where he/she has to decide what actions he/she should take and if he/she is prevented from taking actions that he/she thinks are right, then what is to be done. Plenty of such issues appear in a professional's life now and then.

MACRO ETHICAL ISSUES These issues deal with societal problems that are not often addressed or are neglected until they acquire gigantic proportions. Many national disasters fall under this category, where the engineer may only be a cog in the wheel. Bhopal gas leak is such an example.

Both these types deserve our attention. A professional needs to concern himself with such issues as these help one to look at systematic issues that are of great significance.

- While the day to day small issues need to be resolved, one should look at the macro issues which have great ethical implications & will benefit the society in the long term.
- Since macro issues are likely to be in the realm of senior managements, the professional may not be directly involved but as a professional he/she needs to understand the systematic problems that cause such instances of difficulty.


INITIATION OF TASK
(Idea, Specific Request or Market Demand)
DESIGN
Concept, goals, preliminary design
Performance specifications
Preliminary analysis
Detailed analysis: Simulation/prototyping
Specification for materials & components
Detailed shop drawings
MANUFACTURE
Scheduling of tasks
Purchasing components & materials
Fabrication of parts
Assembly/construction
QUALITY TESTING/CONTROL
IMPLEMENTATION
Advertising, sales & financing
Operating & Part Manuals
Shipping & Installation, Operator training
Provisions for safety measures & devices
Use of the product
Field service: Maintenance, repairs, spare parts
Monitoring social & Environmental effects
Reporting findings to parties at possible risk
FINAL TASKS
Geriatric service: Rebuilding, Recycling
Disposal of materials &wastes
PROGRESSION OF ENGINEERING TASKS

Ethical issues arise as a product develops from a mental concept to physical completion. Engineers encounter both moral & technical problems concerning variability in the materials available to them, quality of work by co-workers at all levels, pressure imposed by time & the whims of marketplace and relationships of authority within the corporation.

ENGINEERING TASKS & POSSIBLE PROBLEMS

TASKS	***SELECTION OF POSSIBLE PROBLEMS***
CONCEPTUAL DESIGN	Blind to New concepts. Violation of patents or trade secrets. Product to be used illegally.
GOALS: PERFORMANCE SPECIFICATIONS	Unrealistic assumptions. Design depends on unavailable or untested materials
PRELIMINARY ANALYSIS	Uneven: overly detailed in designer's area of expertise, marginal elsewhere
DETAILED ANALYSIS	Uncritical use of handbook data & computer programs based on unidentified methodologies
SIMULATION, PROTOTYPING	Testing of prototype done only under most favorable conditions or not completed
DESIGN SPECIFICATIONS	Too tight for adjustments during manufacture & use. Design changes not carefully checked
SCHEDULING OF TASKS	Promise of unrealistic completion date based on insufficient allowance for unexpected events
PURCHASING	Specifications written to favour one vendor. Bribes, kickbacks, inadequate testing of purchased parts
FABRICATION OF PARTS	Variable quality of materials & workmanship. Bogus materials and components not detected
ASSEMBLY/CONSTRUCTION	Workplace safety. Disregard of repetitive – motion stress on workers. Poor control of toxic wastes
QUALITY CONTROL/TESTING	Not Independent, but controlled by production manager. Hence, tests rushed or results falsified
ADVERTISING & SALES	False advertising (availability, quantity). Product oversold beyond client's needs or means

SHIPPING, INSTALLATION, TRAINING	Product too large to ship by land. Installation & Training subcontracted out, inadequately supervised
SAFETY MEASURES & DEVICES	Reliance on overly complex, failure – prone safety devices. Lack of a simple "safety exit"
USE	Used inappropriately or for illegal applications. Overloaded operations manuals not ready.
MAINTENANCE, PARTS, REPAIRS	Inadequate supply of spare parts. Hesitation to recall the product when found to be faulty
MONITORING EFFECTS OF PRODUCT	No formal procedure for following life cycle of product, its effect on society and environment
RECYCLING/DISPOSAL	Lack of attention to ultimate dismantling, disposal of product, public notification of hazards

EXAMPLES OF MORAL ISSUES

- A junior engineer working at a construction site feels that the concreting of the roof is being done incorrectly. Too much water is being added arbitrarily & due to paucity of labour, the concrete being mixed at the site is not placed in position in time. He talks to his executive engineer about this problem.

  The executive engineer tells him to ignore this because he has a soft corner for the contractor. He says that he has done supervision at many sites and knows when to take action. He advises the junior engineer to ignore it and proceed with the construction supervision. The junior engineer feels that this will result in a weekend structure and will cause leakages in the long run. What should he do?
- As an engineer, you pass by a construction site every day. You think that the safety of workers is not being taken care of by the construction firm. The rickety scaffolding is very dangerous and it is not properly made and supported. The workers working at great height are in the degrees of falling to the ground and there are no safety nets provided. You feel it is a hazardous situation that could potentially lead to a tragedy. You are not concerned with the work but something is bothering your mind.

  Should you report your apprehensions or should you keep quiet? What if after a few days, you get to read in the newspaper that, at that very construction site, a labourer fell from the scaffolding & died. Would you

be filled with remorse because you have not done your duty as an engineer & a professional or even as a citizen?

SKILLS REQUIRED TO HANDLE MORAL ISSUES

Refer Mike Martin & Roland for Details...

TYPES OF INQUIRIES

Engineering ethics combines inquiries into values, meanings and facts. The edifice of professional ethics is based upon our understanding of many aspects concerning our lives and the correct moral stand that we have to take. There is an outgoing search for the ethically correct action to be taken in a given situation in professional practices & changes continuously.

Such inquiries can be categorized into three types, in solving ethical problems are: ***Normative inquiry***, ***which are most central seek to identify the values that should guide individuals & groups. Conceptual inquiry seeks to clarify important concepts or ideas whether the ideas are expressed by single words or by statements and questions. Factual or Descriptive inquiry seeks to provide facts needed for understanding & resolving value issues.***

NORMATIVE INQUIRIES

Normative inquiry is probably the most significant inquiry that deals with developing norms for professional conduct. Such enquiry must be supported by the clarity of concepts & principles encompassing the particular profession over its entire spectrum of activities. Such inquiries try to answer questions about what should be the correct nature of professional practice or what can be called a good professional practice.

Normative questions are about what ought to be and what is good, based on moral values. Normative inquiry deals with questions such as the following:

- What are the rights & responsibilities of a professional?
- When and how should a professional exercise his/her rights?
- What are the obligations of professionals to the public as they perform their duties?

CONCEPTUAL INQUIRIES

Conceptual Inquiry is related to the profession itself. It helps us understand the profession and its various aspects & implications better from an ethical point of view. It helps us to understand the concepts & principles associated with the profession itself, as they come up as duties & rights of a professional. Some questions that can be answered by such inquiries are:

- What is a profession?

- Who is a professional?
- What is meant by professionalism?
- What are the concepts and principles having a bearing on professional ethics that need to be defined & clarified?
- What kind of control or monitoring mechanism should be put in place to ensure ethical conduct by professionals?

The concepts & principles evolve and get clarified over a period of time with the experience from dealing with moral issues related to the profession. The idea get fine tuned with experience.

FACTUAL OR DESCRIPTIVE INQUIRIES

This relates to collecting & collating information on many aspects of the profession. Researchers conduct factual inquiries using mathematical or statistical techniques. **The inquiry provide important information on business realities, engineering practice, and the effectiveness of professional societies in fostering moral conduct, the procedures used in risk assessment, and psychological profiles of engineers.** The facts provide not only the reasons for moral problems but also enable us to develop alternative ways of resolving moral problems. Questions that may be answered/Descriptive Inquiry deals with the following:

- How (many) have the practices in the particular profession developed over the years?
- What are the basic concepts & principles that guide the current practices in the profession?
- What is the ethical & psychological profile of the professionals in the system?
- Do the professional have enough guidelines & mechanism to undertake an analysis of the safety and risk factors in the practice of the profession?
- How much is the influence or effectiveness of the professional societies in guiding ethical practices among its member professionals?
- How much care is taken by the employers or professional societies to sensitive the professionals about ethical issues in the profession?
- How effective are the codes of conduct or punitive measures for professional misconduct?

Such research collects information that helps us improve ethical conduct in professional groups. The information flow can also help us take decisions on moral issues as & when problems crop up in professional practice.

MORAL DILEMMAS

Moral (or Ethical) Dilemmas are situations in which moral reasons come into conflict, or in which the application of moral values are unclear and it is not immediately obvious what should be done.

Simply, Moral Dilemmas, at the very least, involve conflicts between moral requirements.

We are faced with moral dilemmas almost every day, both at the individual level & at the societal level. Few reasons for moral dilemmas are discussed below:

REASONS FOR MORAL DILEMMAS

- Moral dilemmas arise due to conflict of interest or due to ignorance of what is the correct thing to do in a given situation
- Moral dilemmas also arise due to conflict of moral principles. We face a dilemma when our moral beliefs such as duty, rights, principles & values come into conflict in a given situation. (telling lie/hiding truth)
- Moral dilemmas occurs due to lack of clarity in a given situation whether a particular act is immoral or not
- Moral dilemmas occur in situations where there is no agreement on what is the right course of action.

TYPES OF MORAL DILEMMAS

- Self – imposed moral dilemmas
- Dilemmas imposed on an agent by the world
- Obligation dilemmas
- Prohibition dilemmas

Based on conflicts

- Epistemic conflicts, conflicts between two (or more) moral requirements; it is difficult for the agent to tell which requirement prevails/precedes (priority based on situation)
- Ontological conflicts, conflicts between two (or more) moral requirements & neither are overridden.

Genuine moral dilemmas, if there are any, are ontological. Both opponents & supporters of dilemmas acknowledge that there are epistemic conflicts.

We might divide ethical dilemmas into two broad categories:

- Right – wrong
- Better – worse

Some ethical dilemmas have solutions that are either right (obligatory) or wrong (morally forbidden); other dilemmas have more than one permissible solution, some of which are better or worse than others in some aspects or overall.

STEPS TO SOLVE DILEMMA

- MORAL CLARITY – Identify the relevant moral values
- CONCEPTUAL CLARITY – Clarify key concepts
- INFORMED ABOUT THE FACTS – Obtain relevant information
- INFORMED ABOUT THE TOPICS – Consider all genuine options
- WELL REASONED – Make a reasonable decision

MORAL CLARITY – IDENTIFY THE RELEVANT MORAL VALUES

- Most basic step in confronting ethical dilemmas by being aware of them
- Identifying the moral values & reasons applicable in the situations bearing them in mind as further investigations are made
- Values & reasons might be obligations, duties, rights, goods, ideals or other moral considerations (it matters which kind of consideration we are considering)

CONCEPTUAL CLARITY – CLARIFY KEY CONCEPTS

- Professionalism requires being a faithful agent of one's employer, but does that mean doing what one's supervisor directs or doing what is good for the corporation in the long term?
- In particular when one's supervisor is adopting a short term view that could harm the long – term interests of the corporation

INFORMED ABOUT THE FACTS – OBTAIN RELEVANT INFORMATION

- Gathering information that is relevant in the light of the applicable moral values
- Sometimes the primary difficulty in resolving moral dilemmas is uncertainly about the facts, rather than conflicting values perse.

INFORMED ABOUT THE TOPICS – CONSIDER ALL GENUINE OPTIONS

- Initially, ethical dilemmas seem to force us into a two way choice: Do this or do that.
- Either bow to one's supervisor's orders or blow the whistle to the town authorities
- A closer look often reveals additional options (some writing down the main options and sub options as a matrix or decisions ensures that all options are considered)

WELL REASONED – MAKE A REASONABLE DECISION

- Arrive at a carefully reasoned judgment by weighing all the relevant moral reasons and facts (can't be made by using a simple program/computer/ as a mechanical process).

- It is a deliberation aimed at taking into accounts all the relevant moral reasons, facts and values & doing so in a morally reasonable manner.
- If there is no ideal solution, we seek at least a satisfactory one
- Often a code of ethics provides a straight forward solution to dilemmas, but not always.

MORAL AUTONOMY

AUTONOMY means ***Self – Determining* or *Independent.*** But not just any kind of independent reflection about ethics amounts to moral autonomy.

Moral autonomy can be viewed as the skill and habit of thinking rationally about ethical issues on the basis of moral concern.

This foundation of moral concern, or general responsiveness to moral values, derives primarily from the training we receive as children in being sensitive to the needs & rights of others, as well as of ourselves. When such training is absent, as it often is with seriously abused children, the tragic result can be an adult social path who lacks any sense of moral right & wrong.

Sociopaths (or psychopaths) are not morally autonomous, regardless of how "independent" their intellectual reasoning about ethics might be.

Improving the ability to reflect carefully on moral issues can be accomplished by improving various practical skills that will help produce autonomous thought about moral issues. As related to engineering ethics, these skills include the following:

- MORAL AWARENESS – Proficiency in recognizing moral problems & issues in engineering
- COGENT MORAL REASONING – Comprehending, classifying and assessing arguments on opposite sides of moral issues
- MORAL COHERENCE – Forming consistent & comprehensive viewpoints based upon a consideration of relevant facts
- MORAL IMAGINATION– Discerning alternative responses to moral issues & receptivity to creative solutions for practical difficulties
- MORAL COMMUNICATION– Precision in the use of a common ethical language, a skill needed to express & support one's moral views adequately to others.

These are the direct goals in college courses & they center on cognitive skills (skills of the intellect in thinking clearly & cogently). Few more skills that specify aspects of moral commitment and responsible conduct are:

- MORAL REASONABLENESS – the willingness & ability to be morally reasonable
- RESPECT FOR PERSONS – Genuine concern for the well – being of others

as well as one self

- TOLERANCE OF DIVERSITY – Within a broad range, respect for ethnic & religious differences and acceptance of reasonable differences in moral perspectives.
- MORAL HOPE – Enriched appreciation of the possibilities of using rational dialogue in resolving moral conflicts.
- INTEGRITY – maintaining moral integrity & integrating one's professional life & personal convictions.

A foundation of moral concern must be presupposed, as well as evoked & expanded, in studying ethics at college level.

Moral autonomy refers to the freedom & self reliance of an individual to take moral decisions or hold moral points of view.

Moral Autonomy is just not any independent decisions taken place by a professional; moral values & ethical conduct imbibed from childhood form the background for a professional to have Moral Autonomy.

Moral Autonomy is the ability to think critically & independent about moral issues and to apply this moral thinking to situations that arise in the course of professional engineering practice. The goal of this course is to foster the moral autonomy of future engineers.

Complete freedom of choice, in the sense that we are free to make any choice we please from an unlimited list of alternatives, is an unrealistic ideal & this cannot be what autonomy requires. At the other extreme, *it would be absurd to say that slaves are free simply because they can choose to obey their master or accept the consequences.* There must be some point between these two extremes where we are justified in saying that a person is acting autonomously.

In short, *a society fosters autonomy to the extent that it makes it possible for people to decide for themselves how they want to live and enable them to implement their decisions effectively.* ***Violent children become violent adults. Preventing violent offenders' works best if you begin in the nursery.***

MORAL DEVELOPMENT THEORIES

Moral development theories are concerned with the development of moral principles in humans. Since a very young age, a child develops some moral perceptions of what is right or wrong. For example, some children would be willing to share things with other children, whereas some children throw a tantrum if their things are even touched by other children.

Moral children are becoming an increasingly relevant topic in the field of education. Media reports consistently talk of increased violence across the board among children, religious and other groups, common people, students and have

become such a common phenomenon that many people believe that there is an acute moral crisis among human beings.

Fortunately, systematic research & scholarship on moral development has been going on for a long time now. We will discuss some of the major works of researchers on this issue & nothing concrete has been arrived on final theory for implementing some actions in this important area. We will look at four basic theories:

- ***PIAGET's theory***
- ***KOHLBERG's theory***
- ***The Domain theory***
- ***GILLIGAN's theory***

PIAGET'S THEORY

Jean Piaget (1896 – 1980) was among the 1st psychologists to study moral development in children. While his work on cognitive development commanded worldwide attention, his theory on moral development is comparatively less known than those by other psychologists. However, his work in this area inspired the well – known theory put forth by Lawrence Kohlberg, whose work remains directly relevant to contemporary theories of moral development.

Piaget focused on the development of moral ideas among children & he developed some ideas about moral development from his interactions with children; he also discussed with them the rules of the games played with marbles & discussed with them their ideas about unethical acts such as telling lies, stealing etc., He formed a hypothesis that people develop knowledge & ideas of morality from constantly interacting with the environment around them.

Piaget called the early stage of moral reasoning the heteronomous stage wherein children believe in the absolute & intrinsic nature of the rule. The heteronomy arises from factors such as ***CHILDREN'S EGOCENTRISM & MORAL REALISM***.

EGOCENTRISM relates to a child's cognitive structure, makes children stick to their views, lack the ability to discern & discriminate between others views & change their stand on issues, makes children force their views on others.

MORAL REALISM associated with objective responsibility, (i.e.,) why young children are more concerned about outcomes than intentions, it also leads to a belief in imminent result for wrong actions.

Piaget's theory is essentially a two – stage theory that applies to children of two age groups – six year olds & twelve year olds. The first is called the Morality of Constraint and the second is the Morality of Cooperation. The features are

- ***Point of view***
- ***Rules***
- ***Intention***
- ***Punishment***
- ***Respect for authority***
- ***Concept of justice***

FEATURES	***MORALITY OF CONSTRAINT (TYPICAL SIX – YEAR OLD)***	***MORALITY OF COOPERATION (TYPICAL TWELVE YEAR OLD)***
POINT OFVIEW	Child has a single, absolute, moral perspective (believes that a particular behavior is right/wrong & that everyone sees it the same way)	Child is aware of differing viewpoints regarding rules & put themselves in the place of others, not absolute in their judgement
RULES	Child sees rules as sacred & unchangeable or ***carved in stone***	Child understands that rules are made by people & can be altered by people
INTENTION	Child is under the impression that the extent of guilt is determined by amount of damage done by an act & not by the motivation behind the action	Child judges actions by intentions & not by consequences & also knows that wrongdoer intention will be considered while evaluating guilt
PUNISHMENT	Child tends to define moral wrong in terms of what is forbidden/punishable. Expects severe punishment for wrong doing & feels the punishment itself defines wrongness of the act	Child expects milder punishment. Punishment should involve restitution or suffering the same fate as the victim of someone's wrongdoing. Peer aggression punished by retaliatory behavior by victim
RESPECTY FOR AUTHORITY	Peer aggression must be punished by an external authority/parent. The child has tendency to run to one of the parents for protection or justice	Mutual respect for authority & peers allows children to value their own opinions & judge other people realistically. Children should obey rules because of mutual concern of rights of others
CONCEPT OF JUSTICE	Child should obey laws because it is set as rule by father, mother/teacher. Confuses moral laws with physical laws that any accident/misfortune happened as punishment by god/supernatural force	Child does not confuse natural misfortune with punishment

CONCLUSIONS OF PIAGET'S THEORY

- To help in moral education in schools lay emphasis on problem solving, ensure cooperative decision – making & guide students in working out common rules based on fairness
- A teacher has to perform the difficult task of not imposing values on children but letting them again acquire such values by their own experiences
- The educator must provide students with opportunities for personal discovery through problem solving, rather than indoctrinating students with norms.

Piaget's theory stimulated further work on moral development by many other psychologists.

KOHLBERG'S THEORY

Lawrence Kohlberg (1969) did extensive research to modify & extend Piaget's work. His work prepared the ground for the current debate in psychology on moral development. As an extension of Piaget's theory, Kohlberg suggested that children, in general, form different ways of thinking through their experiences, which include comprehending moral concepts such as justice, rights, equality & human welfare. Kohlberg extended the development of moral judgement to age groups beyond those studied by Piaget.

SIX STAGES OF KOHLBERG'S THEORY OF MORAL DEVELOPMENT

LEVELS	***STAGES***	***ESSENTIAL FEATURES***
PRE - CONVENTIONAL	1	Obedience & Punishment – oriented
	2	Individualism & Exchange
CONVENTIONAL	3	Good Interpersonal Relationships
	4	Maintaining Social Order
POST - CONVENTIONAL	5	Social Contract & Individual Rights
	6	Universal Principles

He proposed that the process of attaining moral maturity was more gradual & took much more time what Piaget had suggested. On the basis of his research, Kohlberg classified moral reasoning into six stages grouped into three major levels. According to Kohlberg's proposal, each level represented a fundamental shift in the socio – moral perspective of the individual.

LEVEL 1: PRE – CONVENTIONAL LEVEL

The first stage is *HETERONYMOUS ORIENTATION*. In this stage, the focus is on attempts to avoid breaking rules that are followed by punishment; also one opts for distance for its own sake and to avoid the physical consequences of an

action on individuals & property.

The second stage, one can see the ***EARLY EMERGENCE OF MORAL RECIPROCITY***. Moral orientation focuses on the instrumental, pragmatic value of an action. One follows the rules or norms only when it is of immediate interest to the self. The concept of something right is relative, based on a fair sense of an equal exchange, a deal or an agreement.

LEVEL 2: CONVENTIONAL LEVEL

At conventional level of reasoning, they have a **basic understanding of conventional morality.** The rules and societal norms become a characteristic of the individual & he/she tends to uphold them consistently. **He/she tends to view morality as acting in accordance with societal norms.** Within this understanding and reasoning, individual interests take a backseat & the individual tends to be more aware of shared thoughts & feelings, agreements & expectations.

In the first stage of the conventional level (stage 3), **individual tends to define what is right in terms of what is expected from others close to them.** They also tend to think in terms of roles that are stereotypical & defined by what is perceived as good within the family or close relations. This develops the idea of maintaining good relationships & being loyal, honest, grateful, respecting others etc., **Perspective is of the family or a limited local community & the concept of morality in a generalized social system has not evolved at this stage.**

In the second stage of the conventional level (stage 4), there is a shift from what is expected in terms of local norms & role expectations to defining what is right in a larger social context. **The member of society perspective brings about a change in moral standards and roles in the larger context of a social system.** This is a situation in which one is being moral by fulfilling the actual duties defining one's social obligations & responsibilities. **A system of laws and the need for everyone to respect them is considered important** for developing a social order conducive for peaceful living.

LEVEL 3: POST – CONVENTIONAL LEVEL

This level is characterized by reasoning based on principles from a society's perspective.

In the first stage of the post conventional level (stage 5), **Individuals have a stronger social perspective and take decisions & act based on reasoning using principles that come from rules & norms.** While respecting rules & norms, there is no support for uniform application of the rules. The stage 5 attributes have been supported by empirical studies.

The last stage of Kohlberg's model (stage 6), can be considered as **a transformation of the individual from a local domain to a universal domain. The individuals develop respect for universal norms & rules.** This stage is a theoretical end point & a logical follow up of the previous stage; **individuals develop a much wider perspective & imbibe ethical principles that can be said to be universal.** This last stage of moral judgement calls for reasoning based on the ethical fairness from which moral laws would be devised. **Rules and norms are considered in terms of their conformity with basic principles of fairness, rather than on the basis of their acceptance within an existing social order.**

Thus the individual develops an understanding that the elements of ethics, such as regard for life & human welfare, transcend particular cultures & geographical boundaries and are to be supported irrespective of any other rules or normative obligations.

Kohlberg's researches have empirically supported these findings from longitudinal & cross – cultural research.

- Major contribution has been the elaboration of levels & stages of moral development that can form the basis for inculcating values.
- He was critical of the tendency to pass on or thrust upon children values that we consider to be important.
- He emphasized the need to provide children with the opportunity to evolve such ideas & virtues by themselves & imbibe them on their own.

Experiential learning is thus the best way to develop moral values among people. Kohlberg's three levels & six stages are important to understand the way a person organizes his/her understanding of values, laws and norms and how he/she integrates these into a moral choice.

CONCLUSIONS OF KOHLBERG'S THEORY

- Moral education should encourage students to the next stage of moral reasoning
- This model defines development as not gaining more knowledge, but rather the qualitative change in the way the student thinks
- Presumed that within any stage of development , the student's thought processes are organized according to the constraints of that stage; the individual interacts with the environment, according to his/her basic understanding of the environment
- It is enviable that he/she comes across a situation that contradicts his/her understanding & the student will then be forced to rethink and reorganize his/her moral view to accommodate such a conflicting situation & this

process is called **Equilibration** & Development occurs during this process. **Moral development approach is essentially based on this idea of Equilibration.**

- Moral education should **force students to think about contradiction inherent in situation based on their present level of moral reasoning which will enable them to make the necessary adjustments & move on to the next stage of moral reasoning**.

ELLIOT TURIEL'S DOMAIN THEORY

The basic change made in the domain theory is that the development of the child takes place in two domains:

- A distinction between a child developing moral concepts & developing other social skills, which are considered distinct from moral values
- Social convention (used to describe the second domain of social knowledge)

These two dimensions of development have distinct developmental domains and generally emerge out of the child's attempts to account for qualitatively different social experiences.

People have to coordinate and decide the right course of actions in any given situation, coordinated efforts between social conventions & moral standards are considered to be better framework for understanding moral development in children & adults. This provide a better chance to youngsters for making morality based decisions & provide greater variability in decision – making for the individuals across situations.

GILLIGAN'S THEORY

Carol Gilligan, a student & colleague of Kohlberg put forth an entirely different perspective of moral development. Gilligan was a critic on Kohlberg on two counts:

- His theory is biased against women as he used only boys for his experiments
- Opposed Kohlberg's theory of rules & rights, which are again biased against women

Gilligan conducted exhaustive studies on girls & came up with their own theory, called ***The Morality of Care.*** By listening to women's experiences, Gilligan offered that the morality of acre can serve in the place of the morality of justice & rights espoused by Kohlberg.

In her view, **the morality of caring & responsibility is founded on NON – VIOLENCE while, the morality of justice & rights are based on EQUALITY.** One can look at these two moralities as providing two distinct injunctions – the

injunction to not treat other unfairly (justice) & the injunction to not turn away from someone in need (care). **She considers these moralities as distinct, although potentially connected.**

STAGES OF GILLIGAN'S THEORY

STAGES	***GOAL***
PRE CONVENTIONAL	Individual survival
Transition from selfishness to responsibility to others	
CONVENTIONAL	Self Sacrifice is goodness
Transition from goodness to truth that she is a person too	
POST CONVENTIONAL	Principle of Non – violence; Do not hurt others or self

She suggested that women mostly think about the caring thing to do rather than the thing allowed by the rules, the latter being the general view of men. She felt that the transition is fuelled by the changes in the sense of self rather than the cognitive capability.

