Engineering as Experimentation
&
Engineers as Experimenters
Engineering As Experimentation

- Engineering involves development of product or project, and as a whole it can be considered as an experiment.

- To manufacture a product, or to provide a project, we have to go through some iterative steps. Like

  - several assumptions and trials.
  - Design and redesign. Etc….
Fig1. Design as an interactive process
Engineering Project Vs Standard Experiments

Let's identify the similarities and contrasts

**Similarities**
- Partial ignorance
- Uncertainty
- Continuous monitoring
- Learning from the past
Contrasts

The scientific experiments in the laboratory and the engineering experiment in the field exhibit ever contrasts as given below…

- Experimental control
- Humane touch
- Informed consent
- Knowledge gained
ENGINEERS AS RESPONSIBLE EXPERIMENTERS

The engineers share a greater responsibility while monitoring the projects, identifying the risks, and informing the clients and the public with the fact.

Engineers responsibilities

- A conscientious commitment to live by moral values.

- A comprehensive perspective on relevant information. (awareness, monitoring side effect).

- Unrestricted free-personal involvement in all steps of the project/product development (autonomy).

- Be accountable for the results of the project.
CONSCIENTIOUSNESS

- Being sensitive to full range of moral values and responsibilities relevant to the prevailing situation.

- The willingness to develop the skill and put the efforts needed to reach the best balance possible among those considerations.

- Engineers must possess open eyes (moral vision), open ears (moral listening), and an open mind (moral reasoning).

- Respect foremost the safety and health of the affected.

- The human rights of the participant should be protected through voluntary and informed consent.
Comprehensive Perspective

- The Engineers 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)
Moral Autonomy

- Viewing engineering as social experimentation, and anticipating unknown consequences should promote an attitude of questioning about adequacy of the existing economic and safety standards.

- This proves a greater sense of personal involvement in one’s work.
Accountability

- Capacity to understand and act normal reasons.
- Willingness to submit one’s action to moral scrutiny.
- Be responsive to the assessment of others.
- Be liable to justify the decisions, actions or means, and outcomes.
REFERENCE

- A Text book on professional Ethics and Human Values-
- R.S. Nagarazan ,New Age International Publishers
Codes of Ethics

The ‘codes of ethics’ exhibit

- rights
- duties
- obligations of the members of a profession and a professional society

Codes are based on

- broad principles of truth
- honesty
- trustworthiness
- respect for human life and welfare
- fairness
- openness
- competence
- accountability
1. Roles exhibited by the codes:

- Inspiration and guidance
- Support to engineers
- Deterrence (discourage to act immorally)
- Education and mutual understanding
- Create good public image
- Protect the status quo
- Promotes business interests
2. Model Codes Of Ethics

The professional engineers shall
• Offer services, advice on or undertake engineering assignments only in their areas of competence and practice in careful and diligent manner.
• Acts as faithful agents of their clients or employers, maintain confidentiality and disclose conflicts of interests.
• Keep themselves informed in order to maintain their competence and provide opportunities for the professional development of their subordinates.
• Conduct themselves with fairness and good faith towards clients, colleagues and others, give credits where it is due and accept, as well as give, honest and fair professional criticisms.
Model Codes Of Ethics (contd.)

• Be aware of and ensure that clients and employers are aware of societal and environmental consequences of actions or projects and endeavor to interpret engineering issues to the public in an objective and truthful manner
• Present clearly to the clients and employers the consequences if engineering decisions or judgements are overruled or disregarded.
• Report to their association and/or appropriate agencies any illegal or unethical engineering decisions or practices by engineers or others.
3. Limitations

The codes are not remedy for all evils
• General and vague wordings.
• Not applicable to all situations
• Often have internal conflicts
• They can not be treated as final moral authority for professional conduct
• Only a few enroll as members in professional society and non-members can not be compelled.
• Even as members of the professional society, many are unaware of the codes
• Different societies have different codes. The codes can not be uniform or same.
The ‘balanced outlook on law’ in engineering practice stresses:

- the necessity of laws and regulations
- their limitations in directing and controlling the engineering practice

Laws are necessary because:

- people are not fully responsible by themselves
- of the competitive nature of the free enterprise, which does not encourage moral initiatives
- they are needed to provide a minimum level of compliance.
1. Code for Builders by Hammurabi

Hammurabi 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.
2. The United States Steamboat Code: (1852 AD)

- Steam engines in the past were very large and heavy.
- James Watt, Oliver Evans and Richard Trevethik modified them by removing condensers and made them compact.
- It led to an explosion due to high speed of boat.
- The safety valves were unable to keep the pressure up.
- More than 2000 people were killed.
- Due to this ruling Congress passed a law which provided for inspection of the safety aspect of the ships.
- But it became ineffective due to inadequate training, regarding safety checking, given to inspectors.
- Alfred Guthiro inspected the boats and found the reason for the explosions and made a report.
- With its help, another law was passed.
- Now the standards formulated by the American Society of Mechanical Engineers are followed.
3. Proper Role Of Laws

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

- The rules which govern engineering practice should be construed as of responsible experimentation
- Precise rules and sanctions are suitable in case of ethical misconduct that involves the violation of established engineering procedures
- They should not compel the engineers to follow rigid courses of action
- The regulation should be broad, but make engineers accountable for their decisions
The Space Shuttle Challenger disaster is well known to us.


Seven astronauts killed as it exploded just over a minute into the flight.

Next few slides is to give a deep thought into certain facts revolving around it.
Key Dates

- 1974 - Morton-Thiokol awarded contract to build solid rocket boosters.
- November 1981 - O-ring erosion discovered after second shuttle flight.
- January 24, 1985 