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

HEINZ'S DILEMMA

A popular case study by the ethicists in this context is that of **Heinz, a poor man whose wife was suffering from cancer and a costly drug was prescribed to treat her. He struggled hard to get the money for it but failed, and even the pharmacist refused to lend the drugs to him. Finally, with no other choice left to him in order to save his wife, he entered the pharmacy & stole the drug**. In fact, it is this case study that Kohlberg used in his experiments to question several people on whether Heinz was **morally right or wrong.**

The men gave two set of responses:

- Based on **conventional level of thinking**, saying **HEINZ was wrong**
- Based on **post conventional thinking**, saying **HEINZ was right** as the life of his wife was more important than the proprietary right of the pharmacist. This is saying that **he is ethically right, though morally wrong.**

In Gilligan's study, **a majority of the women gave the conventional opinion that HEINZ was wrong** & he could have tried other solutions **(threatening or payment in instalments?)** to convince the pharmacist instead of stealing the drug.

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

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

CONSENSUS AND CONTROVERSY

In the study of moral autonomy, consensus and controversy are relevant factors to discuss on.

Consensus means agreement.

Controversy means conflict or disagreement.

The concept of moral autonomy is more subjective than objective since every engineer has his own interpretation & on the performance of the same duty. Hence, there is always a possibility of two ethical persons disagreeing with ethical conclusions of the other, which is due to the differential development of moral autonomy of each.

Since disagreements are inevitable, there should be some extent of tolerance among individuals. As per the principle of tolerance, the goal of practicing ethics is not only to produce an agreed conformity, but also to highlight & adapt ways of promoting tolerances to achieve autonomy.

There is a need for certain specified authority & there should be some consensus concerning the role of authority.

PROFESSION, PROFESSIONAL & PROFESSIONALISM

Profession is defined as any occupation/job/vacation that requires advanced expertise (skills and knowledge), self – regulation and concerted service to the public good. It brings a high status, socially and economically.

The characteristics of a profession are:

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

2. Self-Regulation: Professional societies play important role in setting standards for admission to profession, drafting codes of ethics, enforcing standards of conduct, and representing the profession before the public and the government.

3. Public Good: The occupation provides some important public good, by concerted efforts to maintain ethical standards. For example, a physician promotes health, a lawyer protects the legal rights, an engineer provides a product or a project for use by the public towards their health, welfare and safety. Teaching is also claimed as a profession as it helps shaping and training the minds of the students, young as well as old.

Some argue that jobs such as carpenter, barbers, porters and drivers are to be recognized as professions. A thorough analysis of the activities expected of these jobs is to be made and checked with explanation of the

requirements of a profession before deciding it as profession. For example, having been engaged for driving one's vehicle is not a profession. But an ace driver who is engaged by a travel agency to drive different types of cars for tourists extends courtesy to the customers, requires education, expertise (a valid driving license) and respect to the public. His job may be termed as a profession. A mercenary is not a professional as he acts against public good.

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

Professionalism is defined as the services related to achieving the public good, in addition to the practices of the knowledge of moral ideals. It is the status of a professional which implies certain attitudes or typical qualities that are expected of a professional.

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

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

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

1. Extensive Training

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

by professional schools.

2. Knowledge and Skills

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

3. Monopoly

The monopoly control is achieved in two ways:

(*a*) The profession convinces the community that only those who have graduated from the professional school should be allowed to hold the professional title. The profession also gains control over professional schools by establishing accreditation standards

(*b*) By persuading the community to have a licensing system for those who want to enter the profession. If practicing without license, they are liable to pay penalties.

4. Autonomy in Workplace

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

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

5. Ethical Standards

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

MODELS OF PROFESSIONAL ROLES

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

1. Savior

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

2. Guardian

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

3. Bureaucratic Servant

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

4. Social Servant

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

5. Social Enabler and Catalyst

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

6. Game Player

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

RESPONSIBILITY

There are different senses of responsibility such as:

- **Characteristic Quality** – Responsibility implies duty with care & effort
- **Obligation** – One's moral responsibility (i.e., duty to act & in moral ways), obligations such as honesty, fairness & decency are incumbent on everyone.
- **General Moral Capacity** – including the understanding & action on moral

reasons.

- Liability & Accountability – ***Liability means one is liable*** (with a legal sense) ***to meet the obligations in better ways.***

  Accountability means that one is willing to justify or defend the decisions, actions or means & outcomes. It could be offering a reasonable excuse or accepting the shame for not having met the end results or accepting the guilt for harming others.
- Praiseworthiness/Blameworthiness – ***When accountability for wrong actions or results is at issue, responsibility means Blameworthy.***

  When the right conduct or successful result is at issue, responsibility is synonymous with praiseworthy.

TYPES OF RESPONSIBILITY

- Moral responsibility
- Casual responsibility
- Job responsibility
- Legal responsibility

RESPONSIBLE PROFESSIONALISM

The most comprehensive virtue of engineers and also be called as ***Professional Responsibility.***

This consists of five types of virtues:

- Self – direction/Self – Governance virtues are fundamental & necessary in exercising moral responsibility
- Public – spirited virtues focus on the good of the clients & the public, which includes the respect for rights (to make decisions & face the risk), non – malfeasance (not harming others intentionally)
- Team – work virtues enable the professionals to work successfully with others which include collegiality, cooperativeness, communicative ability & respect for legitimate authority
- Proficiency virtues means the mastery of technical skills which includes competence, diligence, creativity, excellence & self - renewal
- Cardinal virtues: Wisdom, courage, temperature & justice

SOCIAL RESPONSIBILITY

Corporate organizations have social responsibility to all of their stakeholders, which includes the well being of the employees & their unions, socially responsible investors, customers, dealers, suppliers, local communities, governments, non – governmental organizations & the business owners & managers.

ACCOUNTABILITY

Accountability means the capacity to understand and act on moral reasons. Willingness to submit one's actions to moral scrutiny and be responsive to the assessment of others which 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.

- ***Conscientiousness means being sensitive to full range of moral values and responsibilities and the willingness to upgrade their skills, put efforts, and reach the best balance possible among those considerations,*** and
- ***Blameworthy/Praiseworthy:*** Own the responsibility for the good or wrong outcomes. Courage to accept the mistakes will ensure success in the efforts in future.

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

OBLIGATION

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

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

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

THEORIES ABOUT RIGHT ACTION (ETHICAL THEORIES)

An ethical theory is a comprehensive perspective on morality that clarifies, organizes and guides moral reflection. If successful, it provides a framework for making moral choices & resolving moral dilemmas – not a simple formula, but rather a comprehensive way to identify, structure and integrate moral reasons.

Ethical theories also ground the requirements in engineering codes of ethics by reference to broader moral principles. In doing so, they illuminate connections between engineering codes of ethics and ordinary morality (i.e.,) the justified moral values that play a role in all areas of life.

We discuss five types of Ethical theories that have been especially influenced:

- UTILITARIANISM
- RIGHT ETHICS
- DUTY ETHICS
- VIRTUE ETHICS
- SELF – REALIZATION ETHICS

Utilitarianism says that ***we ought to maximize the overall good, taking into equal account all those affected by our actions.***

Right Ethics says that ***we ought to respect human rights.***

Duty Ethics says that ***we ought to respect individual's autonomy.***

Virtue Ethics says that ***good character is center to morality.***

Self – Realization Ethics emphasizes ***the moral significance of self – fulfillment.***

None of these theories has won a consensus & each has different versions. Nevertheless, suitably modified, the theories complement & enrich each other to the extent that they usually agree with respect to the right action in particular situations. Taken individually & together, they provide illuminating perspectives on engineering ethics.

UTILITARIANISM

Utilitarianism is the view that we ought always to produce the most good for the most people, giving equal consideration to everyone affected. The standard of right conduct is maximization of good consequences which mean either 'utilities' or the 'balance of good over evil'; the utilitarian standard seems simple & plausible. The term Utilitarianism was conceived in the 19th century by **Jeremy Bentham** and **John Stuart Mill** to help legislators determine which laws were morally best.

Utilitarianism even seems a straight forward way to interpret the center principle in most engineering codes: **engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties. After all welfare is a rough synonym for overall good (utility) and safety & health might be viewed as especially important aspects of that good.**

- ***What exactly is the good to be maximised?***
- ***Should we maximize the good effects of individual actions or the good effects of general rules (policies, laws, principles in codes of ethics)?***

Utilitarianism tries to balance the needs of society with the needs of the individual, with an emphasis on what will provide the most benefit to the most people. **Utilitarianism is fundamental to many types of engineering analysis including Risk – Benefit Analysis & Cost – Benefit Analysis. Utilitarianism is a variable tool for ethical problem solving, providing one way of looking at engineering ethics cases.** Depending on how these questions are answered, Utilitarianism takes different forms:

- ***ACT UTILITARIANISM***
- ***RULE UTILITARIANISM***

ACT UTILITARIANISM

Act Utilitarianism focuses on each situation and the alternative actions possible in the situation. A particular action is right if it is likely to produce the most people in a given situation, compared to alternative choices that might be made.

According to Act Utilitarianism, the standards can be applied at any moment. Usually we operate according to the rule of thumb, such as ***complete assignments on time*** & such rules provide only rough guidance based on past experience.

According to JOHN STUART MILL (1806 – 1873), these are the rules of thumb that summarize past human experience about the types of actions that usually maximize utility**. The rules should be broken whenever doing so will produce the most good in a specific situation. The same is true regarding rules stated in engineering code of ethics.**

- Act utilitarianism apparently permits some actions that we know (on other grounds) are patently immoral.
- Act utilitarianism seems to permit injustice by promoting social good at the expense of individuals
- Mill felt that individual actions should be judged based on whether the most good was produced in a given situation, even if the rules are broken too.

- ***Act utilitarianism focuses on individual actions rather than on rules.***

RULE UTILITARIANISM

An alternative version of utilitarianism says that we should take rules, rather than isolated actions much more seriously since ***justified rules are morally authoritative rather than loosing guidelines***. **Right actions are those required by rules that produce the most good for the most people because rules interact with each other if we consider the set of rules needed.**

RICHARD BRANDT (1910-97), who introduced the term Rule Utilitarianism agreed that **individual actions are morally justified when they are required by an optimal moral code – that set of rules which maximizes the public good more than alternative codes would** (or at least as much as alternatives).

- Brandt has in mind society – wide standards, but the same idea applies to engineering codes of ethics, which is justified in terms of its overall good consequences
- Rule utilitarians express this moral knowledge by demonstrating the overall good is promoted when engineers need the principle, **act as faithful agents or trustees of employers**
- Rule utilitarians avoid this result by emphasizing the general good in needing rules like **corporations should inform the public of dangers, discipline or punish only the guilty**
- Rule utilitarians agree that relatively wealthy people should increase their philanthropic giving, but they also think the general good is promoted by allowing individuals to act in accord with a rule such as Give help to others, while keeping sufficient resources for the security and reasonable luxuries for oneself & one's family
- Rule utilitarian hold that adhering to moral rules alone will ultimately lead to the most good.

Rule utilitarianism differs from Act utilitarianism in holding that moral rules are most important.

RIGHT ETHICS & DUTY ETHICS

Right ethics regards human rights as fundamental & duty ethics regards duties of respect for autonomy as fundamental. Historically, the theories developed as distinct moral traditional, but their similarities are for more pronounced than their differences. Both theories emphasise respect for individual's dignity and worth, in contrast with utilitarianism emphasis on the general good.

Furthermore, **right ethics and duty ethics are largely mirror images of**

each other. *Because you have a right to life, I have a duty not to kill you and if I have a duty not to deceive you then you have a right not to be deceived.*

TWO VERSIONS OF RIGHT ETHICS

Right ethics gets more complex as we ask which rights exist. Thus, human rights might come into two forms: **LIBERTY RIGHTS & WELFARE RIGHTS**. ***Liberty rights are rights to exercise one's liberty and they place duties on other people not to interface with one's freedom. Welfare rights are rights to benefits needed for a decent human life, when one cannot earn. Those benefits and when the community has them available.***

First version of rights ethics conceives of human rights as intimately related to communities of people. A.I.Melden, argues that having moral rights presupposes the capacity to show concern for others and to be accountable within a moral community.

Meldon's account, like that of most rights ethics, allows for more positive welfare rights to community benefits needed for living a minimally decent human life (**when one cannot earn those benefits on one's own and when the community has them available**), thus it lays the moral ground work for recognizing the limited welfare system in the united states.

The extent of welfare rights, just like that of liberty rights, always has to be determined contextually.

A second version of rights ethics denies there are welfare human rights. Liberation believes that only liberty rights exist; there are no welfare rights. John Locke (1623-1704) who has the first interpreted as liberation.

Locke believed that the three most basic human rights are to life, liberty and property. Locke's version of human rights was highly individualistic and he viewed primarily as entitlements that prevent other people from meddling in one's life.

The individualistic aspect of Locke's thought is reflected in the contemporary political science in the libertarian political party and outlook, with **its emphasis on the protection of private property and the condemnation of welfare system**. His views had an ***enormous impact at the time of the French and American revolutions and provide the moral foundation of contemporary American society.***

We have few special moral rights, held by particular individuals rather than by every human being. Finally, few rights are absolute, in the sense of being unlimited and having no justifiable exceptions. Libertarians and other rights ethicists agree that members of the public do not have an absolute right not to be harmed by technological products.

DUTY ETHCS

Duty ethics says that right actions are those required by duties to respect the liberty or autonomy (self-determination) of individuals.

One writer suggests the following list of important duties:

- Don't kill
- Don't cause pain
- Don't disable
- Don't deprive of freedom
- Don't deprive of pleasure
- Don't deceive
- Don't cheat
- Keep your promise
- Obey the law
- Do your duty (referring to work, family and other special responsibilities)

HOW DO WE KNOW THAT THESE ARE OUR DUTIES?

Immanuel Kant (1724 – 1804), the most famous duty ethicist, argued that all such specific duties from one fundamental duty to respect persons. **Persons deserve respect because they are moral agents – capable of recognizing & voluntarily responding to moral duty** (or, like children, they potentially have such capacities).

Autonomy – *"Moral Self – determination or self – governance"* means **having the capacity to govern one's life in accordance with moral duties. Hence, respect for persons accounts to respect for their moral autonomy**.

Immorality occurs when we merely use others, reducing them to mere means to our ends, treating them as mere objects to gratify our needs. Immorality involves treating persons as mere to our goals, rather than as autonomous agents who have their own goals.

- Kant says **we have a duty not to commit suicide,** which would bring an end to a valuable life; **we have duties to develop our talents**, as part of unfolding our rational natures; **we should avoid harmful drugs** that undermine our ability to exercise our rationality.
- Kant's repeated appeal to **the idea of rationality makes a number of assumptions about morally worthy aims.** After beginning this idea, he builds in a host of specific goals as part of what it means to be rational.
- Kant stated the fundamental duty of respect for persons as rational & autonomous beings: **Act so that you treat humanity, whether in your own person or in that of another, treat humanity, whether in your own person or in that of another, always as an end & never as a means only.**

As a moral end, each person (including ourselves) places moral limits on our conduct.

- Kant also emphasized that duties are universal: they apply equally to all rational beings (including all humans & supernatural beings like angels & God – whom Kant believed to exist). He stated this idea as **Act only according to that maxim** (i.e., rule of action) **by which you can at the same time will that it should become a universal law**.

  This idea of universal principle is often compared to the golden rule: ***do unto others as you would have them do unto you;*** or in its negative version, ***do not do unto others what you would not want them to do to you.***
- Kant insisted that moral duties are **Categorical Imperatives**. As imperatives, ***they are injunctions or commands that we impose on ourselves as well as other rational beings***. As categorical, ***they require us to do what is right because it is right, unconditionally & without special incentives attached***.

  Be honest says morality – not because doing so benefits us, but because honesty is our duty. Morality is not an ***iffy*** matter that concerns hypothetical (conditional) imperatives, such as **If you want to prosper, be honest**. Morality involves attention to motives and intentions, as idea also important in Virtue Ethics.

To emphasize that most duties have some justified exceptions, the philosopher David Ross (1877 – 1971) introduced the expression **prima facie duties**. In this technical sense, **prima facie simply means might have justified exceptions** (rather than at 1st glance). Most duties are prima facie ones – they sometimes have permissible or obligatory exceptions. Indeed, the same is true of most rights and other moral principles, and hence today the term prima facie is often applied to rights and rules.

VIRTUE ETHICS

Virtue ethics emphasizes character more than rights & rules. **Character is the pattern of virtues** (morally desirable features) **and vices** (morally undesirable features) **in an individual**. ***Virtues are desirable habits or tendencies in action, commitment, motive, attitude, emotion, ways of reasoning & ways of relating to others. Vices are morally undesirable habits or tendencies***.

Words **Virtue & Vive** sound a bit old – fashioned. Words of specific virtues however remain familiar both in engineering & in everyday life. Examples for Virtues are Competence, Honesty, Courage, Fairness, Loyalty & Humility.

Words of specific vices are also familiar: Incompetence, Dishonesty, Cowardice, Unfairness, Disloyalty & Arrogance.

The Greek word ***arete*** can be translated as Virtue, Ethics & Excellence, an etymological fact that reinforces our theme of ethics & excellence going together in engineering. The most comprehensive virtue of engineers **is Responsible Professionalism**. This umbrella virtue implies four (overlapping) categories of virtues:

- Public well–being – ***Public – Spirited virtues***
- Professional competence – ***Proficiency virtues***
- Cooperative practices – ***Team work virtues***
- Personal integrity – ***Self Governance virtues***

Public – spirited virtues are focused on the good of clients and the wider public. The minimum virtue is **nonmaleficence**, i.e., the tendency not to harm others unintentionally. Simply, **Above all, do not harm**. Justice within corporations, government and economic practices is an essential virtue in the profession of engineering.

Proficiency Virtues are the virtues of mastery of one's profession, in particular mastery of technical skills that characterize good engineering practice. The most (important) general proficiency virtue is **Competence:** being well prepared for the jobs one undertakes & also important is **Diligence:** alertness to dangers & careful attention to detail in performing tasks by and **Creativity**.

Team work virtues are those that that are especially important in enabling professionals to work successfully with other people. They include *collegiality, cooperativeness, loyalty and respect for legitimate authority*. Also important are leadership qualities such as the responsible exercise of authority & the ability to motivate others to meet valuable goals within authority – structured corporations.

Self Governance virtues are those necessary in exercising moral responsibility. Some of them center on moral understanding and perception. Other self – governance virtues center on commitment & on putting understanding into action: *Courage, Self – discipline, Perseverance, Fidelity to commitments, Self – respect & Integrity*. Honesty falls into both groups of self – direction virtues, implies truthfulness in speech & belief and trustworthiness in commitments.

ARISTOTLE'S PERSPECTIVE

Aristotle (384 – 322 B.C.) defined the moral virtues as habits of reaching a proper balance between extremes in conduct, emotion, desire and attitude.

Virtues are tendencies to find the Golden Mean between the extremes of too much (excess) & too little (deficiency) with regard to particular aspects of our lives. Thus, truthfulness is the appropriate middle ground (mean) between revealing all information in violation of fact & confidentiality (excess) & being secretive or lacking in candor (deficiency) in dealing truth.

Again, courage is the mean between foolhardiness (the excess of rashness) & cowardice (the deficiency of self control) in confronting dangers. The most important virtue is practical wisdom, i.e., morally good judgement, which enables one to discern the mean for all the other virtues.

Aristotle tells us it arrives from the development of good habits as achieved through proper training within families and communities. We conclude by noting two challenges to virtue ethics, or rather areas needing refinement.

- **Virtue ethics often talk as if virtues are all or nothing**. Eg. Complete honesty with others id often in tension with being considerate & sensitive. Hence, virtue ethics needs to avoid all-or-nothing claims about being virtuous.
- **Virtue ethics seems incomplete and when taken by itself, too vague**: since the virtues fail to provide adequate moral guidance.

SAMUEL FLORMAN'S PERSPECTIVE

Like right ethics, duty ethics & utilitarianism, virtue ethics takes alternative forms especially in the particular virtues emphasized & their roles in morally good lives. Samuel Florman is most famous for his celebration of the ***existential pleasures of engineering*** – **the deeply rooted and elemental satisfaction in engineering that contribute to happiness**. Florman **implicitly set forth a virtue ethics in elaborating on these pleasures**.

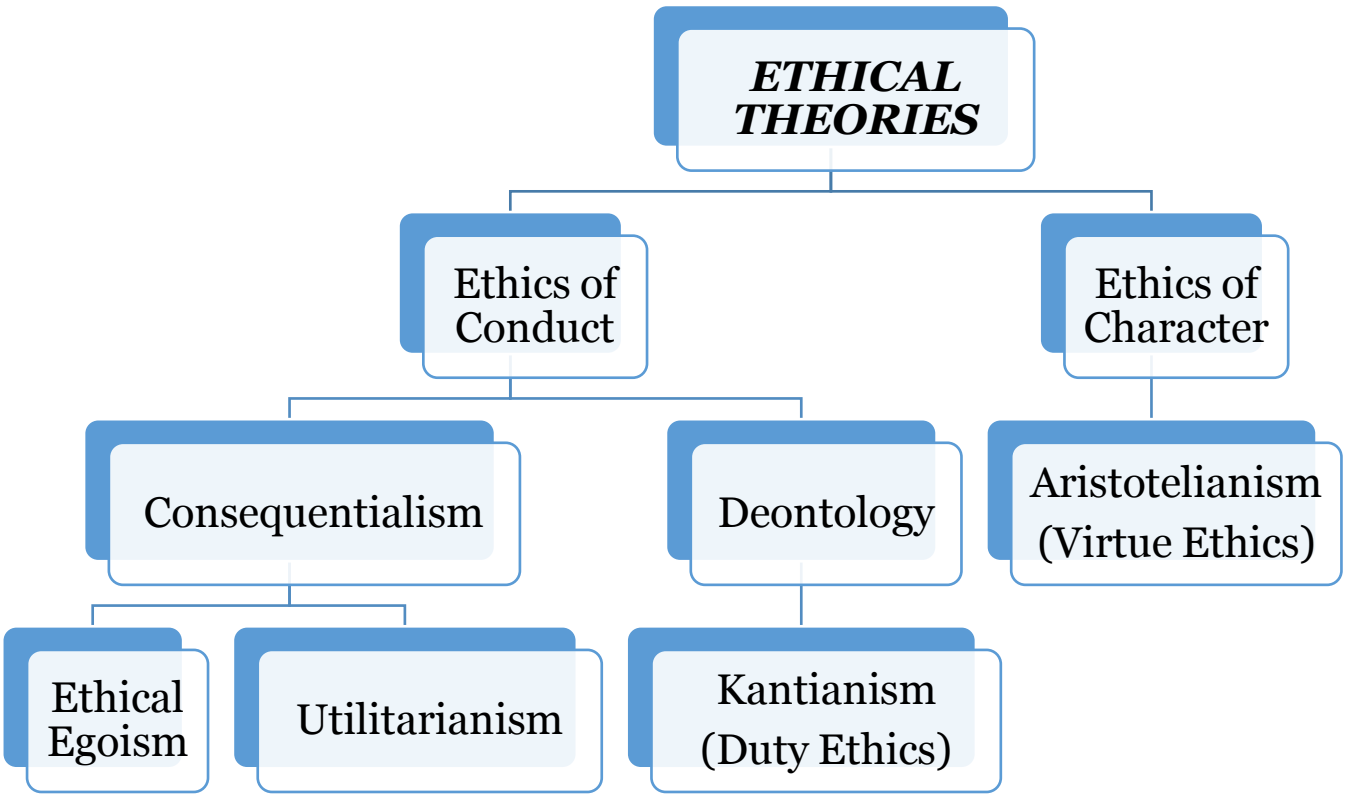
In his view, the essence of engineering ethics is best captured by the word **conscientiousness**. **Engineers who do their jobs well are morally good engineers & doing their jobs well is to be understood in terms of the more specific virtues of competence, reliability, inventiveness, loyalty to employees and respect for laws & democratic processes**. Florman emphasizes mostly on two virtues namely **Competence & Loyalty**.

- One way, Conscientious engineers are competent. Forman estimates **98% of engineering failures are caused by Incompetence**. The other 2% **involve greed, fraud, dishonesty & other conventional understandings**

of wrong doing, often in addition to sloppiness. *Competent does not mean minimally adequate, but instead performing with requisite skill & experience. It implies exercising due care, persistence and diligence & attention to detail and avoiding sloppiness*. In addition to competence, conscientious engineering often requires creative problem solving & innovation thinking.

- On another way, conscientious engineers are loyal to their employers, within the boundaries of laws & democratic institutions. *Professional restraints should be laws & government regulations rather than personal conscience*.

Florman defends the priority of duties to employers, in opposition to professional codes that require engineers to hold paramount the safety, health & welfare of the public. His Competence & loyalty credo could easily be used to encourage engineers to be passive in accepting the dictates of employers & relying on laws as sufficient to protect the public.



CLASSIFICATION OF ETHICAL THEORIES

SELF REALIZATION ETHICS & SELF INTEREST

Each of the preceding ethical theories leaves considerable room for the self – interest. i.e., for pursuing what is good for one – self?

Utilitarianism believes that self – interest should enter into our calculations of the overall good. **Right Ethics** says we have rights to pursue our legitimate interests. **Duty Ethics** says we have duties to ourselves. **Virtue Ethics** links our personal good with participating in communities & social practices.

Self – realization Ethics, however, ***gives greater prominence to self – interest and to personal commitments that individuals develop***.

As with the other ethical theories, we will consider two versions, this time depending on how the self is conceived. In one version, called ***Ethical Egoism***, **the self is conceived in a highly individualistic manner**. In a second version, **the self to be realized is understood in terms of caring relationships and communities**.

Ethical Egoism is a theory that deals with self – interest. According to this theory, **one's actions are ethical if they promote the interest of the person who acts**. An obvious inference is that **ethical egoism doesn't respect the rights of others**. According to the critics of this theory, **ethical egoism will not give permanent happiness to the person following this theory**. Proponents of ethical egoism believe that even if a person takes interest in others, his/her own good & self – interest predominate his/her actions.

Critics of ethical egoism are that it is nothing but **pure selfishness and will not lead to what the individuals aspires for**. This theory **goes against promotion of relationships & comradeship**.

THEORY ABOUT RIGHT ACTION - RELIGION

Moral Absolutism is a term that denotes the view held by some people who firmly believe that there is only one right perspective & that is one held by them. Moral Absolutism can be seen in many religious codes of conduct, which have to be observed without raising questions.

- Moral absolutism can also be seen in a secular perspective where it is deemed that there are things that are absolutely true, irrespective of any contextual differences.
- **Religious Fanaticism is a form of Moral Absolutism**, moral absolutists are of the view that what they believe is the absolute truth & nothing else is true; they fanatically hold on to their views, which they consider to be the truth.
- The problem with moral absolutists is their narrow vision of the world

around them. The continuing occurrence of moral & ethical problems in society goes against the view held by moral absolutists.

- The characteristic feature of moral absolutism is the conviction that there is only one truth & that is the one held by them. This amounts to some form of arrogance & dogmatism that may not be justifiable.
- Moral absolutism in any form is a kind of fundamentalism that does not or will not consider other points of view. It lacks rationalism & is devoid of consideration for moral autonomy of others.
- Moral absolutism can be right in some cases but it may not be acceptable as a principle or theory. The fact that moral dilemmas persist & moral issues come up time & again goes against moral absolutism. Absolutists fail to accept the fact that moral issues may have a contextual bearing.

Example:

- ✓ In the SWAT region of Pakistan, the Taliban forcefully imposed moral codes that they considered to be the absolute truth. **They sentenced a young girl to 100 lashes for walking along with a man because she was not related to him in anyway**. Members of Taliban are a kind of moral absolutists who believe that what they consider to be moral is the absolute truth, irrespective of the context. **Talibanism is a kind of moral policing that is not considered by rational people**.
- ✓ Similar unfortunate incidents are on the rise & have become common even in India. Incidents of moral policing by the police wherein they beat up young couples seen together in parks are a case in point.

THEORY ABOUT RIGHT ACTION – CUSTOMS

Moral Relativism is a philosophy that asserts that no action can be called absolutely moral. *Actions need to be judged against the cultural & individual contexts. An action may be justified in one case but may not be acceptable in another.*

- **Moral relativists believe that similar moral rules or codes of conduct cannot be set & applied in cases of a different nature**. While this perception looks alternative to follow, it can create problems in actually deciding what action to take in a particular case because each person is right in his/her actions relative to his/her individual perceptions and to his/her cultural background.
- ***Disagreements do exist in moral issues, as in issues in any other domain and accepting this is called Descriptive Relativism***. Some moral relativists go further to state that ***each individual is correct in***

his/her actions based upon his/her beliefs and convictions and this called Subjective Relativism.

- **Cultural relativists claim that each action is morally correct according to the cultural background of the individual**. The concept that laws & cultural and social beliefs can be basis for judging actions seems attractive enough. However, this can also lead to many situations that may not be morally acceptable.
- The existence of universal principles of morality should be accepted with the understanding that exceptions would always be there. **Moral relativism is a kind of free – for – all situations that may not work in the present times. Moral relativism gives freedom to each individual to judge his/her action based on his/her perceptions & beliefs**. However, the need & importance of rules & a code of conduct cannot be questioned.

The media seems to think only abortion & gay marriage are religious issues. Poverty is a moral issue, it's a faith issue, it's a religious issue – JIM WALLS, Christian Writer & Political Activist

We have made an extraordinary transition. From moral absolutes to relativism... Moral problems become medical ones & yesterday's sinners become today's patients – ELLEN GOODMAN, American Journalist &Syndicate Columnist

MORAL PLURALISM

Moral, Ethical or Value Pluralism is the idea that there are many human values, which are equally good but can come into conflict with each other in a given situation.

The theory also holds that values are incommensurable because there is no order of priority for these values. The values pursued by us cannot be reduced to a single overriding system of values. Human values by their very nature are held true. However, these can come into conflict with other values that are equally valid.

There is a valid reasoning behind ethical pluralism. **Ethical values are wide & varied, and the manner in which they are applied obviously varies with cultural background. We must recognize this as a ground reality**.

Example: ***Individual liberty is a value held dear by all. However, this can come into conflict with public order. Individual liberty needs to be mellowed down for the convenience of others. It conflicts with equally valid rights of others***. **Playing loud music on your stereo system is your liberty. But this affects the peace & tranquillity of the neighbourhood. This conflicts with the rights of others to have a peaceful night's sleep. CAN YOU HOLD ON TO YOUR INDIVIDUAL LIBERTY PRINCIPLE HERE?**

Consider a case where a convict has been given the death sentence. As per the laws of some countries, the sentence may be right and appropriate. However, many countries have banned the death penalty as it goes against some other values, which reason that a prisoner should be given a chance to mend himself/herself. ***Impartial justice can come into conflict with the virtues of mercy & compassion***.

FEMINIST CONSEQUENTIALISM

Over the years, there have been two schools of thoughts about consequentialism among feminists.

One group has propounded that the morality of actions can be considered a matter of consequences but not on the same lines that have been applied until now. They are of the view that consequences cannot be evaluated on parameters being considered until now in the traditional computational model offered by utilitarianism. They suggest that consequences should be evaluated in terms of their effect on relationships & feelings. An action can be considered morally correct if its consequences tend to foster comradeship & bring people together. If an action has negative consequences, such as destroying relationships & hurting others, it is not considered ethical.

A second thought among feminist consequentialists accepts the existing utilitarian concepts and methods of evaluating consequences. However, they are of the view that such evaluation of consequences should take care of those aspects that affect women. They argue that the existing utilitarianism often tends to neglect this aspect, and is biased against and insensitive to women.

USES OF ETHICAL THEORIES: CASE STUDY

- Ethical theories facilitate our strategies & methods in such decision making which become imperative when we face ethical dilemmas
- Ethical theories can help us focus on the real issues involved by collecting & prioritizing relevant data and moral reasons, before taking a decision
- Using ethical theories one can focus on the prime criteria of public good & safety and abide by the least harm principle
- Ethical Theories helps in relating ordinary & professional morality
- Ethical theories can helps us find justification for our actions based on these principles. Ethical theories help us to identify the ethical considerations that should go into correct decision – making to resolve moral dilemmas.
    - ✓ Utilitarianism talks about most public good & the overall benefit has to be weighed against the likely harm & the decision justified in terms of the overwhelming benefits to the most

- ✓ Rights theory talks about the rights of groups, which should not be validated; It can justify action confronting to safety or respecting the rights of others & any stand we take against the violation of other's rights is justified by the rights theory.
- ✓ Duty ethics will consider the compulsions of the engineer to do his/her duty for public good which may clash with his duty as an employee. We can use duty ethics as a ground for justifying our actions based on moral duty to provide a safe product, respect the rights of others or for least harm to people.

USES OF ETHICAL THEORIES: CASE STUDY

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

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

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

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

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

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

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

UNIT – III
ENGINEERING AS SOCIAL EXPERIMENTATION

ENGINEERING AS EXPERIMENTATION

Before manufacturing a product or providing a project, we make several assumptions and trials, design and redesign and test several times till the product is observed to be functioning satisfactorily. We try different materials and experiments. From the test data obtained we make detailed design and retests. Thus, design as well as engineering is iterative process as illustrated in Fig

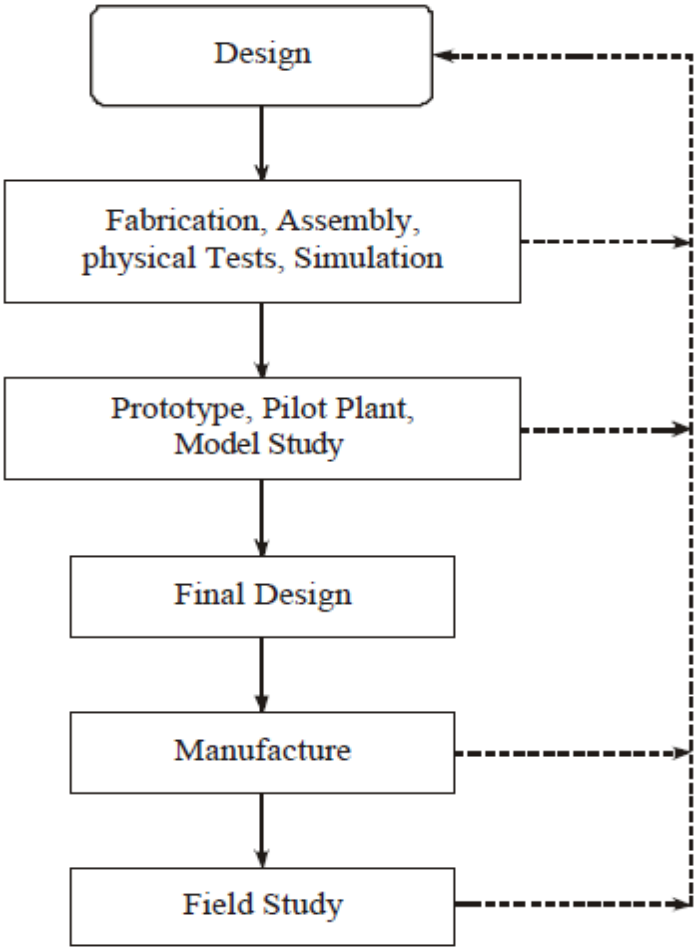


Fig. Design as an interactive process

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

We shall now compare the two activities, and identify the similarities and contrasts.

A. 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 (that is certain!). 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.
2. *Uncertainty*: The final outcomes of projects are also uncertain, as in experiments. Some*t*imes 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.
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.
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, e.g., the Titanic lacked sufficient number of life boats—it had only 825 boats for the actual passengers of 2227, the capacity of the ship being 3547! In the emergent situation, all the existing life boats could not be launched.

Forty years back, another steamship Arctic met with same tragedy due to the same problem in the same region. But the lesson was learned. In most of the hydraulic systems, valves had been the critical components that are least reliable. The confusion on knowing whether the valve was open or closed, was the cause of the Three-Mile Island accident in 1979. Similar malfunctioning of valves and mis-reading of gauges have been reported to have caused the accidents elsewhere in some power plants. But we have not learnt the lesson from the past. The complacency that it will not happen again and will not happen 'to me' has lead to many disasters.

B. Contrasts

The scientific experiments in the laboratory and the engineering experiments in the filed exhibit several contrasts as listed below:

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.

   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. 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. .
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.

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. 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.

    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

    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). The relevant factual information implies, that the engineers are obliged to obtain and assess all the available information related to the fulfilment of one's moral obligations (i.e., wrong or immoral use of a product one designs), including the intended and unintended impacts of the product, on the society. Still there exists a possibility of a large gap of understanding between the experimenter and the subjects (public). Sometimes, the managements have not been willing to disseminate the full information about the project or product beyond the legal requirements, because of the fear of potential competitions and likely exposure to potential litigation.

    People object to *involuntary risks* wherein the affected individual is neither a direct participant nor a decision maker. In short, we prefer to

be the subjects of our own experiments rather than those of somebody else. If it is an asbestos plant or nuclear plant to be approved, affected parties expect their consent to be obtained. But they are ready to accept *voluntary* risks as in the case of stunts and amazing races.

In case of Koodangulam power project as well as the Sethusamudram Canal Project, Tamil Nadu, several citizen groups including Fishermen Forums have responded. The Central government was able contain many harsh apprehensions and protracted legal and political battles, by providing all relevant information.

4. *Knowledge gained*: Not much of new knowledge is developed in engineering experiments asin 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.

   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

Although the engineers facilitate experiments, they are not alone in the field. Their responsibility is shared with the organizations, people, government, and others. No doubt the engineers share a greater responsibility while monitoring the projects, identifying the risks, and informing the clients and the public with facts. Based on this, they can take decisions to participate or protest or promote.

The engineer, as an experimenter, owe several responsibilities to the society, namely,

1. A conscientious commitment to live by moral values.
2. A comprehensive perspective on relevant information. It includes constant awareness of the progress of the experiment and readiness to monitor the side effects, if any.
3. Unrestricted free-personal involvement in all steps of the project/product development (autonomy).
4. Be accountable for the results of the project (accountability).

Conscientiousness

Conscientious moral commitment means: (*a*) Being sensitive to full range of moral values and responsibilities relevant to the prevailing situation and (*b*) the willingness to develop the skill and put efforts needed to reach the best balance

possible among those considerations. In short, engineers must possess open eyes, open ears, and an open mind (i.e., moral vision, moral listening, and moral reasoning).

This makes the engineers as social experimenters, respect foremost the safety and health of the affected, while they seek to enrich their knowledge, rush for the profit, follow the rules, or care for only the beneficiary. The human rights of the participant should be protected through voluntary and informed consent.

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)

A product has a built-in obsolete or redundant component to boost sales with a false claim. In possessing of the perspective of 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.

Moral Autonomy

A detailed discussion is done in previous unit. Viewing engineering as social experimentation, and anticipating unknown consequences should promote an attitude of questioning about the adequacy of the existing economic and safety standards. This proves a greater sense of personal involvement in one's work.

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.

   The tug-of-war between of causal influence by the employer and moral

responsibility of the employee is quite common in professions. In the engineering practice, the problems are:

- The fragmentation of work in a project inevitably makes the final products lie away from the immediate work place, and lessens the personal responsibility of the employee
- Further the responsibilities diffuse into various hierarchies and to various people. Nobody gets the real feel of personal responsibility.
- Often projects are executed one after another. An employee is more interested in adherence of tight schedules rather than giving personal care for the current project.
- More litigation is to be faced by the engineers (as in the case of medical practitioners). This makes them wary of showing moral concerns beyond what is prescribed by the institutions. In spite of all these shortcomings, engineers are expected to face the risk and show up personal responsibility as the profession demands.

CODES OF ETHICS

The 'codes of ethics' exhibit, rights, duties, and obligations of the members of a profession and a professional society. The codes exhibit the following essential roles:

1 *Inspiration and guidance*. The codes express the collective commitment of the profession to ethical conduct and public good and thus inspire the individuals. They identify primary responsibilities and provide statements and guidelines on interpretations for the professionals and the professional societies.

2 *Support to engineers*. The codes give positive support to professionals for taking stands on moral issues. Further they serve as potential legal support to discharge professional obligations.

3 *Deterrence* (discourage to act immorally)and *Discipline* (regulate to act morally). The codes serve as the basis for investigating unethical actions. The professional societies sometimes revoke membership or suspend/expel the members, when proved to have acted unethical. This sanction along with loss of respect from the colleagues and the society are bound to act as deterrent.

4 *Education and mutual understanding*. Codes are used to prompt discussion and reflection on moral issues. They develop a shared understanding by the professionals, public, and the government on the moral

responsibilities of the engineers. The Board of Review of the professional societies *encourages moral discussion for educational purposes*.

5 *Create good public image.* The codes present positive image of the committed profession tothe public, help the engineers to serve the public effectively. They promote more of self-regulation and lessen the government regulations. This is bound to raise the reputation of the profession and the organization, in establishing the trust of the public.

6 *Protect the status quo*. They create minimum level of ethical conduct and promotes agreement within the profession. Primary obligation namely the safety, health, and welfare of the public, declared by the codes serves and protects the public.

7 *Promotes business interests*. The codes offer inspiration to the entrepreneurs, establish shared standards, healthy competition, and maximize profit to investors, employees, and consumers.

Limitations:

The codes are not remedy for all evils. They have many limitations, namely:

1. General and vague wordings. Many statements are general in nature and hence unable to solve all problems.
2. Not applicable to all situations. Codes are not sacred, and need not be accepted without criticism. Tolerance for criticisms of the codes themselves should be allowed.
3. Often have internal conflicts. Many times, the priorities are clearly spelt out, e.g., codes forbid public remarks critical of colleagues (engineers), but they actually discovered a major bribery, which might have caused a huge loss to the exchequer.
4. They cannot be treated as final moral authority for professional conduct. Codes have flaws by commission and omission. There are still some grey areas undefined by codes. They cannot be equated to laws. After all, even laws have loopholes and they invoke creativity in the legal practitioners.
5. Only a few enroll as members in professional society and non-members cannot be compelled.
6. Even as members of the professional society, many are unaware of the codes
7. Different societies have different codes. The codes cannot be uniform or

same! Unifying the codes may not necessarily solve the problems prevailing various professions, but attempts are still made towards this unified code.

8. Codes are said to be coercive. They are sometimes claimed to be threatening and forceful.

INDUSTRIAL STANDARDS

Industrial standards are important for any industry. Specification helps in achieving interchangeability. Standardization reduces the production costs and at the same time, the quality is achieved easily. It helps the manufacturer, customers and the public, in keeping competitiveness and ensuring quality simultaneously. Industrial standards are established by the Bureau of Indian Standards, in our country in consultation with leading industries and services.

International standards have become relevant with the development of the world trade. The International Standards Organization 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. Table gives a list of some types of standards with a few examples.

Table. Industrial standards

Aspects	Purpose	Examples
1. Quality	Value appropriate to price	Surface finish of a plate, life of a motor
2. Quality of service	Assurance of product to ISO procedures	Quality of degrees according institutions by educational institutions
3. Safety	To safeguard against injury or damage to property	Methods of waste disposal
4. Uniformity of physical properties and functions	Interchangeability, ease of assembly	Standard bolts and nuts, standard time.

BALANCED OUTLOOK ON LAW

The 'balanced outlook on law' in engineering practice stresses the necessity

of laws and regulations and also their limitations in directing and controlling the engineering practice. Laws are necessary because, people are not fully responsible by themselves and because of the competitive nature of the free enterprise, which does not encourage moral initiatives. Laws are needed to provide a minimum level of compliance.

The following codes are typical examples of how they were enforced in the past:

Code for Builders by Hammurabi

Hummurabi the king of Babylon in 1758 framed the following code for the builders:

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

This code was expected to put in self-regulation seriously in those years.

Steam Boat Code in USA

Whenever there is crisis we claim that there ought to be law to control this. Whenever there is a fire accident in a factory or fire cracker's store house or boat capsize we make this claim, and soon forget. Laws are meant to be interpreted for minimal compliance. On the other hand, laws when amended or updated continuously, would be counterproductive. Laws will always lag behind the technological development. The regulatory or inspection agencies such as Environmental authority of India can play a major role by framing rules and enforcing compliance.

In the early 19th century, a law was passed in USA to provide for inspection of the safety of boilers and engines in ships. It was amended many times and now the standards formulated by the American Society of Mechanical Engineers are followed.

Proper Role of Laws

Good laws when enforced effectively produce benefits. They establish minimal standards of professional conduct and provide a motivation to people. Further they serve as moral support and defense for the people who are willing to act ethically.

Thus, it is concluded that:

1. The rules which govern engineering practice should be construed as of responsible experimentation rather than rules of a game. This makes the engineer responsible for the safe conduct of the experiment.
2. Precise rules and sanctions are suitable in case of ethical misconduct that involves the violation of established engineering procedures, which are aimed at the safety and the welfare of the public.
3. In situations where the experimentation is large and time consuming, the rules must not try to cover all possible outcomes, and they should not compel the engineers to follow rigid courses of action.
4. The regulation should be broad, but make engineers accountable for their decisions, and
5. Through their professional societies, the engineers can facilitate framing the rules, amend wherever necessary, and enforce them, but without giving-in for conflicts of interest.

CASE STUDY: THE CHALLENGER

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

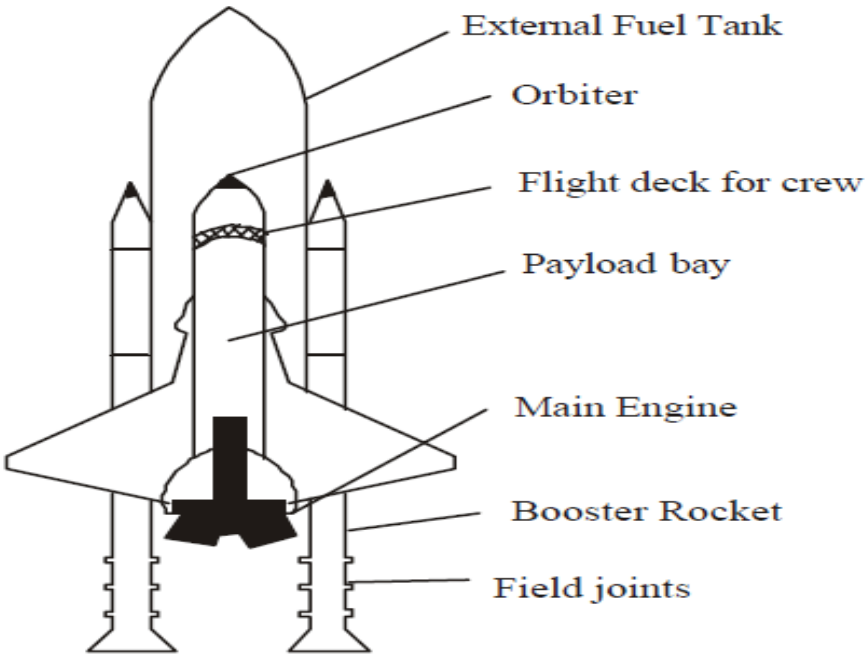
The casing of each booster rocket is about 150 feet long and 12 feet in diameter. This consists of cylindrical segments that are assembled at the launch site. There are four-field joints and they use sealsconsisting of pairs of O-rings made of vulcanized rubber. The O-rings work with a putty barrier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

The engineers were employed with Rockwell International (manufacturers for the orbiter and main rocket), **Morton-Thiokol** (maker of booster rockets), and they worked for NASA. After many postponements, the launch of Challenger was set for morning of Jan 28, 1986. **Allan J. McDonald** was an engineer from Morton-Thiokol and the director of the Solid Rocket Booster Project. He was skeptic about the freezing temperature conditions forecast for that morning, which was lower than the previous launch conditions. A teleconference between NASA engineers and MT engineers was arranged by Allan.

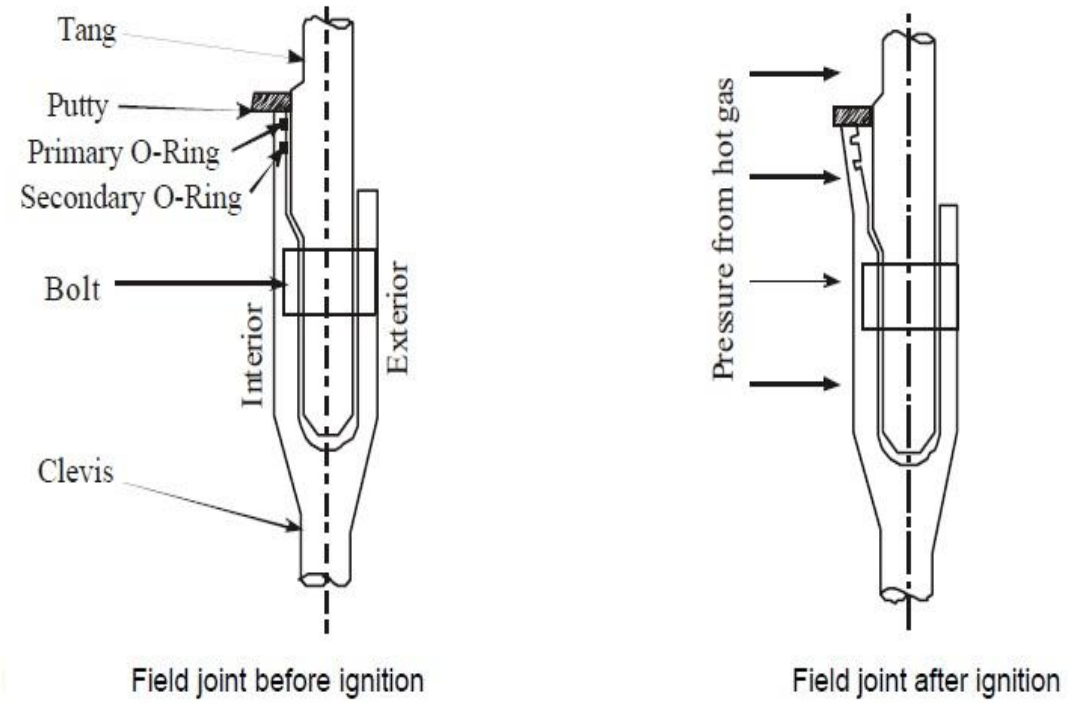
Arnold Thompson and **Roger Boisjoly**, the seal experts at MT explained to

the other engineershow the booster rocket walls would bulge upon launch and combustion gases can blow past the O-rings of the field joints (Fig.).

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



The engineering managers **Bob 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 judgment of the engineers was not given weightage. The inability of these engineers to substantiate that the launch would be unsafe was taken by NASA as an approval by Rockwell to launch.



At 11.38 a.m. the rockets along with Challenger rose up the sky. The cameras recorded smoke coming out of one of the filed joints on the right booster rocket. Soon there was a flame that hit the external fuel tank. At 76 seconds into the flight, the Challenger at a height of 10 miles was totally engulfed in a fireball. The crew cabin fell into the ocean killing all the seven aboard.

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

Moral/Normative Issues

1. The crew had no escape mechanism. Douglas, the engineer, designed an abort module to allow the separation of the orbiter, triggered by a field-joint leak. But such a 'safe exit' was rejected as too expensive, and because of an accompanying reduction in payload.
2. The crew 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.

UNIT – IV
SAFETY, RESPONSIBILITY & RIGHTS

SAFETY

A product or a project is safe, with respect to a person or a group, at a given time, if its risks were fully known, and if the risks are judged to be acceptable, in the light of settled perspectives. When based on judgement, safety can be taken as objective. If the perspectives on values are taken then safety can be subjective as well.

Awareness and maintenance of this situation is called ***Safety***. The safety can be incorporated during design, pre testing, operation, field applications, analog tests and learning from the past or others.

The perception varies from person to person, based on one's physical condition, age, experience, expertise and wisdom. A second hand electric heater when purchased was alright, but when using it might give electric shock and damage the user. Chlorinated municipal water supplied may be considered as unsafe we may judge that the harm to the stomach is unacceptable, but it may really safeguard against gastroenteritis. Sometimes the individual or groups think motorbikes are unsafe and scooters are safe, but young people don't think about safety at all. An aged person is likely to suffer from dust compared to us, a scissor with the child may be unsafe, but with an adult it can be safe.

Various factors that influence the perception of risk are:

1. Probability of Risk (the statistical nature of occurrence of risk)
2. Consequence of the Risk. This is a quantitative measure, it can be physical damage or death of people, economic loss or damage of property, loss of money or reputation, degradation of the environment and sometimes mental agony.
3. Voluntariness (i.e., for thrill and amusement) or under compulsion (involuntariness)
4. Magnitude i.e., number of people or extent of area involved.
5. Proximity, the closeness of relationship with those affected or the gap in the time scale.
6. Method of information dissemination on risk
7. Job related, i.e., whether it is under compulsion or preference

The knowledge of risk acceptance is useful to the engineers. The designer

can redesign the product/project to include safety measures, so as to (a) allow the product fail safely, (b) abandon it safely, and (c) provide for safe escape/evacuation from the product or site, and thus eliminate or minimize the human loss.

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

Risk = Probability of occurrence × Consequence in magnitude

Different methods are available to determine the risk (testing for safety)

1. Testing on the functions of the safety-system components.
2. *Destructive testing*: In this approach, testing is done till the component fails. It is too expensive, but very realistic and useful.
3. *Prototype testing*: In this approach, the testing is done on a proportional scale model with all vital components fixed in the system. Dimensional analysis could be used to project the results at the actual conditions.
4. *Simulation testing*: With the help of computer, the simulations are done. The safe boundary may be obtained. The effects of some controlled input variables on the outcomes can be predicted in a better way.

RISK ANALYSIS

Analytical Methods

Several analytical methods are adopted in testing for safety of a product/project.

1. Scenario Analysis

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

For example, a disaster recovery plan, for an organization is discussed. When the probability and size of loss (indicating possibility and financial significance, respectively) are both high, risk exists. On the other hand, risk is not associated with very low probability of occurrence, or with losses that under any other circumstances would be considered "affordable". But there is a gray area between probability/loss combinations that are truly risky, and those that are not. This reflects the fact that the boundary between risky and non-risky events is fuzzy, not exact.

To assess the risk faced by the organization, the planner matches the probability and loss characteristics of various exposures to one's intuition of risk. This exposure analysis can be most effectively carried out using 'loss scenarios'. A scenario is a synopsis of events or conditions leading to an accident and

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

Steps for Risk Assessment

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

Consider three loss scenarios facing the company which is transporting various cargoes, some hazardous. The three scenarios involve the legal liability arising from use of company vehicles on public roads. The probability/loss combinations associated with these scenarios are 0.1, 1 and 10.4%

Scenario A represents an upset or overturn of a truck carrying dangerous cargoes in a populated area further assumed that the spill leads to an explosion or release of toxic chemicals. Scenario B represents the company's liability for an accident involved bodily injury and property damage from relatively 'ordinary' road hazards, no spill or disruption of cargoes is involved. Finally, Scenario C identifies a situation involving multiple simultaneous catastrophes to the company fleet.

Scenario A has a probability of occurrence of 0.001 and a loss potential of Rs. 50 million which is deemed sufficiently 'possible' and significant so as to be undeniably classified as 'Risky'. Scenario B while more probable than A, involves losses that this firm considers 'affordable' and rated as not risky with confidence. Scenario C, the probability of multiple catastrophes is not strictly zero, it is rare (10^{-6}, or one chance in million), loss potential is great & the chance of occurrence is 'virtually impossible'.

The steps for Scenario building may alternatively be detailed as follows:

1. Identify the hazard of interest
2. State the question to be investigated
3. Develop a planned scenario
4. Develop a scenario tree
5. Collect evidence to evaluate the nodes of the scenario tree
6. Quantify the number of scenario tree, and
7. Link the information generated by scenario analysis with empirical evidence.

Using the Scenario

The uses of scenario based risk analysis are many and varied. The explicit analysis of scenarios may suggest ways of reducing or eliminating exposures through risk or loss-control activities. Risk or loss control actions have the effect of reducing probability and the amount of risk or loss or both. Often, scenarios are posited on the basis that risk potential is As Low As Reasonably Achievable (ALARA). This type of analysis recognizes that even under the best of risk control programs, accidents will happen.

As the corner state of planning, scenario based risk analysis allows identification and prioritization of disaster potential. By concentrating on risky scenarios, the disaster planner can tailor actions to exposures, ensuring the best allocation of resources at the time of crisis.

2. Failure Mode and Effect Analysis

In this method, carious parts or components of the system and their modes (patterns, propagation and nature) of failure are studied. The causes of failure or the interrelationships between the components are not studied. FMEA is one of the qualitative tools, which support proactive quality strategies. Successful implementation of FMEA requires relevant knowledge and insight as well as engineering judgment. FMEA concept was introduced in 1960s by aerospace companies. Then the use of FMEA was extended to automobile industries and other types of industries, understanding the value of this approach. In the last decade, it has undergone metamorphosis where focus was on severity, occurrence and detection rating. Thus, FMEA is defined as a systematic tool to

- Identify possible failure modes in the products/process,
- To understand failure mechanism (process that leads to failure)
- Risk analysis
- Plan for action on elimination or reduction of failure modes.

STEPS TO CONDUCT FMEA

FMEA is a cross-functional team management. Throughout the product development cycles, changes and updates will be introduced to the product and process. These changes have to be reviewed because they can introduce new risks or failure modes. It is thus necessary to review and update changes.

1. Product/process and its function must be understood first. This is the most fundamental concept to be adopted in this methodology. This understanding helps the engineer to identify product/process function that fall with the intended and unintended users.

2. Block diagram of product/process is created and developed. The diagram shows the major components or process steps as blocks, identifies their relations namely, input, function and output of the design. The diagram shows logical relationship of components and establishes a structure for FMEA. The block diagram should always be included in the FMEA form.
3. Header on FMEA form is completed. FMEA form includes part/process name, model date, revision date, and responsibility.
4. The items/functions are listed logically in the FMEA form, based on the block diagram.
5. Then failure modes are identified. A failure mode is defined wherein a component, subsystem, system, and process could potentially fail to meet the design intent.
6. A failure mode in one component can cause failure in another. Each failure should be listed in technical terms. Listing should be done component- or process-wise.
7. Then the effects of each risk/failure mode are described. This is done as perceived by both internal and external customers. The examples of risk/failure effect may include injury to the user, environment, equipment, and degraded performance. Then a numerical ranking is assigned to each risk or failure. It depends upon the severity of the effect. Commonly, in the scale, No.1 is used to represent no effect and 10 to indicate very severe failure, affecting system of operation and user. By this, the failures can be prioritized and real critical risks can be addressed first.
8. Then the causes of each failure mode have to be identified. A cause is defined as a design weakness that results in a failure. The potential causes for each failure mode are identified. The potential causes, for example, may be improper torque or contamination or excessive loading or external vibration.
9. The probability factor indicating the frequency of occurrence is considered. A numerical weightage can be assigned to each cause depending upon the probability of occurrence. A standard scale is used, 1 indicating ‘not likely’ and 10 indicating ‘inevitable’.
10. Design or Process mechanism has to be identified, which can prevent the cause of failure or detect failure, before it reaches customer. Accordingly, the team has to identify tests, analysis, monitoring and

other techniques to detect the risk or failure. Previously undetected or unidentified failures may appear when a new product/process are introduced. Therefore, FMEA should be updated and the required plans for the elimination of risks or failure have to be drawn.

11. Assessment of detection rating is done by assigning a numerical weightage. Value 1 indicates design control will certainly detect the potential cause, 10 indicates design control will not detect the cause or mechanism. A normal scale of 1 – 10 is used.
12. Risk Priority Number (RPN) is calculated and reviewed.

    RPN = Severity x Probability x Detection

    It is used to prioritise failure modes and viewed as a relative measure of the design risk.
13. Recommended actions are determined to address potential risks or failures with high RPN.
14. Revalidate each action by reassessing severity, probability and detection and review the revised RPN. Check any further action is needed. FMEA has to be updated as and when the design or process is modified or changed.

STAGES OF FMEA

The analysis can be executed in four stages as given below:

Stage 1: Identifying possibilities and defining the scope. It includes function, possible failure mode, causes and effects of failure mode and detection/prevention of failure mode.

Stage 2: Measuring the volume of risk involved from the failure modes identified. It includes the probability of cause and occurrence, severity of effect and effectiveness of control to prevent cause, assessment of RPN.

Stage 3: Classification of severity of effects and the solution for the causes of high risk. Based on RPN, it prioritizes work, indicates detailed action, and assigning responsibility and target completion time to the team.

Stage 4: Revalidation of the above procedure, after corrective and preventive actions are implemented. Check whether target data and work is met. Review RPN and decide if any further action is needed.

FMEA DOCUMENT

The top portion of document is called header and mainly used for tracking. Except the first column of work sheet, all other details remain the same. The header includes following:

1. Model No.: It includes name and identification number of system,

subsystem or component in order to avoid confusion between similar components.

2. Prepared By: The Details like name, telephone number, address of the personnel should be included in the space for clarification, if any.

3. Responsibility: The team in charge of design or process should be included. It also includes the company or department of the person or group responsible for preparing the document. It is a common work sheet that can be used both for design FMEA and process FMEA.

In design FMEA, following points are to be entered: name and number of item, listing the functions of the item (system or sub-system or component-wise), Environment in which system operates. In process FMEA, descriptions of processes, listing of processes and complete purpose of processes have to be entered.

4. FMEA team: The names of responsible individuals and departments that have authority to perform task are included.

5. FMEA date: The date of original FMEA compiled should be entered. In revision column latest revision date is entered.

Worksheet for Design/Process FMEA

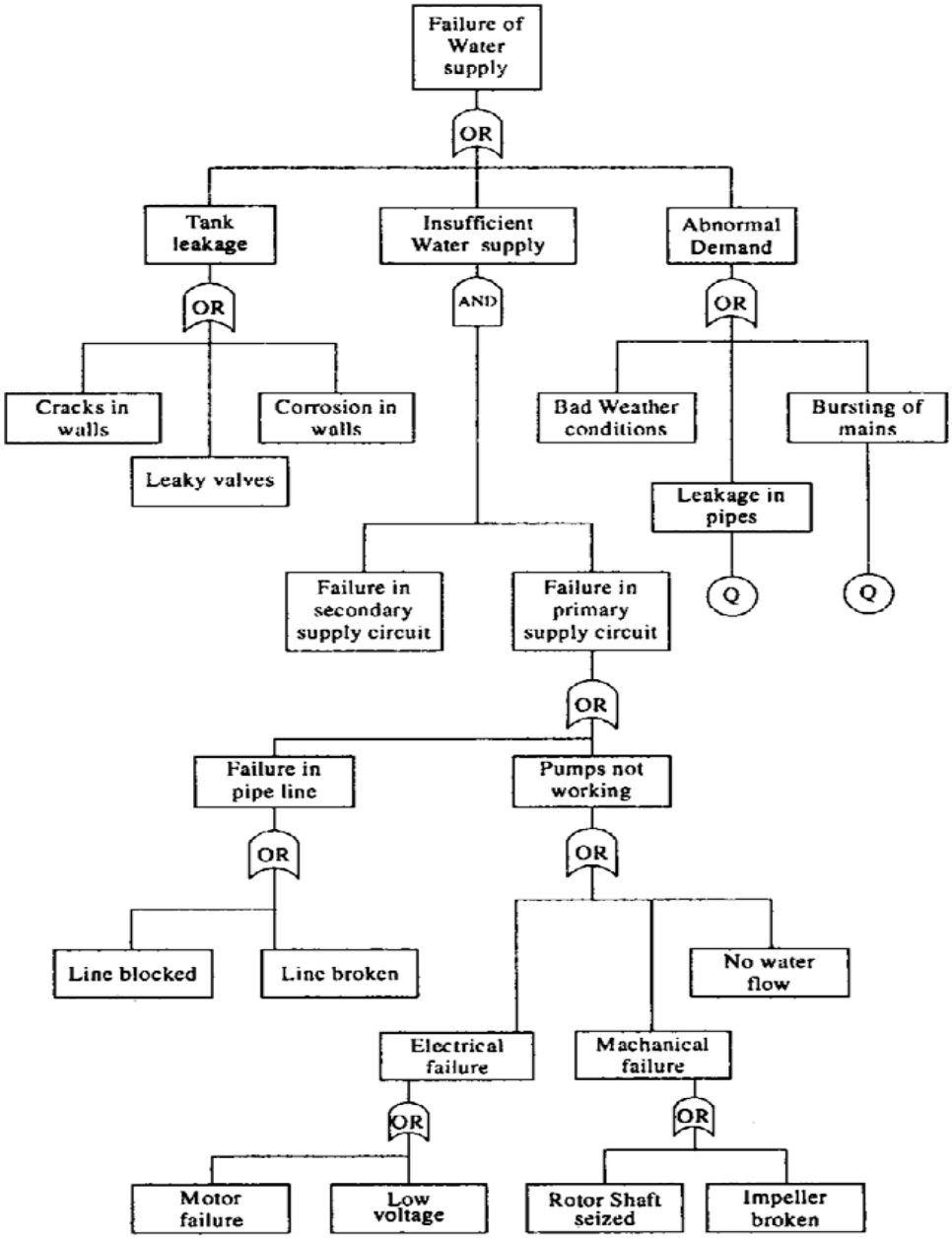
Model No: FMEA team members					Prepared By: Original FMEA date:					Responsibility: Date of Revision:					
Design/Product	Potential Cause of Failure	Potential Effects of Failure	Severity	Class	Potential Cause/ Mechanism of Failure	Occurrence	Current Process control	Detection	RPN	Recommended Actions	Responsibility & Target date	Action details			
												Severity	Occurrence	Detection	RPN

3. Fault-tree Analysis

This is a qualitative method and was originated by Bell Telephones. It is technology-based deductive logic. The failure (undesirable event) is initially

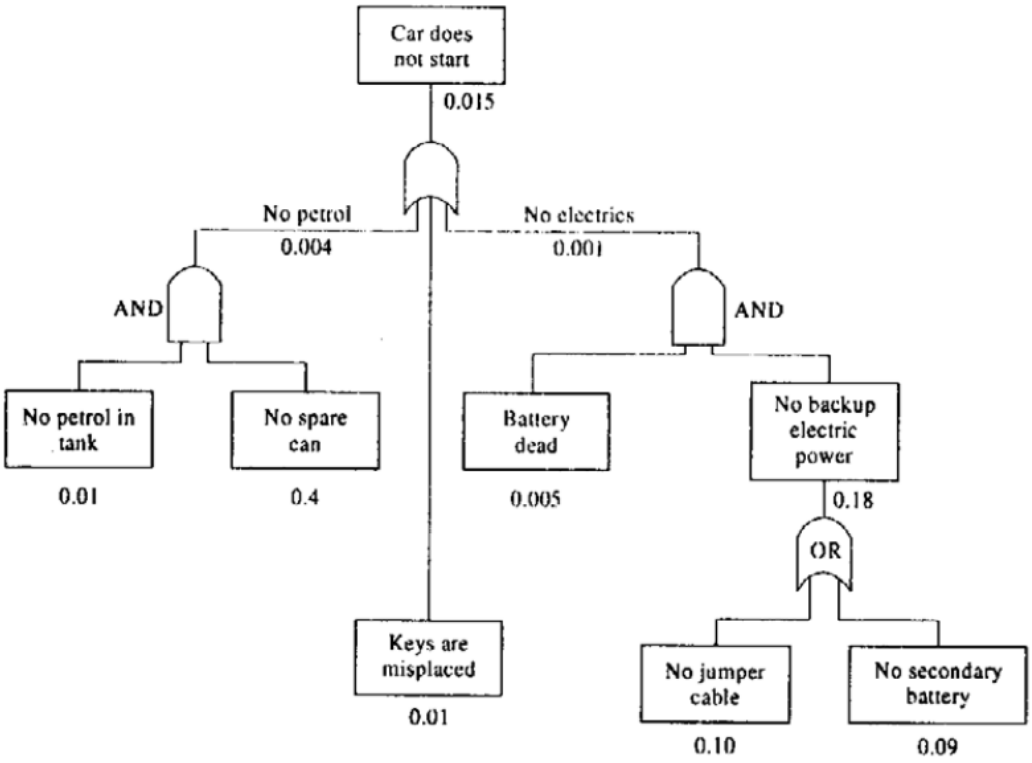
defined, and the events (causal relationships) leading to that failure are identified at different components level. This method can combine hardware failures and human failures

Example 1: Consider the failure of the steam flow in a thermal station. The water is pumped from a big reservoir nearby. The details are shown in Fig.



The common mode event in this case is an earthquake. This quake has affected many systems or components at the same time. Hence, we can call the 'earthquake' as the common mode/cause.

Example 2: An automobile car does not start. The details of this case are shown in Fig.



The advantages of FTA are (*a*) the primary cause can be located easily, and (*b*) It is useful in emergent situations i.e., a fire-fighting approach.

4. Event – tree Analysis

This method illustrates the sequence of outcomes which may arise after the occurrence of a selected initial event. This method uses inductive logic. It is mainly used for consequence analysis and in identifying the potential hazardous existing situation in the system. It is the inverse of the FTA. FTA allows one to proceed back in time from possible catastrophic accidents to examine the components of sequences with probability of failure. But, the ETA allows the observer to proceed forward in time from potential component failures to final accident.

The most serious outcome such as explosion, toxic release etc., is selected as the final event. A tree is then constructed by relating the sequences of events, which individually or in combination, could lead to the final event.

Example: Going late for Duty

The events are listed, arranged chronologically, and in separate clusters, to include only that are relevant & important. Fig. shows the ETA for the event of

going late to the office as a simple illustrative example. The branching structure starts with the initiating event (initiator) on the left hand side of the tree and lead to a bad end event (final damaged state) shown at the far right side. The sequence starts with the person getting up late and being time pressed to get to duty.

The person has three alternatives to get there, namely (a) driving his own car along the highway, that is subject to periodic overcrowding and delays while driving, (b) to use the public transport (express train or bus), and (c) call a colleague and share the car.

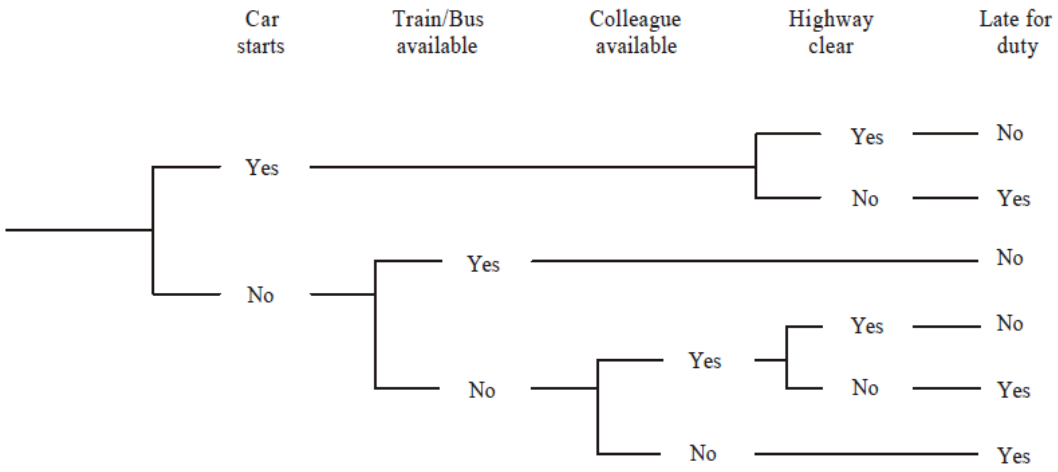


Fig. Event-tree analysis

The figure shows the event-tree including the alternatives and different things that could lead to the employee being 'late again'. Alternative outcomes are shown under each column. Trace back from the outcomes towards the left hand side of the tree along horizontal paths. There are series of vertical branches labeled, **Yes** or **No**, which are connected to previous paths. The vertical branches represent the response (Yes/No) to the question (or the systems responsible) that appear on the top of the tree.

Tracing back from first 'No' under 'Late again' one comes to the first label Y/N: Is the highway clear? The up branch represents 'Yes' showing that the highway that morning was clear. The person arrived on time for duty. The down branch representing 'No' means that the highway was not clear and the person was late. This branch is attached to the earlier path and representing the condition that the car did not start. The up branch corresponding to question 'car starts?' indicates 'Yes'. Because car did start, there is no need to consider the backup alternatives of the colleague.

What are the possible outcomes, if the car does not start? Work from left to right starting on the lower "no'' branch for the question 'car starts?'. The next question is train/express bus available? The 'Yes' path goes straight to the outcome of not being late. Notice the questions in the event tree are very simple. We may even ask, is the train sufficiently frequent and are the terminals conveniently located to go to the office in time? Is the day analyzed a holiday with reduced trips? Has there been an accident or breakdown that day, on the line in question?

If the answer is 'No', then we are left with the 'colleague' option, and if he is available and is he willing to offer the ride in time. If not, he will be late. If 'Yes', the question 'Is the highway clear?' must be considered. Heavy highway traffic (Monday morning) may still cause a late arrival.

Remarks

ETA is a variant of FTA that can be used to explore both success and failure alternatives at each level. Event trees are meant to show the path by which we get there. Hence, the event trees are said to have the memory. The event trees are portrayed in a logical structure that branches from left to right and uses only OR gate. In contrast, a Fault Tree is organized 'top to bottom' hierarchy and uses both AND and OR gates logic. More AND gates a tree contains, the more fault tolerant (and safer) a system typically is. A proliferation of OR gates indicate a failure – prone situation.

Human Error

The human – error contribution to overall system failure can be included in a FTA or ETA, if human – error probabilities are described in the same terms as component and hardware failures. To include human error, a detailed task analysis is first required, listing the actions to be done, conditions, speed of operation and the correct sequencing of individual actions. After allowing for deviations and shaping factors, which influence individual performance (such as skill and stress), and recovery factors (most human errors are recoverable), the contribution of human error can be estimated, by using data on human error rates.

Cost Analysis

A quantitative risk analysis is made on (i) Primary Costs: the loss of human lives, or property (assets), crops, and natural resources are estimated, and (ii) Secondary Costs: the loss of human capability or loss of earning capacity, cost of treatment and rehabilitation, damage to the property, fertility to the soil, salinity to the groundwater etc., are estimated.

ASSESSMENT OF SAFETY AND RISK

Uncertainties in Assessment

There are many positive uncertainties in determining the risk of a product/service.

1. Restricted access to knowledge on risk: Some organizations do not disclose the data, citing legal restrictions.
2. Uncertain behaviour of materials: Test data supplied by the suppliers are only statistical. The individual parts may behave considerably different from the statistical mean obtained from the tests on random samples.
3. Uncertain and varying behaviour of user environments such as physical shock, thermal shock, fatigue, creep, impulse and self-excited vibrations in components or structures due to winds, snow fall, and rains cause sudden failure of the whole structure. An error or wrong procedure during assembly or joining the components may cause additional stress leading to early failure.
4. The use or misuse of materials/products, remaining untracked, eg., exposure to rain or snow or damp weather is likely to change the properties.
5. Newer applications of obsolete technologies, remaining unpublished.
6. Substitution of newer materials whose behaviour are not disclosed, and
7. The unexpected and unintended outcomes of the product/project.

All these aspects make the estimation of risk complex and unreliable. Hence the data are to be monitored continuously and risk estimation updated periodically.

For example, a few friends live very near the cement plant, as they are unable to choose a better location to their house. The group work as motor mechanics in an automobile service station nearby.

The air is full of dust and some drainage canals cut across their house sites. They hold that they are exposed to involuntary risk, from dust and drain. But the same persons have previously-owned motor cycles, with which they travel during weekends to their villages through muddy roads.

Now they are willing to take risk voluntarily, i.e., they have no apprehensions on this travel. Statistical study indicates that individuals are more ready to accept voluntary risks (hunting, skiing, fighting in wars) than the involuntary risks (electric shock, natural calamity). Even though the voluntary

risks are thousand times more fatal than involuntary ones, individuals meet them, for the thrill or adrenal quest or for achievement and for a page in the Guinness record.

Another stand or perception closely related to this example is that of 'Control'. There are people who choose to play stunts such as jumping through fire gates, skiing and flying, car racing through tortuous terrains. Most of these people exhibit extraordinary confidence in them and on their gadgets and also believe that the hazards are under their control.

SAFE EXIT

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

1 The product, when it fails, should fail safely
2 The product, when it fails, can be abandoned safely (it does not harm others by explosion or radiation)
3 The user can safely escape the product (e.g., ships need sufficient number of life boats for all passengers and crew; multi-storeyed buildings need usable fire escapes)

RISK-BENEFIT ANALYSIS

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

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

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

1. Primarily the benefits may go to one group and risks may go to another group. Is it ethically correct?
2. Is an individual or government empowered to impose a risk on someone else on behalf of supposed benefit to somebody else? Sometimes, people who are exposed to maximum risks may get only the minimum benefits. In such cases, there is even violation of rights.
3. The units for comparison are not the same, e.g., commissioning the express highways may add a few highway deaths versus faster and comfortable travel for several commuters. The benefits may be in terms of fuel, money and time saved, but lives of human being sacrificed. How do we then compare properly?
4. Both risks and benefits lie in the future. The quantitative estimation of

the future benefits, using the discounted present value (which may fluctuate), may not be correct and sometime misleading.

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

Personal Risk

Assessing the involuntary personal risk is not an easy task. For example, a group residing near the cement plant is exposed to a lot of risk. If suppose a cement plant or refinery was to come up in the area where this group already reside, they will object the proposal. The adequacy of compensation amount payable cannot be fixed reasonably. How to estimate the rupee value of an individual human being? For example, a person may be a father to his young ones, husband to his beloved wife, son to his aged parents , friend to the needy, and as well a guardian for his pet dogs.

There are persons who dared to serve people in dire straits, in spite of the risky situations where their lives were in stakes. For example, Mahatma Gandhi served people during Navakali yatra, when dangers were present all over. For such saviours, there was no personal risk.

However, any of the following methodologies may be adopted to assess quantitatively, the personal risk:

- Assess the voluntary activities (eg., life insurance policy taken)
- Assess the degree of occupational hazard (eg. dust, radiation and asbestosis) and its effect on health.
- Loss of senses such as sight (eyes), hearing (ears) and loss of limbs (immobility by the loss/damage to organs or disfigurement of the limbs or body)
- Loss of earning capability, especially due to physical disability, and
- Get assistance by trained arbiters.

Public Risk

Assessing the public risk is relatively easy, as in the societal value system the cost of disability can be averaged out. For example, the US National Safety Council 1 adopts an equivalent of 6000 days (16.42years), for death, as per the personal value system for social costs of disability.

To assess the public risk, the loss on the assets and the correction costs are estimated. For example,

- Loss of or reduction in future income or earning capacity due to loss of limbs or their capability.
- Costs associated with accident, which includes the transplantation or

reinforcement of body parts/limbs, and medical treatment and

- Cost of welfare, which includes rehabilitation, provision of less demanding alternate jobs, and other disability benefits.

Reducing Risk (Improving Safety)

Several techniques adopted to reduce the risks (or improve safety) in a product or process are listed as follows:

- Application of inherent safety concepts in design, eg. LPG cylinder is provided with frame to protect the valve while handling and facilitate cryogenic storage. A magnetic door catch provides an easy escape for children caught inside the 'fridge' accidentally.
- Use of redundancy principle in the instrument protection/design. For example, use of stand by device, and back up for computer storage.
- Periodical monitoring (inspection) and testing of safety system to ensure reliability, e.g., fire extinguishers, 'earth' system in electric circuits are checked periodically
- Issue of operation manuals, training of the operating personnel and regular audits are adopted to ensure that the procedures are understood, followed and the systems are kept in working condition.
- Development of well-designed emergency evacuation plan and regular rehearsal/drills to ensure preparedness, in case of emergency.

Voluntary Risk

Voluntary risk is the involvement of people in risky actions, although they know that these actions are unsafe. The people take these actions for thrill, amusement or fun. They also believe that they have full control over their actions (including the outcomes) and equipment or animals handled, eg people participate in car racing and risky stunts.

Testing becomes inappropriate when the products are

1. Tested destructively
2. When the test duration is long, and
3. When the components failing by tests are very costly. Alternate methods such as design of experiments, accelerated testing and computer-simulated tests are adopted in these circumstances.

SAFETY LESSONS FROM 'THE CHALLENGER'

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

1. Negligence in design efforts. The booster rocket casing recovered from earlier flights indicated the failure of filed-joint seals. No design changes were incorporated. Instead of two O-rings, three rings should have been

fixed. But there was no time for testing with three rings. At least three rings could have been tried while launching.

2. Tests on O-rings should have been conducted down to the expected ambient temperature i.e., to 20 ^{0}F. No normalization of deviances should have been allowed.
3. NASA was not willing to wait for the weather to improve. The weather was not favorable on the day of launch. A strong wind shear might have caused the rupture of the weakened O-rings.
4. The final decision making of launch or no-launch should have been with the engineers and not on the managers. Engineers insisted on 'safety' but the managers went ahead with the 'schedule'.
5. Informed consent: The mission was full of dangers. The astronauts should have been informed of the probable failure of the O-rings (field joints). No informed consent was obtained, when the engineers had expressed that the specific launch was unsafe.
6. Conflict of interest (Risk vs. Cost): There were 700 criticality-1 items, which included the field joints. A failure in any one of them would have cause the tragedy. No back-up or stand-bye had been provided for these criticality-1 components.
7. Escape mechanism or 'safe exit' should have been incorporated in the craft. **McDonnell** Douglas, the engineer, designed an abort module to allow the separation of the orbiter, when triggered by a field joint leak. Unfortunately such a 'safe exit' was rejected due to the increase in the cost, simultaneously with reduction in payload.
8. Ethical engineers should have been given awards and encouraged to hold their discretion (moral autonomy) in risky situations, and to report to appropriate agency their views, in the interest of public safety.

CASE STUDY: POWER PLANTS

THREE MILE ISLAND

The TMI nuclear power plant Unit 2 is located in a river basin in Pennsylvania, USA (March 28, 1979, 4 a.m.)

The Nuclear power plant had a Pressurized Water Reactor system (PWR). The main reactor core (1) release heat which is transferred to water in the primary circuit (1-2-3-4). The heat from the steam generator (3) is transferred to water in the secondary circuit (7) at low pressure. The water in the secondary circuit gets converted into steam in the boiler (3). This steam flow drives the

turbine (8), and the exhaust steam is converted into water in the condenser (10) and circulated back in to the steam generator (3) by means of pumps (11,13,14).

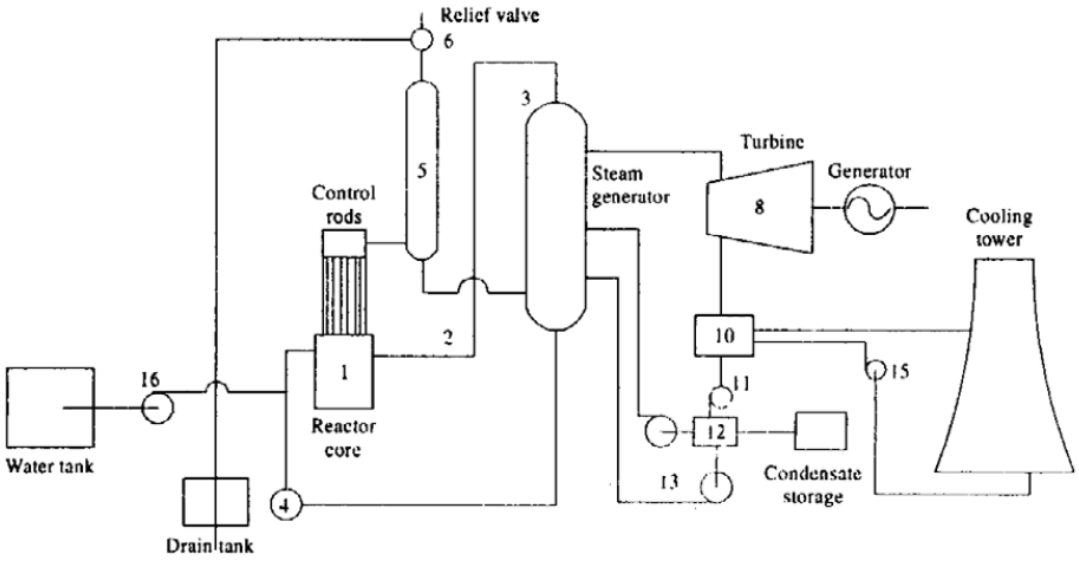


Fig. System Components of TMI – 2 Plant

The demineraliser (12) contains resin beads to clean condensate. A problem in the demineraliser arose and this led to the closure of the outlet valve of (12) to the steam generator (3). This resulted in the shutdown of main feed water pump (13) and the auxiliary feed water pump (14) failed.

The reactor pressure increased to very high level, opened a pressure relief valve (6) and gave a signal (SCRAM), which helped to lower the control rods in the reactor core, in order to stop the main fission process. This valve (6) remained opened for long.

When pump (14) failed, the steam generator (3) went dry. So, heat was not removed from the reactor. Water was pouring out at 220 gallons/min but reactor has not cooled down.

Pumps (16) were started to refill water reactor core. There was too much of water in the reactor now. The reactor fuel rods began to break to pieces.

Then the chemical reaction between steam and the Zinc alloy fuel elements produced Hydrogen and the Hydrogen accumulated caused the explosion of the structure.

The radiation levels in the building increased and the sound alarm blew. Immediately people contacted Nuclear Regulatory Commission and B and W, who constructed the reactor. Nobody was there to answer the call at B and W. But somehow people escaped without any loss of human lives.

After 13 hours and a half, the reactor was put under control.

Chernobyl, Near Kiev, Russia (April 1986)

The RBMK (Acronym for water cooled and graphite moderated) reactors were graphite moderated and they use water tubes. A test on the turbine generator was planned to be conducted during a scheduled plant shut-down maintenance.

To conduct the test, the power plant output was reduced to 700 MW. But due to a sudden and unexpected demand, the power output has to be raised.

1. To go ahead with the test, the reactor operators had already disconnected the emergency core-cooling system, ignoring the raise in demand situation.
2. Further, a control device was not properly reprogrammed to maintain power at 700-100 MW level
3. The test was conducted at 200 MW power out-put which is very low for the test. They should have shut down the reactor.
4. The operators blocked all emergency signals and automatic shut-down controls, thus all safety systems were disconnected.
5. The operators raised control rods to increase power output and tried to continue the test. This made the reactor unsafe. The temperature of RBMK reactor increased and the fission rate increased.
6. The test should have been postponed but continued. The reactor core melted and due to the Hydrogen accumulation, the reactor caught fire and the radioactive waste began to spread out in USSR and also Europe.

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

Safety Lessons from TMI and Chernobyl

- The thickness of the containment should be more, to withstand the possible explosion and further damage due to radiation and leakage over the surroundings (Chernobyl).
- When the test began at low loads, the demand for increased out power should have been declined.
- The tests should have been abandoned and all controls switched on. Then the output should have been increased (Chernobyl).

- The decision making on test and increase the load should have been with one person or the decision makers should have coordinated with each other (Chernobyl).
- Valves are the least reliable components in the hydraulic system. Such a malfunction of the pressure relief valve and lack of information about its opening (or closing) were reported elsewhere in the past. But there was no 'learning from the past' (TMI).
- Continuous monitoring of the components such as demineraliser and the pressure operated relief valve must have been made (TMI).
- A comprehensive precursor program (emergency procedures) should have been implemented to record a few accident sequences and map these events to risk models. The mapping based on technical and human factors give us accounts, how people react and interact under conditions of stress (TMI).
- Periodical mock drill of emergency for the operators (safe exit) should have been arranged (TMI & Chernobyl).
- In stack radioactivity monitoring instrument indicated a rise earlier. The operators at TMI 2 should have informed the superiors at once. People residing in the neighbourhood ought to have been informed and steps initiated to evacuate the public immediately (TMI especially, and also Chernobyl).

RESPONSIBILITY

Senses: There are different senses of responsibility, such as:

1. Characteristic Quality

Primarily responsibility implies duty with care and efforts.

2. Obligations

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

3. General Moral Capacity

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

4. Liability and Accountability

Liability and Accountability for actions. It means that one is liable (with a

legal sense) to meet the obligations in better ways. The person is likely to respond legally, if necessary.

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

5. Praiseworthiness/Blameworthiness

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

Types of Responsibilities:

Different types of responsibilities exhibited in human transactions are:

1. Moral Responsibility

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

(*a*) *Obligations*: A commitment to moral actions (primary obligation to protect the safety of the human beings and respect their rights),

(*b*) *Conscientious*: A comprehensive perspective to accept the duties, and diligently do the right things by putting their heart, head and hands (awareness of the experimental nature of the product/project, anticipating possible and unexpected outcomes and putting efforts to monitor them),

(*c*) Accountability (being accountable for the decisions, actions, and the results of product/ project including safety), and

(*d*) Praiseworthy/Blameworthy as applied to context of doing things right/doing things wrongly, respectively.

2. Causal Responsibility

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

3. Job Responsibility

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

4. Legal Responsibility

It is the response required by law and includes legal obligations and

accountability to meet them. Many of these responsibilities overlap with moral responsibility.

Responsible Professionalism

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

1. Self-direction (Self-governance) virtues are fundamental and necessary in exercising moral responsibility. On the basis of 'understanding and cognition', it includes self-understanding, humility (proper assessment of one's character), and good moral judgment (termed as 'practical wisdom' by Aristotle). On the basis of 'commitment and action', it covers courage, self-discipline, perseverance, self-respect, and integrity. Honesty a virtue common to both bases as it implies truthfulness in thoughts and words and trustworthiness in actions.
2. Public-spirited virtues focus on the good of the clients and the public. It includes the respect for rights (to make decisions and face the risk), non-malfeasance (not harming others intentionally). Engineering codes go a step further and prescribe beneficence that includes preventing or removing harm to others and also promoting the public safety, health, and welfare, generosity (helping the community by voluntarily giving their time, talent, and money-voluntary service to the professional society and community), and justice (unbiased) in all decisions and actions.
3. Team-work virtues enable the professionals to work successfully with others. They include collegiality, cooperativeness, communicative ability, and respect for legitimate authority. Responsible exercise of authority and the ability to motivate other to achieve are also the relevant to team-work virtues.
4. Proficiency virtues, which mean the mastery of technical skills (called as Intellectual Virtue by Aristotle). It includes competence (having qualified, licensed, and prepared to execute the job that is undertaken), diligence (alert to dangers, careful attention, and avoidance of laziness or workaholic nature), creativity (learning to respond to the changing technological society), excellence (perform at the highest level), and self-renewal through continuing education.
5. Cardinal (chief) virtues: Wisdom (prudence), courage (fortitude), temperance and justice. Some of these may overlap other virtues. They

are called 'cardinal' (Latin: cardo, hinge) because they are hinges on which all virtues depend. These are also called *moral* (Latin: mores, fixed values) because they govern our actions, regulate our passions, and guide our conduct according to faith and reason. Wisdom is perception of truth and ability to distinguish between the right and wrong. Courage means a firm and elevated mind. Temperance represents order in words and actions. Justice is preserving humanity and observing the faith of contracts. Although these virtues ring religious tones, they are very relevant to the engineering practice.

Social Responsibility

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

(i) How the product/project is marketed, used or misused, how it fails, and how it is disposed or discarded. The ways in which the used battery cells and computers are discarded have been debated in the engineers' forums.

(ii) Protecting the work environment during manufacture as well as the external environment during transport or use

(iii) Training the disadvantaged or physically-challenged workers

(iv) Subcontracting and hiring practices, and

(v) Contribution to local communities to enrich their cultural, social, and civic life. It may be even compensatory against the harm to environment (e.g., planting trees).

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

Events	Responsibility
1. A stray cattle on the rail track caused the derailment of goods train	(a) Although cattle is the cause, the owner of the cattle is morally responsible (b) For letting the cattle go astray on the railway track, that is trespassing the owner is legally responsible
2. A child playing with (safety?) matches causes fire	Although the child is the cause, the parents who have left the match box within the reach of the child, are morally responsible

3. (*a*) Seth was driving a car. He failed to stop at the red signal, which caused an accident (b) Suppose he applied brakes, but they failed	(*a*) Seth is causally responsible (*b*) Seth has been negligent of maintenance of brakes
4. There was a forest fire. It was traced to camp fire at specific site and Raj was the last to use the campsite.	Raj is causally responsible for the forest fire he failed to put out the camp fire. Although the temperature was high, and the dry leaves helped the fire to spread, Raj allowed the fire to spread. Hence, he is the cause
5. The products sold have caused harm while being used	The engineer or the engineering firm is legally responsible for the harmful effects of defects in their products. But they are not morally responsible for the harm or defects
6. A fitter lost one his eyes while inserting a chip by using a hammer	The hammer manufacturer was legally responsible on the basis of the doctrine of strict liability, which does not require any proof of effect in the design of the hammer. Morally the manufacturer was not responsible
7. In a contract, it is not implied that the engineer to be held for not observing the possibility of danger. But an accident occurs	The engineer is free from legal responsibility, but he has moral responsibility to observe the work done
8. A pandal erected by the contractor, in a marriage hall catches fire, due to a leakage of electric current	No legal responsibility for pandal contractor. Owner of the hall is morally responsible for the leakage
9. Question papers were leaked out by some persons, during transport	Controller of Examinations cannot be held legally responsible, although he is morally responsible

COLLEGIALITY AND LOYALTY

Collegiality

Collegiality is the tendency to support and cooperate with the colleagues.

It is a virtue essential for team work to be effective. This consists of various aspects such as:

- ***Respect to the ideas and work of others***: This results in support and cooperation with one's colleagues. One gets back the support and cooperation in return, and this is mutually beneficial.
- ***Commitment to Moral Principles:*** Commitment is towards moral decisions, actions, goals of the organisation and the values of the profession.
- ***Connectedness:*** It means the shared commitment and mutual understanding. It ensures the absence of egoism and paves way for progress for both.

Loyalty

Loyalty is exhibited in two senses, namely

1. Agency Loyalty

It is an obligation to fulfil his/her contractual duties to the employer. The duties are specific actions one is assigned, and in general cooperating with others in the organization. It consists of several obligations to employers. But, for the engineers, the paramount obligation is still "the safety, health, and welfare of the public".

2. Attitude Loyalty (or) Identification loyalty

It is concerned with the attitudes, emotions, and a sense of personal identity. It includes willingness to meet moral duties, with attachment, conviction, and trust with employer. The attitude loyalty is more a virtue than an obligation. This type of loyalty is all right when the organizations work for productivity or development of community. Working together in falsification of records or serious harm to the public, does not merit loyalty. Further, with frequent takeovers or merger resulting in large-scale lay- off, employees find it difficult to maintain attitude-loyalty.

Authority

Decisions can be taken by a few people, but putting into action requires larger participation from different groups of people, such as operation, purchase, sales, accounts, maintenance, finance etc. In effectively-and efficiently-transferring decisions to actions, the authority comes into play a great role. Otherwise the individual discretions may ruin the activities. Further the

authority fixes the personal responsibility and accountability uniquely on each person. This is necessary to ensure progress in action.

3. ***Institutional Authority***

It is the authority exercised within the organization. It is the right given to the employees to exercise power, to complete the task and force them to achieve their goals. Duties such as resource allocation, policy dissemination, recommendation, supervision, issue orders (empower) or directions on sub-ordinates are vested to institutional authority, e.g., Line Managers and Project Managers have the institutional duty to make sure that the products/projects are completed successfully. The characteristics features of institutional authority are that they allocate money and other resources and have liberty in execution.

4. ***Expert Authority***

On the other hand, the Expert Authority is (*a*) the possession of special knowledge, skills and competence to perform a job thoroughly (expertise), (*b*) the advice on jobs, and (*c*) is a staff function. It is also known as 'authority of leadership'. These experts direct others in effective manner, e.g., advisers, experts, and consultants are engaged in an organization for a specific term.

COLLECTIVEBARGAINING

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

A. Faithful Agent or Trustee?

Professional societies such as NSPE and IEI refuse to accept the 'collective coercive action' of unionism, holding the principles of professional integrity as right, e.g., as per NSPE code III, i.e., engineers shall not promote their own interest at the expense of the dignity and integrity of the profession. The engineers are said to exhibit a higher standard than self – interest; and they are expected to perform an ethical duty to their employer as faithful agent or trustee. The actions of unions are usually against the interests of the employers and they use coercion and force against the employers. These actions are interpreted as unprofessional and disloyal. But in certain cases, the safety of the workers had been ignored for a long period or the employees were under paid for years. Can

we still hold the action as unethical?

It can be concluded from this discussion, that

(a) The duty of the employee to one's employer does not mean sacrifice of monetary self – interests, and

(b) Trustee or faithful agent means executing the assigned tasks and safeguarding the property. It does not nullify the right to negotiate for safe and hygienic conditions and economic benefits collectively.

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

(d) Can collective and coercive action to be restored, when all other efforts have failed?

B. Service to the Public?

The service to the public is of foremost importance. But the unions promote the interests of a few members only. The public welfare should not suffer because of their actions. Imagine a situation when all the teachers, medical practitioners and ambulance drivers go on strike. Will this not cause damage to the public safety and health?

Collective bargaining by engineers through union or association or forums may act within limits set by the concern for the public welfare. Professional societies can play a great role in the promotion and establishment of principles and practices towards fair employment and exploitation. But they cannot function as collective bargaining agents.

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

C. Assessment on Unionism

The moral assessment on Unions is a complex process. A careful consideration of all relevant moral facts is to be inquired into and judged. It cannot be generalized, because of the divergent views on unionism, as shown in table.

For Unionism	Against Unionism
Unions have been useful in	Unions have led to disturb the

improving the standard of living and economic benefits of the workers. Even non-union members leading to inflationary condition are able to get those benefits.	economy of state by salaries, and increase salaries and expenses, leading to inflationary conditions
Unions have obtained greater participation in organization, by participative management. Union members are appointed as Directors in the Board and credited to act as bridge between the employers and employees	Instead of being cooperative, they act in negative and destructive ways, causing loss of man-days. Opinions of the individual worker is suppressed and used as pawns.
Unions have contributed to the job security, and protection against arbitrary treatment to the employees	Unions encourage mediocrity, and act in favor of seniority-based promotion. Merit-based promotion and awards for personal achievement are disregarded
They are able to put resistance to unethical orders and support to ethical actions. They have provided for effective grievance redressal mechanism for employees.	Unions thrive on prolonged unrest, dissatisfied, and tense relations between workers and management
They act to safe guard against the possible political interference, exploitation, and alienation in the company affairs	They cause pigeon-holing of employee in narrow job classifications to which the salary scales are attached

CONFIDENTIALITY

Confidentiality means keeping the information on the employer and clients, as secrets. It is one of the important aspects of teamwork.

Justification for Confidentiality

Confidentiality can be justified by various *ethical theories*. According to Rights-based theory, rights of the stakeholders, right to the intellectual property of the company are protected by this practice. Based on Duty theory, employees and employers have duty to keep up mutual trust. The Utilitarian theory holds good, only when confidentiality produce most good to most

people. Act utilitarian theory focuses one such situation, when the employer decides on some matters as confidential.

Further, the following moral principles also justify the concept of 'confidentiality':

1. Respect for Autonomy

It means respecting the freedom and self-determination of individuals and organizations to identify their legitimate control over the personal information of themselves. In the absence of this, they cannot keep their privacy and protect their self-interest.

2. Respect for Promises

This means giving respect for the promises made between the employers and employees. Employees should not disclose the promises given to the employers. This information may be considered as sensitive by the employer. But promises do not establish complete obligations.

3. Trustworthiness

Maintaining confidentiality by lawyers, accountants and attorneys are necessary to develop confidence and welfare of the individuals and the organizations. It does not mean however that these professionals collude with them unethically.

4. Respect for Public Welfare

This moral consideration is important in identifying relationships in professional transactions, for the benefit of public welfare, eg., if the medical practitioners keep confidentiality on the problems of patients, patients develop confidence and trust in them, they feel free to reveal their problems and personal information, without being shy. This is likely to increase their chances of being cured. Similarly, a company keeping confidentiality about its products gets economic benefits of competitiveness. Besides, the public are also benefited from a healthy competition. An attorney keeping the data on clients confidential, prove safety and welfare of the clients as well as the public.

Types of Confidential Information

On the basis of acquisition (possession), the confidential information are divided into two types, as follows:

1. Privileged Information

It is information that is available and accessed, by virtue of a privilege, i.e., privilege of being employed on that assignment. The security check is also insisted during exit from the workplace against the leakage of this type of information. An engineer working on defense project may know that the missile he has developed is to be tested against the terrorists across the border.

2. Proprietary Information

It is the information owned by the organization. It refers to the knowledge and procedures established by and in the organization. Some internal communication in an organization is marked as 'Proprietary'. It is protected legally by the organization from use by others, including the employees. The trade secret is proprietary information that has not been made public. A limited legal protection is available for this proprietary information by common law, which prevents employees from disclosing it to outsiders. The quality manual is another example for proprietary information.

On the basis of severity of risk from breach, the confidential information is divided as:

1. ***Obvious information***: It refers to data, information and test results on the products yet to be released or designs, formulae and technical processes of the products. The risk or loss from the breach is large and may threaten the survival.

2. ***Information of lesser confidentiality***: This relates the business information such as the number of employees working on projects, the identity of vendors or suppliers, customers, marketing strategies, yield of manufacture, cost of manufacture, substitution of materials etc., The risk or loss involved is relatively less. In competitive business situations, this information also plays a vital role.

More on Confidentiality

A. Is Switching Job Ethical?

When persons change jobs (employers), what happens to their moral obligation? The obligation to protect the information does not cease, when one shifts to another employee. Otherwise, the former employee will reveal this information to the new employer or sell it to a competitor of the former employer. The integrity of the employee, even upon switching the employer

demands that he maintains confidentiality and does not to divulge the information. The professional integrity of engineers is more valuable than the loyalty to the current employer.

Many engineers value professional advancement than long-term tie and loyalty to a single employer. The engineers involved in research and development and expert contribution change jobs. Normally they are familiar with the innovative developments in the parent organizations. For example, one manufacturing expert along with his colleagues as well as with some secret documents left General Motors and joined Volkswagen. This violation of trade secret, lead the V W to pay huge compensation to GM in cash and compulsion to buy parts from GM for seven subsequent years.

Employees, who change jobs, will not able to withhold their knowledge and expertise. They are sought after only for their expertise. They may not carry the papers and but their active brain always carry memories. Although some organizations hold that this is unethical, the individuals cannot be prevented from divulging the facts to benefit the current employer. The courts have held a moral verdict. Even though the previous employers had the right to maintain their trade secrets confidential, the personal rights of the employees, who switched job in pursuit of career advancement, had to be honoured and balanced.

B. Management Policies

How can we protect the rights of the employers and at the same time recognize the genuine personal rights and other rights of the engineers/employees? Some of the management practices and their limitations are discussed here under:

1. One way is to restrict the future employment of employees, by using employment contracts at the time of their exit. Details such as the restriction on geographical location, time gap between the departure from one place and engagement with the other employer, and on the type of jobs that one can perform with future employer, are entered into contracts. But such contracts have not been given legal sanction.

2. An incentive instead of threatening their rights by the employment contract, may offer some positive benefits in exchange for the restrictions listed. A lump sum post-employment payment or

compensation over a specific period may offered as incentive to restrict him.

3. Another approach by the management is to effect tighter controls on internal information flow on trade secrets and other vital features. But this is likely to create a mutual distrust in the organization and to throttle the creativity of engineers involved in the research and development.

A better understanding between the ethical management and the professional responsibility of the engineers will fulfil both professional concerns and employee loyalty.

CONFLICT OF INTERESTS

A conflict of interest occurs when the employee has more than one interest. A professional conflict of interest is the situation where the professional has an interest that, if pursued, might prevent him from meeting his obligations to his employers or clients, eg. An Electrical Engineer working in the State Electricity Board may have a financial interest in a company which supplies electrical instruments. If the engineer is decide on the bid for the supply of electrical instruments, a clear case of conflict of interest exists.

A 'conflict of interest' is different from 'conflicting interests'. A student has to clear four arrears subjects in the supplementary examination. But he finds that the time available is sufficient to study only three subjects. This is a situation of 'conflicting interests', where he has two or more desires that cannot be fulfilled under the given circumstances. But there is no moral problem involved in pursuing all subjects. In case of professional conflict of interest, there is a possibility of pursuing all the conflicting interests, thereby inviting a moral problem.

Types of Conflicts of Interest

Several types of conflicts of interests exist depending on the ways and severity of outside interests. A few common types are discussed here.

1. Actual Conflict of Interest

This refers to the situation where the objectivity is lost in decision making, and the inability to discharge the duty to the employer. It is the result of weaker judgement and service. A Civil Engineer working in the Public Works Department has a financial interest in a contracting company, which has submitted a bid for the construction of a bridge. There may be a variety of outside interests, but the conflict arises when the outside interest influences or

threatens the professional judgement in serving the employer or clients.

2. Apparent Conflict of Interest

This is explained in the following example. An Engineer is paid on a percent of the cost of the design and there is no incentive for him to cut the costs. In this situation, it appears that the Engineer makes the design more expensive in order to get larger commission for him. This situation leads to doubting the Engineer's interest and ability of professional judgement.

3. Potential Conflict of Interest

There are situations where the interest of an employee extends beyond the current employer and into the interest on one's spouse, relative or friend. The interest changes into intimacy and subsequent non moral judgements against the interest of the employer and in favour of the outsider or even a potential competitor.

(a) Favorable Contact

When an Engineer's spouse is working for a contractor or vendor, a conflict does not arise. But if the Engineer is to give a subcontract to the contractor or purchase order to the supplier, the conflict arises. This happens even when the Engineer has partial or substantial stockholding in the business of that contractor or supplier.

(b) Bribe and Gift

The conflict arises when accepting large gifts from the suppliers. Bribe is different from a gift. The following table shows a comparison of the nature of bribe and gift.

Tests	Bribe	Gift
1. Timing	Given before	Givenafter
2. Cost of item	Large amount	Smallamount,articlesofdaily use
3. Quality of product	Poor	Good/High
4. Giver is a friend	Yes	No
5. Transparency	Made in secret	Madeinopen
6. Motive	Expect undue favor	Expectafavoror thankingforthefavor
7. Consequence on organization's goodwill	Damaging the goodwill and reputation	Nodamageisinvolved

Table: How does bribe differ from gift?

Codes of ethics do not encourage even gifts, but employees have set forth flexible policies. Government and company policies generally ban gifts more than a nominal value (>Rs.1000?) An additional thumb rule is that the acceptance of gift should not influence one's judgment on merit.

(*c*) Moonlighting

It is a situation when a person is working as employee for two different companies in the spare time. This is against the right to pursue one's legitimate self-interest. It will lead to conflict of interests, if the person works for competitors, suppliers or customers, while working under an employer. Another effect of moonlighting is that it leaves the person exhausted and harms the job performance in both places.

(*d*) Insider Information

Anotherpotentialconflictofinterestiswhenusing'inside'informationtoestabl ishabusiness venture or get an advantage for oneself or one's family or friends. The information may be either of the parent company or its clients or its business partners, e.g., engineers might inform the decision on the company's merger with another company or acquisition or an innovative strategy adopted. In such cases, their friends get information on stock holding and decide on trading their stocks to sell or buy quickly, so that gain more or prevent a loss. For example, in WorldCom USA, the insider information was used to manipulate and sell a large amount of stock holding by the Director, upon knowing that the government has declined to admit their product.

OCCUPATIONALCRIME

An occupational crime may be committed by (1) wrong actions of a person through one's lawful employment or (2) crime by an employee to promote one's own or employer's interest or (3) theft or pilferage by the employee or (4) damage to the property or an employee of one's organisation. These are also called ***White Collared Crimes.***

Many of these crimes are examples of conflicts of interest. These are motivated by the greed, corporate and misguided loyalty. Even the crime to promote the interests of the employer, is an occupational crime. Some of the examples of occupational crimes are:

1. Price Fixing

Fixing the bidding rate by companies, in collusion with other companies, especially for the contract/services, is called price fixing. This is an occupational

crime, prevalent in electrical equipments industries, where there used to be a few contractors but large number of contracts. Because of this, public as well as the government incur huge loss. Two top officers of Westinghouse and GE, USA who were involved in price fixing without the knowledge of their Directors, were sentenced to imprisonment a few years back. These officers held that it was legal to fix price and even argued that this procedure is really beneficial to the people! However, the court did not accept this view.

2. Industrial Espionage

It means simply spying for personal or company benefits, eg., in the Silicon Valley Area, there are several company manufacturing chips, ICs, and microprocessors. There are a lot of engineers who are entrepreneurs and venture capitalists. The espionage is more prevalent here because of the following factors:

(a) The development of chips is extremely competitive and on fast track. Profit and loss can be made quicker.

(b) Manufacture of chips is very costly. Huge saving through reverse engineering could be made only by breaking open the competitor's gadgets or fast tests. Some organizations prefer to steal the design details through illegal means rather testing and development

(c) The components involved are very small. Hence, pilferage or removal of gadgets could be done easily and without being caught.

(d) The crime detection and law enforcement are difficult and ineffective.

(e) Employees do not carry out the activities directly, but through engineers who were employees or through the weakest link in the supplier – producer chain.

3. Bootlegging

Manufacturing, selling or transporting products (liquor and narcotics) that are prohibited by law, is called bootlegging. In engineering context, it refers to working on projects which are prohibited or not properly authorized.

4. Endangering Lives (Occupational Hazards)

Industries who expose their employees to hazards usually escape penalties. Victims have the right to sue, but only to claim some monetary compensation. The asbestos industries in USA were responsible for the death of one lakh workers and 27 million workers afflicted with cancer, in the 80's. Even after 22 years since Bhopal gas tragedy, appropriate compensation has not been paid.

Even the government could not bring to book the culprits for the crime committed.

Occupational Health and Safety Assessment Series, OHAS-18001 Certification has been adopted in many Indian Industries. As per the Annual report of RIL, an initiative called Project CASH, Change Agent for Safety and Health, had been formed to bring about a positive change and continual improvement in occupational health practices at the workplace, besides attitudinal and behaviour changes. This is claimed to have prevented work-related diseases, injuries, reduced absenteeism, and ultimately increased the productivity level.

HUMANRIGHTS

Human rights are defined as moral entitlements that place obligations on other people to treat one with dignity and respect. Organisations and engineers are to be familiar with the minimum provisions under the human rights, so that the engineers and organizations for a firm base for understanding and productivity. Provisions under 'human rights' are as follows:

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

Under professional rights, the following provisions are protected:

1. *Right to form and express professional judgment*: It is also called the *right of professional conscience*. In pursuing professional responsibilities, this empowers one to form and exercise the professional judgment. Both technical and moral judgments are included. This right is bound by the responsibilities to employers and colleagues.
2. *Right to refuse to participate in unethical activities*: It is also called the *right of conscientious refusal*. It is the right to refuse to engage in unethical actions and to refuse to do so solely because one views that as unethical. The employer cannot force or threaten the employee to do

something that is considered by that employee as unethical or unacceptable. For example, unethical and illegal activities that can be refused are: falsifying data, forging documents, altering test results, lying, giving or taking bribe etc. There may be situations, when there is a disagreement or no shared agreement among reasonable people over whether an act is unethical. Medical practitioners have a right not to participate in abortions. Similarly, the engineers must have a right to refuse assignments that violate their personal conscience, such as when there exists a threat to human life or moral disagreement among reasonable people.

3. *Right to fair recognition and to receive remuneration for professional services*: Engineers have a right to professional recognition for their work and achievements. This includes fair monetary and non-monetary forms of recognition. It is related to morality as well as self- interest. They motivate them to concentrate their energy on jobs and to update their knowledge and skills through continuing education. This will prevent the engineers from diversion such as moonlighting or bother on money matters. Many times, the engineers who have labored to get patents on the organizations are not adequately remunerated. Based on the resources of the organization and the bargaining power of the engineers, the reasonable salary or remuneration for patent discovery can be worked out.

4. *Right to warn the public about dangers*: It should be done without damaging the reputation of the employer. The views can be expressed through the professional society to get a backing.

5. *Right to talk publicly about the job*: This should be done within the limits of decency, confidentiality and loyalty.

6. *Right to engage in the activities of professional societies*: Attending membership campaign and seminars are typical activities to promote the professional activity.

EMPLOYEE RIGHTS

Employee rights are the moral and legal rights that are obtained by the status of being an employee. The provisions made to the employees under this category are:

1. Professional rights

2. Basic Human rights

3. Institutional rights or Contractual Employee rights. This include the rights to the institution due to the organisational policies or contracts, right to receive specified salary and annual increments, and profit sharing. The quantum of such benefits, scale of pay etc. are fixed and reviewed periodically by the employers and employees.

4. Non – Contractual Employee rights: These are the rights provided in common, besides the contractual ones. They include:

1. Right to Privacy

It is the right to control the access to and use of information about oneself. This right is limited in certain situations by employers' rights. But who among the employers can access the personal information is again restricted. Only duly authorized persons can get the personal information.

For example,

(a) The pay Bill Section can access the information on insurance premium paid, medical reimbursement etc. but one's immediate boss need not get this data.

(b) Persons who have applied for the jobs of cashier are required to report if there are any criminal or civil cases pending against them. Those persons may mishandle the money. Hence, that information may be sought from them.

(c) A supervisor might suspect a worker and conduct a search in his cupboard when the worker is absent. But the supervisor is to have another officer as witness, in such cases. Otherwise the supervisor may plant in some evidences against the worker.

(d) Upon frequent pilferage reported from the stores, the company may install surveillance cameras or bugging devices to monitor personal conversations, without notifying the employees. Prior notice to the employees on the intentions of such a step along with the proposed date of implementation should have been communicated to all concerned.

2. Right to Choose Outside Activities

This is also interpreted as a right to personal privacy as that means a right to have a private life outside the job. There are some situations when this right can be curbed. For example,

1. When those activities lead to violation or found detrimental to the duties of their job.

2. When the activities of the employees form a conflict or interest (e.g., when moonlighting).

3. When the interest of the employer is getting damaged (if the employee transfers some vital information on plans or strategies to the competitor)

3. ***Right to Due Process from Employer***

It is the right to fair process or procedures in firing, demotion and in taking any disciplinary actions against the employees. Written explanation should be initially obtained from the charged employee and the orders are given in writing, with clearly-stated reasons. Simple appeal procedures should be framed and made available to all those affected. Fairness here is specified in terms of the process rather than the outcomes.

4. Right to Equal Opportunity—Non-discrimination

Discrimination because of caste, sex, religion, creed, and language are regressive actions. Discrimination which means a morally unjust treatment of people in the workplace is damaging to the human dignity. For example,

(*a*) A senior manager post is vacant. There is competent and proven candidate from outside the state. A local engineer with lesser competence is promoted.

(*b*) Prize amounts for the winners in the world sport events are not the same for men and women.

5. Right to Equal Opportunity—Sexual Harassment in the Workplace

The sexual harassment is a display of arrogance and misuse of power through sexual means. It is against the moral autonomy i.e., freedom to decide on one's own body. It is also an assault on one's human dignity and trust.

Sexual harassment may be defined as the unwanted compulsion or attack on sexual requirements (gratification) in the context of unequal power. It includes physical as well as psychological attack or coercion and indecent gestures by men shown on women or by women on men. Two such forms of harassment are found to exist. In one type called 'exchange of favors', senior officers demand sexual favour as a condition for giving a job, or granting a promotion or increment. It may be either in the form of a physical or verbal

threat or sexual offer. In another type called 'hostile work environment', it is the sexually-oriented work environment that threatens the employee's right to equal opportunity. Undesirable sexual proposals, advances, lewd remarks, mailing obscene photographs are some of the typical examples of this type of harassment.

A rights ethicist interprets this as a serious violation of human right to pursue one's job free from extraneous force, compulsion, punishment or threat or insult. A duty ethicist would call it as a blatant violation of duty to treat human being with dignity and individual freedom, and not to treat as in animate object for immoral gratifications. The utilitarian would expose the effect on the happiness and the welfare of the victims, especially of women.

6. Right to Equal Opportunity—Affirmative Action or Preferential Treatment

It means giving a preference or advantage to a person of a group that was denied equal treatment in the past. Such treatments are given especially to women and minorities all over the world. It is also called 'reverse preferential treatment', because it reverses the historical preferences.

There are arguments in favour of as well as against such treatments, all over the world. Comparison of these views is presented on table given below.

In favour of Preferential Treatment	Against Reverse Preferential Treatment
Compensatory Justice: Violations of rights in the past must be compensated. Usually this treatment is extended to all in the group rather than individuals.	It violate the rights to equal opportunity for majority, to compete on merits.
Racial and sexual violation and violence still exist today. To counterbalance this, the reverse preferential treatment is necessary to ensure equal opportunity to minorities and women.	Compensation may be given only to specific individuals and not for all. Provide special funding and education for the disadvantaged. But jobs should not be used as a compensatory tool.
It has produced desirable consequences. It has raised the social and economic status and provided them role models and	Reduces the productivity, as the merit is the casualty. Self-doubts and in decision affect others morale and efficiency.

have promoted self-esteem.	

Table: Pro & Against Preferential Treatments

A compromising stand is to permit reverse preferential treatment within organizations, where the bias against women and minorities existed. Alternatively, the weak form of reverse treatment instead of the strong form, may be accepted.

For example, in India, the admissions and employment in government organizations and all educational institutions are given on the preferential (community quota) basis, namely scheduled, backward and most backward castes etc. The article 15(5) of the Constitution effective from January 20,2006, provides for the advancement of socially and educationally backward classes of citizens in matters of admission including reservation of seats. The reservation in state run educational institutions including IITs and IIMs is planned to be fixed at 22.5% for Scheduled Castes and Tribes and 27% for the other backward classes, from June 2007 onwards.

This is being suggested for implementation in the private organizations also. But the Indian private sector and multinational organizations and industries prefer to follow the system of affirmative action where the deprived are raised to required levels of competence.

WHISTLE BLOWING

Whistle blowing is defined as conveying information by an employee, or an important moral problem to somebody in a position to take action on the problem. Further, this is done outside the approved organizational channels.

Aspects

There are four aspects of whistle blowing, namely:

1. *Basis of disclosure*: The basis for disclosure may be intentional, or under pressure from superiors or others not to disclose.
2. *Relevance of topic*: The whistle blower believes that the information is about a significant problem for the organization or its business ally. It can be a threat to the public or employees' health, safety and welfare or a criminal activity, or unethical policies or practices, or an injustice to the workers within the organization.

3. *Agent*: The person disclosing the information may be a current or former employee or a person having a close link to the organization.
4. *Recipient*: The person or organization, who receives the information, is in a position to remedy the problem or alert the affected parties. Usually, the recipients are not aware of the information fully or even partially.

Types

Based on the *destination (recipient),* whistle blowing is classified into types, as:

(*a*) *Internal*: In this case, the information is conveyed to a person within the organization, but beyond the approved channels.

(*b*) *External*: This happens when the information is transmitted outside the organization. The recipient may be a municipal chairman or member of legislature or minister. It becomes severe if the information reaches the press and through them the public. The damage is maximum and sometimes poses difficulty in remedying the situation.

Based on the origin or source (agent), this can be divided into three types, as follows:

(*a*) *Open*: The originator reveals his identity as he conveys the information. This information is reliable and true, but sometimes partially true.

(*b*) *Anonymous*: The identity is concealed. The information may or may not be true. But the agent anticipates perhaps some repression or threat, if identity is revealed.

(*c*) *Partly anonymous (or partly open)*: Such a situation exists when the individual reveals his identity to the journalist, but insists that the name be withheld from others.

When to Justify?

Under the following situations, the whistle blowing may be justified:

1. When the potential harm existing is identified as serious, or anticipated to occur with a high probability, in the near future.
2. When sufficient data on the harm had been gathered and adequately documented. This condition may not be required if revealing the information would jeopardize the national interests or help the

competitors. A request to the appropriate authority for external investigation or permission by a court to release the information may be a solution.

3. The concerns have been reported earlier to the immediate superiors and no satisfactory response was forthcoming from them, within a reasonable time.

4. Regular channels within the organization have been used to transport the information to the highest level of management and the information has reached them. Situations 3 and 4 may not be appropriate, when one's supervisors are the main source of the problem or when urgency demands that regular channels are expected to only add the delay.

5. There is a reasonable hope that the whistle blowing can prevent or remedy the damage existing or anticipated.

Professional societies, unions and some central laws are there to protect the genuine whistle blowers, but the role is full of adventure still. Laws alone are not sufficient. The engineers and other employees have to act as watch dogs and provide necessary legal assistance to the blowers. The IEEE has taken active roles by assisting the members, backing them when they are face to legal proceedings, helping the engineers discharged unjustly, and honouring the courageous whistle blowers with public recognitions.

To conclude, the whistle blower has to consider (a) the personal obligation to family (b) right to pursue one's career and (c) sometime sacrifices, before this venture.

Before you Blow the Whistle

Here are some of the instructions that should be followed before blowing the whistle:

1. One should familiarize with the rules for appealing within the organization. Normal organizational channels, up to the ombudsman or top ethics committee, should be tried, except when extreme urgency conditions exist.

2. Consult the trusted colleagues for advice and to avoid isolation.

3. Use polite and tactful language. Avoid any personal criticisms that may antagonize and divert the attention towards solving the problems.

4. Keep the supervisors informed of your actions, through informal discussion and formal memorandum.

5. Keep your observations and claims precise and accurate. Prepare formal records of events in support of your chains.

6. Before going outside the organization, consult the ethics committee of your professional society.

7. If necessary consult a lawyer regarding potential litigations.

8. Offering to resign is one of the peaceful and effective methods of blowing your views. Whether you are relieved from the specific project or from the organization, either way your autonomy and self-respect are recognized.

INTELLECTUAL PROPERTY RIGHTS

Patent, Publish and Prosper – Dr. Mashelkar, Dir. Genl., CSIR

Future can be best predicted by inventing it – Xerox, USA.

Intellectual Property

It is the information and original expression that derives its original value from creative ideas, and is with a commercial value. IP permits people to have fully independent ownership for their innovations and creativity, like that of own physical property. This encourages the IP owners towards innovation and benefit to the society. It is an asset that can be bought or sold, licensed, and exchanged. It is intangible i.e., it cannot be identified by specific parameters.

The agreements with World Trade Organisation (WTO) and Trade-Related aspects of Intellectual Property System (TRIPS) have been adopted effective from January 2005. Besides the minimum standards set for protection of IP rights, appropriate laws framed by the member countries are expected to reduce distortions and barriers for and promote the international trade. The global IPR system strengthens protection, increases the incentives for innovation, and raises returns on international technology transfer. However, it could raise the costs of acquiring new technology and products, shifting the global terms of trade in favor of technology producers.

Need for Protection of IP

IP plays an essential role to stabilize and develop the economy of a nation.

This protection actually stimulates creativity, research, and innovation by ensuring freedom to individuals and organizations to benefit from their creative intellectual investments. The IP serves many purposes, namely

(a) It prevents others using it,

(b) Prevent using it for financial gain,

(c) Prevent plagiarism

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

(e) Provides a strategy to generate steady income.

Some of the challenges in the acquisition of IP are:

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

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

(c) Lack of strong enforcement mechanism.

Types and Norms

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

1. Patents

Patent is a contract between the individual (inventor) and the society (all others). Patents protect legally the specific products from being manufactured or sold by others, without permission of the patent holder. Patent holder has the legally-protected monopoly power as one's own property. The validity is 20 years from the date filing the application for the patent. It is a territorial right and needs registration. The Patent (Amendment) Act 2002 guarantees such provisions.

Patent is given to a product or a process, provided it is entirely new, involving an inventive method and suitable for industrial application. While applying for a patent, it is essential to submit the documents in detail regarding the problem addressed, its solution, extent of novelty or innovation, typical applications, particulars of the inventor, and the resources utilized. Inventions are patentable and the discoveries are not.

Some of the salient features of the Patent Act 2002 are listed as follows:

1. *Patent outside India*: Applications for Patent outside India, on inventions for defense purposes or related to atomic energy are prohibited. For other patents, an inventor should apply for a patent within India and then seek clearance for filling patents abroad.

2. *Licensing*: The controller of patents grants the license upon verification and on some terms and conditions. The controller shall endeavour to secure that the articles manufactured under the patent shall be available to the public at the lowest price consistent with patentees deriving a reasonable gain from their patent rights.
3. *Negative right*: The grant of patent for an invitation does not guarantee the merit or any other commercial value of the invention disclosed. The state which grants the patent does not also guarantee the validity of the patent granted. If other regulations do not permit, even the patent holder cannot commence manufacturing. In this context, it is a negative right.
4. *First to file rule*: Indian like many other countries follows the system of first to file or first to register system to determine priority. Accordingly, a patent or invention which is filed or registered first in the patent office will have precedence to the patent or invention, which is filed later in the date, even if it had been invented earlier.
5. *Burden of proof of infringement*: Legal rights of patent cannot be enforced automatically. In any suit for infringement of a patent, the patentee must move the court. The court may direct the defendant to prove that the process used by him to obtain the product, identical to the product of the patented process, is different from the patented process.

Types of Patents

(a) Utility Patent

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

(b) Industrial Design Patent

The industrial design patent is an idea or conception regarding features of shape, configuration, pattern, ornamental with lines or colours applied to any article, two or three dimensional, made by any industrial process and is judged by the eye or a product. The Designs Act 2000 excludes from its purview the functioning features of an article and grants protection only to those which have an aesthetic appeal.

For example, the design of a tea cup must have a hollow receptacle for holding tea and a handle to hold the cup. These are functional features that cannot be registered. But a fancy shape or ornamentation on it would be

registerable. A table has a flat surface on which other objects can be placed. This is its functional element. But its shape, colour or the way it is supported by legs or otherwise, are all elements of design or artistic elements and they are registerable, if unique and novel. Other examples include the design applied to shoes, TV and textiles.

The design patent has a term of 14 years from the date of filing the application. Designs Act 2000 gives further details on this aspect.

2. Copyright

The copyright is a specific and exclusive right, describing rights given to creators for their literary and artistic works. This protects literary material, aesthetic material, music, film, sound recording, broadcasting, software, multimedia, paintings, sculptures, and drawings including maps, diagrams, engravings or photographs. There is no need for registration and no need to seek lawyer's help for settlement. The life of the copyright protection is the life of the inventor or author plus 50 years.

Copyright gives protection to particular expression and not for the idea. Copyright is effective in (*a*) preventing others from copying or reproducing or storing the work, (*b*) publishing and selling the copies, (*c*) performing the work in public, commercially (*d*) to make film (*e*) to make translation of the work, and (*f*) to make any adaptation of the work. Copying the idea is called 'plagiarism' and it is dealt with separately.

Can software be protected through copyright? Indian copyright Act amended in 1984 included the rights of in a computer program as literary work. Many countries protect software as a copyright. Some holds the view that copyright is not the right type of protection for software. They held that the patents and trade secrets are more appropriate forms of protecting software. While trade secret is the most conventional form of protection of software, in the recent years, both patents and copyrights are adopted to protect software.

Copyright (Amendment) Act 1999, India ensures fair dealing of broadcasting through the internet. The concerns of Book industry, Music Industry, Film and Television Industry, Computer Industry and Database Industry are sufficiently met by this updated Act.

3. Trademark

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

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

There are three functions of trademark:

- Just as we are identified by our names, good are identified by their trademarks. For example, the customer goes to the shop and asks for Lux soap. The word 'Lux' is a trade mark. In other words it shows the origin or source of the goods.
- The trademark carries with it an inherent indication or impression on the quality of goods, which indirectly demonstrates that it receives the customer's satisfaction.
- The trademark serves as silent sales promoter. Without a trademark, there can be no advertisement. In other words, it serves as a medium for advertising the goods.

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

Relatively, the suggestive marks do not describe the goods at first sight, but with an element of imagination or perception the nature of the goods can be understood. Thus, the suggestive marks are distinctive and are protected as trademarks. Arbitrary marks and fanciful marks are distinctive and hence accepted for registration.

Besides this, there is also a certification mark by the Bureau of Indian Standards (BIS or ISI) which guarantees that the holder's product bearing the mark has met certain standards or requirements. This adds considerably to the market value and to a great value in the export trade.

4. Trade Secret

A trade secret is the information which is kept confidential as a secret. This information is not accessed by the any other (competitor) than the owner

and this gives a commercial advantage over the competitors. The trade secrets are not registered but only kept confidential. These are given limited legal protection, against abuse by the employee or contractor, by keeping confidentiality and trust.

The trade secrets may be formulae, or methods, or programs, or processes or test results or data collected, analysed, and synthesized. These are related to designs, technical processes, plant facilities, and list of suppliers or customers etc. this information should not be disclosed or used by any other person.

UNIT V
GLOBAL ISSUES

GLOBALIZATION

Globalization means integration of countries through commerce, transfer of technology, and exchange of information and culture. In a way, it includes acting together and interacting economies through trade, investment, loan, development schemes and capital across countries. In a different sense, these flows include knowledge, science, technology, skills, culture, information, and entertainment, besides direct human resource, tele-work, and outsourcing. This interdependence has increased the complex tensions and ruptures among the nations. For the engineers, the issues such as multinational organizations, computer, internet functions, military development and environmental ethics have assumed greater importance for their very sustenance and progress.

MULTINATIONAL CORPORATIONS

Organisations who have established business in more than one country, are called Multinational Corporation. The headquarters are in the home country and the business is extended in many host countries. The Western organizations doing business in the less-economically developed (developing, and overpopulated) countries gain the advantage of inexpensive labor, availability of natural resources, conducive-tax atmosphere, and virgin market for the products. At the same time, the developing countries are also benefited by fresh job opportunities, jobs with higher remuneration and challenges, transfer of technology, and several social benefits by the wealth developed. But this happens invariably with some social and cultural disturbance. Loss of jobs for the home country, and loss or exploitation of natural resources, political instability for the *host* countries are some of the threats of globalization.

International Human Rights

To know what are the moral responsibilities and obligations of the multinational corporations operating in the host countries, let us discuss with the framework of rights ethics. Common minimal rights are to be followed to smoothen the transactions when the engineers and employers of MNCs have to

interact at official, social, economic and sometimes political levels. At international level, the organizations are expected to adopt the minimum levels of (*a*) values, such as mutual support, loyalty, and reciprocity, (*b*) the negative duty of refraining from harmful actions such as violence and fraud, and (*c*) basic fairness and practical justice in case of conflicts.

The ten international rights to be taken care of, in this context are:

- Right of freedom of physical movement of people
- Right of ownership of properties
- Freedom from torture
- Right to fair trial on the products
- Freedom from discrimination on the basis of race or sex. If such discrimination against women or minorities is prevalent in the host country, the MNC will be compelled to accept. MNCs may opt to quit that country if the human rights violations are severe.
- Physical security. Use of safety gadgets have to be supplied to the workers even if the laws of the host country do not suggest such measures.
- Freedom of speech and forming association
- Right to have a minimum education
- Right to political participation
- Right to live and exist (i.e., coexistence). The individual liberty and sanctity of the human life are to be respected by all societies.

Technology Transfer

It is a process of moving technology to a new setting and implementing it there. Technology includes hardware (machines and installations) and the techniques (technical, organizational, and managerial skills and procedures). It may mean moving the technology applications from laboratory to the field/factory or from one country to another. This transfer is effected by governments, organizations, universities, and MNCs.

Appropriate Technology

Identification, transfer, and implementation of most *suitable* technology for a set of new situations, is called *appropriate technology.* Technology includes both hardware (machines and installations) and software (technical, organizational and managerial skills and procedures). Factors such as economic, social, and engineering constraints are the causes for the modification of technology.

Depending on the availability of resources, physical conditions (such as temperature, humidity, salinity, geographical location, isolated land area, and availability of water), capital opportunity costs, and the human value system (social acceptability) which includes their traditions, beliefs, and religion, the appropriateness is to be determined.

For example, small farmers in our country prefer to own and use the power tillers, rather than the high-powered tractors or sophisticated harvesting machines. On the other hand, the latest technological device, the cell phones and wireless local loop phones have found their way into remote villages and hamlets, than the landline telephone connections. Large aqua-culture farms should not make the existing fishermen jobless in their own village.

The term *appropriate* is value based and it should ensure fulfillment of the human needs and protection of the environment.

How Appropriate is Aptech?

1. A case against the technology transfer is that the impact of borrowed or transferred technology has been threatening the environment beyond its capacity and sustainable development of the host countries. Large plantations that orient their efforts to exports leave the small farmers out of jobs and at the mercy of the foreign country. For example, genetically-modified cotton have shown sufficient disturbance in Europe and Africa. This has made the European Union to oppose the entry of G.M. cotton into Europe.
2. The high technology has contributed to large-scale migration from villages to the cities where corporations are located, leading to the undesirable side-effects of overcrowding of cities, such as the scarcity of water, insanitation, poverty, and the increase in crimes.
3. The term 'appropriate' should emphasize the social acceptability and environmental protection of the host countries, and this need to be addressed while transferring technology. Thus, we confirm the view that engineering is a continual social experimentation with nature.

MNCs and Morality

The economic and environmental conditions of the home and host countries may vary. But the multinational institutions have to adopt appropriate measures not to disturb or dislocate the social and living conditions and cultures of the home countries. A few principles are enlisted here:

1. MNC should respect the basic human rights of the people of the host countries.
2. The activities of the MNC should give economic and transfer technical benefits, and implement welfare measures of the workers of the host countries.
3. The business practices of the multinational organisations should improve and promote morally justified institutions in the host countries.
4. The multinationals must respect the laws and political set up, besides cultures and promote the cultures of the host countries.
5. The multinational organisations should provide a fair remuneration to the employees of the host countries. If the remuneration is high as that of home country, this may create tensions and if it is too low it will lead to exploitation.
6. Multinational institutions should provide necessary safety for the workers when they are engaged in hazardous activities and 'informed consent' should be obtained from them. Adequate compensation should be paid to them for the additional risks undertaken.

Case Study: Bhopal Gas Tragedy

The Union Carbide had 51% and the Indian subsidiary UC India Ltd. had 49% of stock. In 1983, there were 14 plants in India manufacturing chemicals, pesticides, and other hazardous products. The Bhopal plant had a license to make Methyl isocyanate-based pesticides. In November 1984, they had decided to close down the plant. For quite some years before the production rate was going down.

In the history of chemical plants disasters, three other wake-up calls were reported. Flixborough accident in 1974 in U.K. when certain modifications carried out in the plant led to the leakage and explosion of *cyclohexane*, which killed 28 people. The Piper Alpha offshore oil platform disaster in 1988, near Scotland, killed 167 people and resulted in $ 2 billion losses. The third occurred in Toulouse, France in 2001, killing 29 people, and injuring thousands. A warehouse holding 300 tonnes of *ammonium nitrate* fertilizer exploded and damaged 10000 buildings, including schools, a university, and a hospital. But we have not learnt from the past.

The cumulative effects of the following factors caused the tragedy in Bhopal on December 3, 1984.

- Maintenance was neglected and the trained maintenance personnel

were reduced as economy measure. Need for quick diagnosis aggravates the situation by causing considerable psychological stress on the plant personnel.

- Training activities for the supervisory personnel were stopped. This led to inadequate training of the personnel to handle emergencies.
- Periodical Safety Inspection teams from U.S. which visited previously were also stopped. From the initial U.S. Standards, the safety procedures were reduced to low level Indian standards. The procedures had been deteriorating at these sites for weeks or months, prior to the accident. There was clear lack of management systems and procedures to ensure safety.
- Vital spares for equipments and machineries were not available
- Absence of capital replacement led to the stagnant economy of the plant.
- The high turnover of the experienced engineers and technicians, who were demoralized by the lack of development.
- Lack of experienced personnel to operate and control the vital installations.
- They have not conducted a thorough process hazards analysis that would have exposed the serious hazards which resulted in disaster later.
- No emergency plan was put in practice, during the shutdown and maintenance.
- Above all, the commitment of top-level management to safety was lacking. They have been paying only lip service to safety of people of the host country.

Technologically, the tragedy was caused by a series of events listed:

1. The safety manual of Union Carbide prescribed that the MIC tanks were to be filled only up to 60% of the capacity. But the tanks were reported to have been filled up to 75%.
2. The safety policy prescribed that an empty tank should be available as a stand-bye in case of emergency. But the emergency tank was also filled with to its full capacity. These facts confirmed that the MNC had not followed and implemented appropriate safety standards of the home country in the host country. Can this be called as an example of ‘misappropriate technology’?
3. The storage tanks should be refrigerated to make the chemical less reactive. But here the refrigeration system was shut down as an

economy measure. This raised the temperature of the gas stored.

4. The plant was shut down for maintenance two months earlier. The worker who cleaned the pipes and filters connected to the tanks and closed the valves, was not trained properly. He did not insert the safety disks to prevent any possible leakage of the gas. This led to the buildup of temperature and pressure in the storage tanks.
5. When the gas started leaking out, the operators tried to use the vent gas-scrubber that was designed to reduce the exhausting gas. But that scrubber was also shut down.
6. There was a flare tower that was designed to burn-off the gas escaping from the scrubber. That was not also in working condition.
7. The workers finally tried to spray water up to 100 feet to quench the gas (which is water soluble). But the gas was escaping from the chimney of 120-feet high.
8. The workers were not trained on safety drills or emergency drills or any evacuation plans.

The gas escaped into the air and spread over 40 sq. km. About 600 people died and left 7000 injured and the health of about 2 million people was affected adversely. Even after 22 years, influence of the Central Government and the courts, the compensation had not reached all the affected people.

Ethical Balance

Should an organization adopt the rules and practices of the host country fully and face dangers and other serious consequences or adopt strictly their own country's standards and practices in the host country?

There is a saying, "When in Rome do as Romans do". Can this be applied in the case of MNCs? This is called *ethical relativism*. The actions of corporation and individuals that are accepted by law, custom and other values of a society can be morally right in that society. It is morally false, if it is illogical. It means, the corporation (and the engineers) functioning in other countries must understand their law, customs, and beliefs and act in line with those prevailing in that country. This will lead to disaster if the country is a developing one where the safety standards are given a go-bye. Laws and conventions are not morally self-sustaining. In an overpopulated country, the loss of human lives may not physically affect them, but the tragedy cast shadow for over decades, as it happened in Bhopal in 1984. This will be criticized from the points of view of human rights, public welfare, and respect to people.

On the other hand, the organizations may practice laws of the home country, without adjustments to the host culture. This stand is called *ethical absolutism*. This is again false, since the moral principles in a different culture come into conflicts, and implementation in the 'hostile' culture is almost impossible.

Hence, MNCs may adopt ethical *relationalism (contexualism)* as a compromise. Moral judgments are made in relation to the factors prevailing locally, without framing rigid rules. The judgments should be contextual and in line with the customs of other cultures. The *ethical pluralism* which views more than one justifiable moral solution is also adaptable. This principle accepts cultural diversity and respects the legitimate cultural differences among individuals and groups, of the host country.

ENVIRONMENTAL ETHICS

Environmental ethics is the study of (*a*) moral issues concerning the environment, and (*b*) moral perspectives, beliefs, or attitudes concerning those issues.

Engineers in the past are known for their negligence of environment, in their activities. It has become important now that engineers design eco-friendly tools, machines, sustainable products, processes, and projects. These are essential now to (*a*) ensure protection (safety) of environment (*b*) prevent the degradation of environment, and (*c*) slow down the exploitation of the natural resources, so that the future generation can survive.

The American Society of Civil Engineers (ASCE) code of ethics, has specifically requires that "engineers shall hold paramount the safety, health, and welfare of the public and shall strive to comply with the principles of sustainable development in the performance of professional duties" The term *sustainable development* emphasizes on the investment, orientation of technology, development and functioning of organizations to meet the present needs of people and at the same time ensuring the future generations to meet their needs.

Compaq Computer Corporation (now merged with HP) was the leader, who exhibited their commitment to environmental health, through implementation of the concept of 'Design for environment' on their products, unified standards all over the world units, and giving priority to vendors with a record of environmental concern.

Engineers as experimenters have certain duties towards environmental ethics, namely:

1. *Environmental impact assessment*: One major but sure and unintended

effect of technology is wastage and the resulting pollution of land, water, air and even space. Study how the industry and technology affects the environment.

2. *Establish standards*: Study and to fix the tolerable and actual pollution levels.
3. *Counter measures*: Study what the protective or eliminating measures are available for immediate implementation
4. *Environmental awareness*: Study on how to educate the people on environmental practices, issues, and possible remedies.

Disasters

1. Plastic Waste Disposal

In our country, several crores of plastic bottles are used as containers for water and oil, and plastic bags are used to pack different materials ranging from vegetables to gold ornaments. Hardly any of these are recycled. They end up in gutters, roadsides, and agricultural fields. In all these destinations, they created havoc. The worse still is the burning of plastic materials in streets and camphor along with plastic cover in temples, since they release toxic fumes and threaten seriously the air quality. Cities and local administration have to act on this, collect and arrange for recycling through industries.

2. e-Waste Disposal

The parts of computers and electronic devices which have served its useful life present a major environmental issue for all the developing countries including India. This scrap contains highly toxic elements such as lead, cadmium, and mercury.

Even the radioactive waste will lose 89% of its toxicity after 200 years, by which time it will be no more toxic than some natural minerals in the ground. It will lose 99% of its remaining toxicity over the next 30,000 years. The toxic chemical agents such as mercury, arsenic, and cadmium retain toxicity undiminished forever.

But these scraps are illegally imported by unscrupulous agencies to salvage some commercially-valuable inputs. Instead of spending and managing on the scrap, unethical organizations sell them to countries such as India. This is strictly in violation of the Basel Convention of the United Nations Environment Program, which has banned the movement of hazardous waste. A recent report of the British Environment Agency has revealed that the discarded computers,

television sets, refrigerators, mobile phones, and electrical equipments have been dispatched to India and Pakistan in large quantity, for ultimate disposal in environmentally-unacceptable ways and at great risk to the health of the labour. Even in the West, the electronic junk has been posing problems. Strong regulation including (*a*) pressure on industries to set up disassembling facilities, (*b*) ban on disposal in landfill sites, (*c*) legislation for recycling requirements for these junk and (*d*) policy incentives for eco-friendly design are essential for our country. The European Union through the Waste Electrical and Electronic Equipment (WEEE) directive has curbed the e-waste dumping by member countries and require manufacturers to implement methods to recover and recycle the components.

Indian Government expressed its concern through a technical guide on environmental management for IT Industry in December, 2004. It is yet to ratify the ban on movement of hazardous waste according to the Basel Convention. A foreign news agency exposed a few years back, the existence of a thriving e-waste disposal hub in a suburb of New Delhi, operating in appallingly dangerous conditions. Our country needs regulations to define waste, measures to stop illegal imports, and institutional structures to handle safe disposal of domestic industrial scrap.

3. Industrial Waste Disposal

There has been a lot of complaints through the media, on (*a*) against the Sterlite Copper Smelting Plant in Thuthukkudi (1997) against its pollution, and (*b*) when Indian companies imported the discarded French Warship Clemenceau for disposal, the poisonous *asbestos* compounds were expected to pollute the atmosphere besides exposing the labor to a great risk, during the disposal. The government did not act immediately. Fortunately for Indians, the French Government intervened and withdrew the ship, and the serious threat was averted!

4. Depletion of Ozone Layer

The *ozone* layer protects the entire planet from the ill-effects of ultraviolet radiation and is vital for all living organisms in this world. But it is eaten away by the Chloro-fluro-carbons (CFC) such as *Freon* emanating from the refrigerators, air conditioners, and aerosol can spray. This has caused also skin cancer to sun-bathers in the Western countries. Further NO and NO_2 gases were also found to react with the ozone. Apart from engineers, the organizations, laws

of the country and local administration and market mechanisms are required to take up concerted efforts to protect the environment.

5. Global Warming

Over the past 30 years, the Earth has warmed by 0.6 °C. Over the last 100 years, it has warmed by 0.8 °C. It is likely to push up temperature by 3 ^{o}C by 2100, according to NASA's studies. The U.S. administration has accepted the reality of global climate change, which has been associated with stronger hurricanes, severe droughts, intense heat waves and the melting of polar ice. Greenhouse gases, notably carbon dioxide emitted by motor vehicles and coal-fired power plants, trap heat like the glass walls of a greenhouse, cause the Earth to warm up. Delegates from the six countries — Australia, China, India, Japan, South Korea and US met in California in April 2006 for the first working session of the Asia-Pacific Partnership on Clean Development and Climate. These six countries account for about half of the world's emissions of climate-heating greenhouse gases. Only one of the six, Japan, is committed to reducing greenhouse gas emissions by at least 5.2 per cent below 1990 levels by 2012 under the Kyoto Agreement.

About 190 nations met in Germany in the middle of May 2006 and tried to bridge vast policy gaps between the United States and its main allies over how to combat climate change amid growing evidence that the world is warming that could wreak havoc by stoking more droughts, heat waves, floods, more powerful storms and raise global sea levels by almost a meter by 2100.

6. Acid Rain

Large emissions of sulphur oxides and nitrous oxides are being released in to the air from the thermal power stations using the fossil fuels, and several processing industries. These gases form compounds with water in the air and precipitates as rain or snow on to the earth. The acid rain in some parts of the world has caused sufficient damage to the fertility of the land and to the human beings.

Human-Centered Environmental Ethics

This approach assumes that only human beings have inherent moral worth duly to be taken care of. Other living being and ecosystems are only instrumental in nature. Utilitarianism aims to maximize good consequences for human beings. Most of the goods are engineered products made out of natural resources. Human beings have also (*a*) recreational interests (enjoy leisure through

mountaineering, sports, and pastimes), (*b*) aesthetic interests (enjoy nature as from seeing waterfalls and snow-clad mountains), (*c*) scientific interests to explore into nature or processes, and (*d*) a basic interest to survive, by preservation as well as conservation of nature and natural resources.

Rights ethicists favor the basic rights to live and right to liberty, to realise the right to a live in a supportive environment. Further, virtue ethics stresses importance of prudence, humility, appreciation of natural beauty, and gratitude to the Mother Nature that provides everything.

However, the nature-centered ethics, which ensures the worth of all living beings and organisms, seems to be more appropriate in the present-day context. Many Asian religions stress the unity with nature, rather than domination and exploitation. The Zen Buddhism calls for a simple life with compassion towards humans and other animals. Hinduism enshrines the ideal of oneness (advaitha) in and principle of *ahimsa* to all living beings. It identifies all the human beings, animals, and plants as divine. The eco-balance is the need of the hour and the engineers are the right experimenters to achieve this.

COMPUTER ETHICS

Computer ethics is defined as (*a*) study and analysis of nature and social impact of computer technology, (*b*) formulation and justification of policies, for ethical use of computers. This subject has become relevant to the professionals such as designers of computers, programmers, system analysts, system managers, and operators. The uses of computers have raised a host of moral concerns such as free speech, privacy, intellectual property right, and physical as well as mental harm. There appears to be no conceptual framework available on ethics, to study and understand and resolve the problems in computer technology.

Types of Issues

Different types of problems are found in computer ethics.

1. Computer as the Instrument of Unethical Acts

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

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

(c) Defraud a bank or a client, by accessing and withdrawing money from

other's bank account.

2. Computer as the Object of Unethical Act

The data are accessed and deleted or changed.

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

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

(*c*) *Health hazard*: The computers pose threat during their use as well as during disposal. These are discussed in # 5.3.2 and # 5.2.1, respectively, in detail.

3. Problems Related to the Autonomous Nature of Computer

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

(*b*) *Loss of human lives*: Risk and loss of human lives lost by computer, in the operational control of military weapons. There is a dangerous instability in automated defense system. An unexpected error in the software or hardware or a conflict during interfacing between the two, may trigger a serious attack and cause irreparable human loss before the error is traced. The Chinese embassy was bombed by U.S. military in Iraq a few

years back, but enquiries revealed that the building was shown in a previous map as the building where insurgents stayed.

(*c*) In flexible manufacturing systems, the autonomous computer is beneficial in obtaining continuous monitoring and automatic control.

Various issues related to computer ethics are discussed as follows:

Computers in Workplace

The ethical problems initiated by computers in the workplace are:

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

Property Issues

The property issues concerned with the computers are:

1. Computers have been used to extort money through anonymous telephone calls.
2. Computers are used to cheat and steal by current as well as previous employees.

3. Cheating of and stealing from the customers and clients.
4. Violation of contracts on computer sales and services.
5. Conspiracy as a group, especially with the internet, to defraud the gullible, stealing the identity and to forge documents.
6. Violation of property rights: Is the software a property? The software could be either a Program (an algorithm, indicating the steps in solving a problem) or a Source code (the algorithm in a general computer language such as FORTAN, C and COBOL or an Object code (to translate the source code into the machine language). How do we apply the concept of property here? This demands a framework for ethical judgments.

Property is what the laws permits and defines as can be owned, exchanged, and used. The computer hardware (product) is protected by patents. The software (idea, expression) is protected by copyrights and trade secrets. But algorithms cannot be copyrighted, because the mathematical formulas can be discovered but not owned. The object codes which are not intelligible to human beings cannot be copyrighted.

Thus, we see that reproducing multiple copies from one copy of (licensed) software and distribution or sales are crimes. The open source concepts have, to a great extent, liberalized and promoted the use of computer programs for the betterment of society.

Computer Crime

The ethical features involved in computer crime are:

1. Physical Security

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

2. Logical security

The aspects related are (*a*) the privacy of the individuals or organizations, (*b*) confidentiality, (*c*) integrity, to ensure that the modification of data or program are done only by the authorized persons, (*d*) uninterrupted service. This is achieved by installing appropriate uninterrupted power supply or back-up provisions, and (*e*) protection against hacking that causes dislocation or distortion. Licensed anti-virus packages and firewalls are used by all computer users to ensure this protection. Passwords and data encryption have been incorporated in the computer software as security measures. But these have also

been attacked and bye-passed. But this problem is not been solved completely.

Major weaknesses in this direction are: (*a*) the difficulty in tracing the evidence involved and (*b*) absence of stringent punishment against the crime. The origin of a threat to the Central Government posted from an obscure browsing center, remained unsolved for quite a long time. Many times, such crimes have been traced, but there are no clear *cyber laws* to punish and deter the criminals.

Privacy and Anonymity

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

1. Records of Evidence

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

2. Hacking

There are computer enthusiasts who willfully or for fun, plant virus or "Trojan horses" that may fill the disc space, falsify information, erase files, and even harm the hardware. They breakdown the functioning of computers and can be treated as violation of property rights. Some hackers opine that the information should be freely available for everybody. It is prudent that the right to individual privacy in limiting the access to the information on oneself, should not be violated. Further any unauthorized use of personal information (which is a property), is to be considered as theft. Besides the individual privacy, the national security, and freedom within the economy are to be respected. The proprietary information and data of the organizations are to be protected so that they can pursue the goals without hindrance.

3. Legal Response

In the Indian scene, the Right to Information Act 2005 provides the right to the citizens to secure access to information *under the control of public authorities*, including the departments of the central government, state governments, government bodies, public sector companies and public sector banks, to promote transparency and accountability of public authorities.

Right to information: Under the Act, section 2 (*j*), the right to information includes the right to

(1) Inspect works, documents, records, (2) take notes, extracts or certified copies of documents or records, (3) take certified samples of material, and (4) obtain information in the form of printouts, diskettes, floppies, tapes, video cassettes or in any other electronic mode.

WHAT IS NOT OPEN TO DISCLOSURE? The following are exempt from disclosure (Sections8 and 11)

1. Information, disclosure of which would prejudicially affect the sovereignty and integrity of India, the security, strategic, scientific or economic interests of the state, relation with, foreign state or lead to incitement of an offence.
2. Information which has been expressly forbidden to be published by any court of law or tribunal or the disclosure of which may constitute contempt of court.
3. Information, the disclosure of which would cause a breach of privilege of Parliament or the State Legislature.
4. Information including commercial confidence, trade secrets or intellectual property, the disclosure of which would harm the competitive position of a third party, unless the competent authority is satisfied that larger public interest warrants the disclosure of such information.
5. Information available to a person in his fiduciary relationship, unless the competent authority is satisfied that *the larger public interest warrants the disclosure of such information.
6. Information received in confidence from foreign government.
7. Information, the disclosure of which would endanger the life or physical safety of any person or identify the source of information or assistance given in confidence for law enforcement or security purposes.
8. Information which would impede the process of investigation or apprehension or prosecution of offenders.
9. Information which relates to personal information the disclosure of which has no relationship to any public activity or interest, or which would cause unwarranted invasion of the privacy of the individual.
10. Notwithstanding anything in the Official Secrets Act 1923 nor any of the

exemptions listed above, a public authority may allow access to information, if public interest in disclosure outweighs the harm to the protected interests.

11. Where the Information Officer, intends to disclose any information or record, on a request, which relates to or has been supplied by a third party and has been treated as confidential by that third party, the officer shall give a written notice to such third party of the request and of the fact that the officer intends to disclose the information, and invites the third party to make a submission in *writing* or *orally*, regarding whether the information should be disclosed, and such submission of the third party shall be kept in view while taking a decision about disclosure of information: provided that except in the case of trade or commercial secrets protected by law, disclosure may be allowed if the public interest in disclosure outweighs in importance any possible harm or injury to the interests of such third party.

Laws to regulate the access to information are very expensive to enforce and inconvenient to genuine users such as accessing records of people for medical research.

4. Anonymity

Anonymity in the computer communication has some merits as well as demerits. While seeking medical or psychological counseling or discussion (chat) on topics, such as AIDS, abortion, gay rights, the anonymity offers protection (against revealing their identity). But frequently, anonymity is misused by some people for money laundering, drug trafficking and preying upon the vulnerable.

Professional Responsibility

The computer professionals should be aware of different conflicts of interests as they transact with other at different levels. The IEEE and Association for Computing Machinery (ACM) have established the codes of ethics to manage such responsibilities.

The Big Net

Almost all the countries are now connected by the internet. But there are no international laws to regulate the issues of freedom of speech, intellectual property rights, privacy rights etc. Another development in this direction is, the universities offering degrees-on-line. Third World is certainly gaining knowledge and education. Even Google.com has announced plans to publish research

papers through the World Wide Web. Knowledge is power. Knowledge is internationalised! Will this lead to empowerment of the Third World and promotion of World peace? Only the future can answer this question.

WEAPONS DEVELOPMENT

Military activities including the world wars have stimulated the growth of technology. The growth of Internet amply illustrates this fact. The development of warfare and the involvement of engineers bring out many ethical issues concerned with engineers, such as the issue of integrity in experiments as well as expenditure in defense research and development, issue of personal commitment and conscience, and the issues of social justice and social health.

Engineers involve in weapons development because of the following reasons:

1. It gives one job with high salary.
2. One takes pride and honor in participating in the activities towards the defense of the nation (patriotic fervor).
3. One believes the he fights a war on terrorism and thereby contribute to peace and stability of the country. Ironically, the wars have never won peace, only peace can win peace!
4. By research and development, the engineer is reducing or eliminating the risk from enemy weapons, and saving one's country from disaster.
5. By building-up arsenals and show of force, a country can force the rogue country, towards regulation. Engineers can participate effectively in arms control negotiations for surrender or peace, e.g., bombing of Nagasaki and Hiroshima led to surrender by the Japanese in 1945.

Many engineers had to fight and convince their personal conscience. The scene such as that of a Vietnamese village girl running wild with burns on the body and horror in the face and curse in her mind has moved some engineers away from their jobs.

ENGINEERS AS MANAGERS

Characteristics

The characteristics of engineers as managers are:

1. Promote an ethical climate, through framing organization policies, responsibilities and by personal attitudes and obligations.
2. Resolving conflicts, by evolving priority, developing mutual understanding, generating various alternative solutions to problems.
3. Social responsibility to stakeholders, customers and employers. 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 managers have the ethical responsibility to produce safe and good products (or useful service), while showing respect for the human beings who include the employees, customers and the public. Hence, the objective for the managers and engineers is to produce valuable products that are also profitable.

Managing Conflicts

In solving conflicts, force should not be resorted. In fact, the conflict situations should be tolerated, understood, and resolved by participation by all the concerned. The conflicts in case of project managers arise in the following manners:

(*a*) Conflicts based on schedules: This happens because of various levels of execution, priority and limitations of each level.
(*b*) Conflicts arising out of fixing the priority to different projects or departments. This is to be arrived at from the end requirements and it may change from time to time.
(*c*) Conflict based on the availability of personnel.
(*d*) Conflict over technical, economic, and time factors such as cost, time, and performance level.
(*e*) Conflict arising in administration such as authority, responsibility, accountability, and logistics required.
(*f*) Conflicts of personality, human psychology and ego problems.
(*g*) Conflict over expenditure and its deviations.

Most of the conflicts can be resolved by following the principles listed here:

1. People

Separate people from the problem. It implies that the views of all concerned should be obtained. The questions such as what, why, and when the error was committed is more important than to know who committed it. This impersonal approach will lead to not only early solution but also others will be prevented from committing errors.

2. Interests

Focus must be only on interest i.e., the ethical attitudes or motives and not

on the positions (i.e., stated views). A supplier may require commission larger than usual prevailing rate for an agricultural product. But the past analysis may tell us that the material is not cultivated regularly and the monsoon poses some additional risk towards the supply. Mutual interests must be respected to a maximum level. What is right is more important than who is right!

3. Options

Generate various options as solutions to the problem. This helps a manager to try the next best solution should the first one fails. Decision on alternate solutions can be taken more easily and without loss of time.

4. Evaluation

The evaluation of the results should be based on some specified objectives such as efficiency, quality, and customer satisfaction. More important is that the means, not only the goals, should be ethical.

CONSULTING ENGINEERS

The consulting engineers work in private. There is no salary from the employers. But they charge fees from the sponsor and they have more freedom to decide on their projects. Still they have no absolute freedom, because they need to earn for their living. The consulting engineers have ethical responsibilities different from the salaried engineers, as follows:

1. Advertising

The consulting engineers are directly responsible for advertising their services, even if they employ other consultants to assist them. But in many organisations, this responsibility is with the advertising executives and the personnel department.

They are allowed to advertise but to avoid deceptive ones. Deceptive advertising such as thefollowing are prohibited:

- By white lies.
- Half-truth, e.g., a product has actually been tested as prototype, but it was claimed to have been already introduced in the market. An architect shows the photograph of the completed building with flowering trees around but actually the foundation of the building has been completed and there is no real garden.
- Exaggerated claims. The consultant might have played a small role in a well-known project. But they could claim to have played a major role.
- Making false suggestions. The reduction in cost might have been achieved

along with the reduction in strength, but the strength details are hidden.

- Through vague wordings or slogans.

2. Competitive Bidding

It means offering a price, and get something in return for the service offered. The organizations have a pool of engineers. The expertise can be shared and the bidding is made more realistic. But the individual consultants have to develop creative designs and build their reputation steadily and carefully, over a period of time. The clients will have to choose between the reputed organizations and proven qualifications of the company and the expertise of the consultants. Although competent, the younger consultants are thus slightly at a disadvantage.

3. Contingency Fee

This is the fee or commission paid to the consultant, when one is successful in saving the expenses for the client. A sense of honesty and fairness is required in fixing this fee. The NSPE Code III 6 (*a*) says that the engineers shall not propose or accept a commission on a contingent basis where their judgment may be compromised.

The fee may be either as an agreed amount or a fixed percentage of the savings realized. But in the contingency fee-agreements, the judgment of the consultant may be biased. The consultant may be tempted to specify inferior materials or design methods to cut the construction cost. This fee may motivate the consultants to effect saving in the costs to the clients, through reasonably moral and technological means.

4. Safety and Client's Needs

The greater freedom for the consulting engineers in decision making on safety aspects, and difficulties concerning truthfulness are the matters to be given attention. For example, in design-only projects, the consulting engineers may design something and have no role in the construction. Sometimes, difficulties may crop-up during construction due to non-availability of suitable materials, some shortcuts in construction, and lack of necessary and adequate supervision and inspection. Properly-trained supervision is needed, but may not happen, unless it is provided. Further, the contractor may not understand and/or be willing to modify the original design to serve the clients best.

A few on-site inspections by the consulting engineers will expose the deficiency in execution and save the workers, the public, and the environment that may be exposed to risk upon completion of the project.

The NSPE codes on the advertisement by consultants provide some specific regulations. The following are the activities prohibited in advertisement by consultant:

1. The use of statement containing misrepresentation or omission of a necessary fact.
2. Statement intended or likely to create an unjustified expectation.
3. Statement containing prediction of future (probable) success.
4. Statement intended or likely to attract clients, by the use of slogans or sensational language format.

ENGINEERS AS EXPERT WITNESS

Frequently engineers are required to act as consultants and provide expert opinion and views in many legal cases of the past events. They are required to explain the causes of accidents, malfunctions and other technological behavior of structures, machines, and instruments, e.g., personal injury while using an instrument, defective product, traffic accident, structure or building collapses, and damage to the property, are some of the cases where testimonies are needed. The focus is on the past.

The functions of eye-witness and expert-witness are different as presented in the Table.

Eye Witness	Expert Witness
Eye-witness gives evidence on only what has been seen or heard actually (perceived facts)	Gives expert view on the facts in their area of their expertise
	Interprets the facts, in term of the cause and effect relationship
	Comments on the view of the opposite side
	Reports on the professional standards, especially on the precautions when the product is made or the service is provided.

The engineers, who act as expert-witnesses, are likely to abuse their positions in the following manners:

1. Hired Guns

Mostly lawyers hire engineers to serve the interest of their clients. Lawyers are permitted and required to project the case in a way favorable to their clients. But the engineers have obligations to thoroughly examine the events

and demonstrate their professional integrity to testify only the truth in the court. They do not serve the clients of the lawyers directly. The hired guns forward white lies and distortions, as demanded by the lawyers. They even withhold the information or shade the fact, to favor their clients.

2. Money Bias

Consultants may be influenced or prejudiced for monitory considerations, gain reputation and make a fortune.

3. Ego Bias

The assumption that the own side is innocent and the other side is guilty, is responsible for this behavior. An inordinate desire to serve one's client and get name and fame is another reason for this bias.

4. Sympathy Bias

Sympathy for the victim on the opposite side may upset the testimony. The integrity of the consultants will keep these biases away from the justice. The court also must obtain the balanced view of both sides, by examining the expert witnesses of lawyers on both sides, to remove a probable bias.

Duties

1. The expert-witness is required to exhibit the responsibility of *confidentiality* just as they do in the consulting roles. They can not divulge the findings of the investigation to the opposite side, unless it is required by the court of law.
2. More important is that as witness they are *not required to volunteer* evidence favorable to the opponent. They must answer questions truthfully, need not elaborate, and remain neutral until the details are asked for further.
3. They should be *objective* to discover the truth and communicate them honestly.
4. The stand of the experts depends on the *shared understanding* created within the society. The legal system should be respected and at the same time, they should act in conformance with the professional standards as obtained from the code of ethics.
5. The experts should earnestly be *impartial* in identifying and interpreting the observed data, recorded data, and the industrial standards. They should not distort the truth, even under pressure. Although they are hired by the lawyers, they do not serve the lawyers or their clients. They serve the justice. Many a time, their objective judgments will help the lawyer to put up the best defense for their clients.

ENGINEERS AS ADVISORS IN PLANNING AND POLICY MAKING

Advisors

The engineers are required to give their view on the future such as in planning, policy-making, which involves the technology. For example, should India expand nuclear power options or support traditional energy sources such as fossil fuels or alternative forms like solar and wind energy? In the recent past, this topic has created lot of fireworks, in the national media.

Various issues and requirements for engineers who act as advisors are:

1. Objectivity

The engineers should study the cost and benefits of all possible alternative means in objective manner, within the specified conditions and assumptions.

2. Study All Aspects

They have to study the economic viability (effectiveness), technical feasibility (efficiency), operational feasibility (skills) and social acceptability, which include environmental and ethical aspects, before formulating the policy.

3. Values

Engineers have to possess the qualities, such as (*a*) honesty, (*b*) competence (skills and expertise), (*c*) diligence (careful and alert) (*d*) loyalty in serving the interests of the clients and maintaining confidentiality, and (*e*) public trust, and respect for the common good, rather than serving only the interests of the clients or the political interests.

4. Technical Complexity

The arbitrary, unrealistic, and controversial assumptions made during the future planning that are overlooked or not verified, will lead to moral complexity. The study on future is full of uncertainties than the investigations on the past events. On the study of energy options, for example, assumptions on population increase, life style, urbanization, availability of local fossil resources, projected costs of generating alternative forms of energy, world political scenario, world military tensions and pressures from world organizations such as World Trade Organisation (W.T.O.) and European Union (EU) may increase the complexity in judgment on future.

5. National Security

The proposed options should be aimed to strengthen the economy and security of the nation, besides safeguarding the natural resources and the environment from exploitation and degradation.

For the advisors on policy making or planning, a shared understanding on balancing the conflicting responsibilities, both to the clients and to the public, can

be effected by the following roles or models:

1. Hired Gun

The prime obligation is shown to the clients. The data and facts favorable to the clients are highlighted, and unfavorable aspects are hidden or treated as insignificant. The minimal level of interest is shown for public welfare.

2. Value-neutral Analysts

This assumes an impartial engineer. They exhibit conscientious decisions, impartiality i.e., without bias, fear or favor, and absence of advocacy.

3. Value-guided Advocates

The consulting engineers remain honest (frank in stating all the relevant facts and truthful in interpretation of the facts) and autonomous (independent) in judgement and show paramount importance to the public (as different from the hired guns).

MORAL LEADERSHIP

Engineers provide many types of leadership in the development and implementation of technology, as managers, entrepreneurs, consultants, academics and officials of the government. Moral leadership is not merely the dominance by a group. It means adopting reasonable means to motivate the groups to achieve morally desirable goals. This leadership presents the engineers with many challenges to their moral principles.

Moral leadership is essentially required for the engineers, for the reasons listed as follows:

1. It is leading a group of people towards the achievement of global and objectives. The goals as well as the means are to be moral. For example, Hitler and Stalin were leaders, but only in an instrumental sense and certainly not on moral sense.
2. The leadership shall direct and motivate the group to move through morally desirable ways.
3. They lead by thinking ahead in time, and morally creative towards new applications, extension and putting values into practice. 'Morally creative' means the identification of the most important values as applicable to the situation, bringing clarity within the groups through proper communication, and putting those values into practice.
4. They sustain professional interest, among social diversity and cross-disciplinary complexity. They contribute to the professional societies,

their professions, and to their communities. The moral leadership in engineering is manifested in leadership within the professional societies. The professional societies provide a forum for communication, and canvassing for change within and by groups.

5. *Voluntarism*: Another important avenue for providing moral leadership within communities, by the engineers is to promote services without fee or at reduced fees (pro bono) to the needy groups. The professional societies can also promote such activities among the engineers. This type of voluntarism (or philanthropy) has been in practice in the fields of medicine, law and education. But many of the engineers are not self-employed as in the case of physicians and lawyers. The business institutions are encouraged to contribute a percentage of their services as free or at concessional rates for charitable purposes.
6. *Community service*: This is another platform for the engineers to exhibit their moral leadership. The engineers can help in guiding, organising, and stimulating the community towards morally- and environmentally-desirable goals. The corporate organizations have come forward to adopt villages and execute many social welfare schemes, towards this objective.

The Codes of Ethics promote and sustain the ethical environment and assist in achieving the ethical goals in the following manner:

- It creates an environment in a profession, where ethical behavior is the basic criterion.
- It guides and reminds the person as to how to act, in any given situation.
- It provides support to the individual, who is being pressurized or tortured by a superior or employer, to behave unethically.
- Apart from professional societies, companies and universities have framed their own codes of ethics, based on the individual circumstances and specific mission of the organisations. These codes of conduct help in employees' awareness of ethical issues, establish, and nurture a strong corporate ethical culture.

CODES OF ETHICS

National Society of Professional Engineers

Preamble

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the higher standards of honesty and integrity. Engineering has a direct and vital impact on the quality of life for all

people. Accordingly, the services provided by engineers require honesty, impartiality, fairness, and equity, and must be dedicated to the protection of then public health, safety, and welfare. Engineer must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct.

I Fundamental Canons

Engineers in the fulfilment of their professional duties shall

- Hold paramount the safety, health, and welfare of the public.
- Perform services only in areas of their competence.
- Issue public statements only in 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.

II Rules of Practice

1. Engineers shall hold paramount the safety, health, and welfare of the public.

(a)If engineers' judgment is overruled under circumstances that endanger life or property, they shall notify their employer or client and such other authority as may be appropriate.

(b) Engineers shall approve only those engineering documents that are in conformity with applicable standards

(c) Engineers shall not reveal facts, data, or information without prior consent of the client or employer except as authorized or required by law or this code.

(d) Engineers shall not permit the use of their name or associate in business ventures with any person or firm that they believe are engaged in fraudulent or dishonest enterprise.

(e) Engineers shall not aid or abet the unlawful practice of engineering by a person or firm.

(f) Engineers having knowledge of any alleged violation of this Code shall report thereon to appropriate professional bodies and when relevant, also to public authorities, and cooperate with the proper authorities in furnishing such information or assistance as may be required.

2. Engineers shall perform services only in the areas of their competence.

(a) Engineers shall undertake assignments only when qualified by education or experience in the specific technical fields involved.

(b)Engineers shall not affix their signatures to any plans or documents dealing with the subject matter in which they lack competence, nor to any plan or document not prepared under their direction and control.
(c) Engineers may accept assignments and assume responsibility for coordination of an entire project and sign and seal the engineering documents for the entire project, provided that each technical segment is signed and sealed only by the qualified engineers who prepared the segment.

3. Engineers shall issue public statements only in an objective and truthful manner.

(a) Engineers shall be objective and truthful in professional reports, statements, or testimony. They shall include all relevant and pertinent information in such reports, statements, or testimony, which should bear the date indicating when it was current.
(b) Engineers may express publicly technical options that are founded upon knowledge of the facts and competence in the subject matter.
(c) Engineers shall issue no statements, criticisms, or arguments on technical matters that are inspired or paid for by interested parties on prefaced their comments by explicitly identifying the interested parties on whose behalf they are speaking and by revealing the existence of any interest the engineers may have in the matters.

4. Engineers shall at for each employer or client as faithful agents or trustees

(a) Engineers shall disclose all known or potential conflicts of interest that could influence or appear to influence their judgment or the quality of their services.
(b) Engineers shall not accept compensation, financial or otherwise, from more than one party for services on the same project, or for services pertaining to the same project, unless the circumstances are fully disclosed and agreed to by all interested parties.
(c) Engineers shall not solicit or accept financial or other valuable consideration, directly or indirectly, from outside agents on connection with the work for which they are responsible.
(d) Engineers in public service as members, advisers, or employees of a governmental or quasi-governmental body or department shall not participate in decisions with respect to services solicited or provided by them or their organizations in private or public engineering practice.
(e) Engineers shall not solicit or accept a contract from a governmental body on which a principal or officer of their organization serves as a member.

5. Engineers shall avoid deceptive acts

(a) Engineers shall not falsify their qualifications or permit misrepresentation of their or their associate's qualifications. They shall not misrepresent or exaggerate their responsibility in or for the subject matter of prior assignments. Brochures or other presentations incident to the solicitation of employment shall not misrepresent pertinent facts concerning employers, employees, associates, joint ventures, or past accomplishments.

(b) Engineers shall not offer, give, solicit or receive, either directly or indirectly, any contribution to influence the award of a contract by public authority, or which may be reasonably construed by the public as having the effect of intent to influence the awarding of a contract. They shall not offer any gift or other valuable consideration in order to secure work. They shall not pay a commission, percentage, or brokerage fee in order to secure work, except to a bonafide employee or established commercial or marketing agencies retained by them.

III Professional Obligations

1. Engineers shall be guided in all their relation by the highest standards of honesty and integrity.

(a) Engineers shall acknowledge their errors and shall not distort or alter the facts.

(b) Engineers shall advice their clients or employers when they believe a project will not be successful

(c) Engineers shall not accept outside employment to the detriment of their regular work or interest. Before accepting any outside engineering employment they will notify their employers.

(d) Engineers shall not attempt to attract an engineer from another employer by false or misleading pretenses.

(e) Engineers shall not promote their own interest at the expense of the dignity and integrity of the profession.

2. Engineers shall at all times strive to serve the public interest.

(a) Engineers shall seek opportunities to participate in civic affairs, career guidance for youths, and work for the advancement of the safety, health, and well-being of their community.

(b) Engineers shall not complete, sign, or seal plans and/or specifications that are not in conformity with applicable engineering standards. If the client or employer insists on such unprofessional conduct, they shall notify the proper authorities and withdraw from further service on the project.

(c) Engineers shall endeavour to extend public knowledge and appreciation of

engineering and its achievements.

3. Engineers shall avoid all conduct or practice that deceives the public.

(a) Engineers shall avoid the use of statements containing a material misrepresentation of fact or omitting a material fact.

(b)Consistent with the foregoing, engineers may advertise for recruitment of personnel.

(c) Consistent with foregoing, engineers may prepare articles for the lay or technical press, but such articles shall not imply credit to the author for work performed by other.

4. Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former client or employer, or public body on which they serve.

(*a*) Engineers shall not, without the consent of all interested parties, promote or arrange for new employment or practice in connection with a specific project for which the engineer has gained particular and specialized knowledge.

(b) Engineers shall not, without the consent of all interested parties, participate in or represent in adversary interest in connection with a specific project or proceeding in which the engineer has gained particular specialized knowledge on behalf of a former client or employer.

5. Engineers shall not be influenced in their professional duties by conflicting interests.

(*a*) Engineers shall not accept financial or other consideration including free engineering designs, from material or equipment suppliers for specifying their product.

(*b*) Engineers shall not accept commission or allowances, directly or indirectly, from contractors or other parties dealing with clients or employers of the engineer in connection with work for which the engineer is responsible.

6. Engineers shall not attempt to obtain employment or advancement or professional engagements by untruthfully criticizing other engineers, or by other improper methods.

(*a*) Engineers shall not request, propose, or accept a commission on a contingent basis under circumstances in which their judgement may be compromised.

(*b*) Engineers in salaried positions shall accept part-time engineering work only to the extent consistent with policies of the employer and in accordance with ethical consideration.

(*c*) Engineers shall not, without consent, use equipment, supplies, laboratory, or office facilities of an employer to carry on outside private practice.

7. Engineers shall not attempt to injure, maliciously or falsely, directly or indirectly, the professional reputation, prospects, practice, or employment of other engineers. Engineers who believe others are guilty of unethical or illegal practice shall resent such information to the proper authority for action.
(*a*) Engineers in private practice shall not review the work of another engineer for the same client, except with the knowledge of such engineer, or unless the connection of such engineer with the work has been terminated.
(b)Engineers in governmental, industrial, or educational employment are entitled to review and evaluate the work of other engineers when so required by their employment duties.
(c) Engineers in sales or industrial employ are entitled to make engineering comparisons or represented products with products of other suppliers.

8. Engineers shall accept personal responsibility for their professional activities, provided, however, the engineers may seek indemnification for services arising out of their practice for other than gross negligence, where the engineer's interests cannot otherwise be protected.

(*a*) Engineers shall conform to state registration laws in the practice of engineering.
(*b*) Engineers shall not use association with a non-engineer, a corporation, or partnerships a 'cloak' for unethical acts.

9. Engineers shall give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others.
(a) Engineers shall, whenever possible, name the person or persons who may be individually responsible for designs, inventions, writings, or other accomplishments.
(b) Engineers using designs supplied by a client recognize that the designs remain the property of the client and may not be duplicated by the engineer for others, without the express permission.
(c) Engineers before undertaking work for others in connection with which the engineer may make improvements, plans, designs, inventions, or other records that may justify copyrights or patents, should enter into a positive agreement regarding ownership.
(d) Engineers' designs, data, records, and notes referring exclusively to an employer's work are the employer's property. The employer should indemnify the engineer for use of the information for any purpose other than the original purpose.

(e) Engineers shall continue their professional development throughout their careers and should keep current in their specialty fields by engaging in professional practice, participating in continuing education course, reading in the technical literature, and attending professional meetings and seminars.

The Institute of Electrical & Electronics Engineers (IEEE)

Code of Ethics

We the members of the IEEE, in recognition of the importance of our technologies in affecting the quality of life throughout the world, and in accepting a personal obligation to our profession, its members and the communities we serve, do hereby commit ourselves to the highest ethical and professional conduct and agree:

1. To accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose prompt factors that might endanger the public or the environment.
2. To avoid real or perceived conflicts of interest whenever possible, and to disclose them to affected parties when they do exist.
3. To be honest and realistic in stating claims or estimates based on available data.
4. To reject bribery in all its forms.
5. To improve the understanding of technology, its appropriate application, and potential consequences.
6. To maintain and improve our technical competence and to undertake technological tasks for others only if qualified by training or experience, or after full disclosure of pertinent limitations.
7. To seek, accept, and offer honest criticism of technical work, to acknowledge and correct errors, and to credit properly the contributions of others.
8. To treat fairly all persons regardless of such factors as race, religion, gender, disability, age, or national origin.
9. To avoid injuring others, their property, reputation, or employment by false or malicious action.
10. To assist colleagues and co-workers in their professional development and to support them in following code of ethics.

Institution of Engineers (India) (IEI)

Code of Ethics (Effective from March 2004)

Introduction

Engineers serve all members of the community in enhancing their welfare, health, and safety by a creative process utilizing the engineers' knowledge, expertise and experience.

The code of ethics is based on broad principles of truth, honesty, justice, trustworthiness, respect and safeguard of human life and welfare, competence and accountability, which constitutes the moral values every corporate member of the institution, must recognize, uphold and abide by.

Preamble

The corporate members if the IEI are committed to promote and practice the profession of engineering for the common good of the community bearing in mind the following concerns:

1. The ethical standard
2. Social justice, social order, and human rights
3. Protection of the environment
4. Sustainable development
5. Public safety and tranquillity

The Tenets of the Code of Ethics

A corporate member

1. Shall utilize his/her knowledge and expertise for the welfare, health, and safety of the community without any discrimination for sectional or private interests.
2. Shall maintain the honour, integrity and dignity in all his professional actions to be worthy of the trust of the community and the profession.
3. Shall act only in the domains of his competence and with diligence, care, sincerity and honesty.
4. Shall apply his knowledge and expertise in the interest of his employer or the clients for whom he shall work without compromising with other obligations to these tenets.
5. Shall not falsify or misrepresent his own or his associates qualification, experience etc.
6. Wherever necessary and relevant, shall take all reasonable steps to inform, himself, his employer or clients, of the environmental, economic, social and other possible consequences, which may arise out of his actions.
7. Shall maintain utmost honesty and fairness in making a statement or giving witness and shall do so on the basis of adequate knowledge.
8. Shall not directly or indirectly injure the professional reputation of another member.
9. Shall reject any kind of offer that may involve unfair practice or may cause avoidable damage to the eco-system.
10. Shall be concerned about and shall act in the best of his abilities for maintenance of sustainability of the process of development.

11. Shall not act in any manner which may injure the reputation of the institution or which may cause any damage to the institution financially or otherwise.

General Guidance

The tenets of the code of ethics are based on the recognition that-

A common tie exists among the humanity and that the Institution of Engineers (India) derives its value from the people, so that the actions of its corporate members should indicate the member's highest regard for equality of opportunity, social justice and fairness

The corporate members of the institution hold a privileged position in the community so as to make it a necessity for their not using the position for personal and sectional interests.

And as Such, a Corporate Member

1. Should keep his employer or client fully informed on all matters in respect of his assignment which are likely to lead to a conflict of interest or when, in his judgment, a project will not be viable on the basis of commercial, technical, environment or any other risks.
2. Should maintain confidentiality of any information with utmost sincerity unless expressly permitted to disclose such information or unless such permission, if withheld, any adversely affects the welfare, health and safety of the community.
3. Should neither solicit nor accept financial or other considerations from anyone related to a projector assignment of which he is in the charge.
4. Should neither pay nor offer direct or indirect inducements to secure work.
5. Should compete on the basis of merit alone.
6. Should refrain from inducing a client to breach a contract entered into with another duly-appointed engineer.
7. Should, if asked by the employer or a client, to review the work of another person or organization, discuss the review with the other person or organization to arrive at a balanced opinion.
8. Should make statements or give evidence before a tribunal or a court of law in an objective and accurate manner and express any opinion on the basis of adequate knowledge and competence.
9. Should reveal the existence of any interest-pecuniary or otherwise—which may affect the judgment while giving an evidence or making a statement.

Indian Institute of Material Management

Code of Ethics

1. To consider first the total interest of one's organization in all transactions without impairing the dignity and responsibility to one's office.
2. To buy without prejudice seeking to obtain the maximum ultimate value for

each rupee of expenditure.
3. To subscribe and work for honesty and truth in buying and selling.
4. To denounce all forms and manifestations of commercial bribery and to eschew anti-social practices.
5. To respect one's obligations and those of one's organization consistent with good business practice.

Institution of Electronics and Telecommunication Engineers

Preamble

1. To uphold the concept of professional conduct amongst its corporate members, the Council of the Institution felt the need to evolve a Code of Ethics for corporate members.
2. A corporate member should develop *spirit-de-corps* among the fraternity and uphold the principles of honesty, integrity, justice, and courtesy to guide him in the practice of his responsibilities and duties to the public and the profession.
3. He should scrupulously guard his professional and personal reputation and avoid association with persons and organizations of questionable character and uphold the dignity and honour of the institution.

The Codes

1. A corporate member will, at all times, endeavour to protect the engineering profession from misrepresentation and misunderstanding.
2. A corporate member will interact with others in his profession by free exchange of information and experience. He will contribute to the growth of the institution to maximum effectiveness to the best of his ability.
3. A corporate member will not offer his professional services by advertisement or through any commercial advertising media, or solicit engineering work, trading, teaching either directly or indirectly or through agencies/organizations in any manner derogatory to the dignity of the profession and the institution.
4. A corporate member will not directly or indirectly injure the professional reputation, work, or practice of another corporate member.
5. A corporate member will not divulge confidential findings or actions of the council or committee of which he is a member, without obtaining official clearance.
6. A corporate member will not take credit for an activity, professional work, engineering proposal when engaged in a team and give due recognition to those where due.
7. A corporate member will express an opinion only when it is founded on facts and honest conviction before a forum, court, commission or at an

inquiry.

8. A corporate member will exercise due restraint in criticizing the work or professional conduct of another corporate member which would impinge or hurt his character and reputation.
9. A corporate member will not try to supplant another corporate member in a particular employment, office or contract.
10. A corporate member will be upright in all his dealings with person(s), organizations, in business, contractors, agencies. He should not take actions that lead to groupism, political connotation or unethical conduct in the discharge if his official powers.
11. A corporate member will not misrepresent his qualification to gain undue advantage in his profession.
12. A corporate member will act with fairness and justice in any office, employment or contract.
13. A corporate member will not associate in engineering work which does not conform to ethical practices.
14. A corporate member will not compete unfairly with another corporate member by means, which in the opinion of others, are based on garnering support for personal gain, enlisting uncalled for sympathy, espousing unjust cases or amounts to use of unconstitutional methods.
15. A corporate member will act in professional matters as a faithful agent or trustee.
16. A corporate member will not receive remuneration, commission, discount or any indirect profit from any work with which he is entrusted, unless specifically so permitted.
17. A corporate member will not accept financial or other compensation from more than one source for the same service or work connected thereto, unless so authorized
18. A corporate member will immediately inform his organisation/institution of any financial interest in a business, and engineering work which may compete with, adversely affect or hamper the growth of parent body.
19. A corporate member will engage or enlist the services of specialist/experts when in his judgement; such services are in the best interest of his employer or to the profession.
20. A corporate member will endeavour to develop a team among his colleagues and staff and provide equal opportunity to them for professional development and advancement.
21. A corporate member will subscribe to the principle of appropriate norms, appreciation and adequate compensation for those engaged in office, technical and professional employment including those in subordinate positions.
22. A corporate member, if he considers that another corporate member is guilty

of unethical, illegal, unfair practice, defalcation, will not present such information to the Council of the Institution for necessary action, unless armed with substantial proof.

ENGINEERING COUNCIL OF INDIA

Engineering Council of India was formed in 2002 with one of its objectives as "to establish a common code of ethics for professional and consulting engineers for adoption by Associations/Professional Societies and to evolve the strategy for its enforcement." The IEI, IETE, and Consulting Engineers Association of India (CEAI), AICTE, and NBA are the members of this council. The Engineers Bill, drafted in 2004 and aimed to introduce the common codes of ethics, is yet to enter the statute books.

CODES OF ETHICS FOR TATA GROUP

Several Indian companies have risen to the challenge and have established a reputation for fair play and ethics. Among leaders of IT companies, there are models of good governance.

The 15 million $ Tata Group upholds the *leadership with trust* as its key asset and holds up the Tata codes of Conduct to its 2.2 million plus employees. Founded on the five *core values, namely*

Integrity, Understanding, Excellence, Unity, and Responsibility, the code is enunciated in 24 canons embracing ethical conduct, conflict of interest, corporate governance, whistle blowing, and national interest, health, safety, and welfare of the public including environmental concern.

An elaborate mechanism to monitor the management of business in each of the 91 member companies is provided. All the IT professionals in the group numbering 50 000 plus worldwide, sign allegiance to the code and in particular to mandates on equal opportunity, prevention of gender inequality, concurrent employment, quality of services, and integrity of data furnished.

ETHICS AND CODES OF BUSINESS CONDUCT IN MNC

Sarbans-Oxley Act, 2002 (U.S.A.) and New York Stock Exchange listing standards have made many corporate organizations ethics conscious. The organizations are to disclose codes of business conduct and ethics for the organizations.

For example, Texas Instruments a major MNC, has declared that "Ethical reputation is our vital asset. Upon applying values each of the employee can say, TI is a good company, and one reason is that I am part of it".

Three major values such as Integrity, Innovation and Commitment, have been elaborated in the form of 28 ethics statements (as pledges to keep) and 17 codes of business conduct have been presented in their documents.

A quick ethics test suggested by TI for all of its employees, without exception, will sufficiently explain their commitment:

1. Is the action LEGAL?
2. Does it comply with our VALUES?
3. If you do it, will you feel BAD?
4. How will it look in the NEWSPAPER?
5. If you know it is WRONG, don't do it.
6. If you are not sure, ASK
7. Keep asking until you get an answer.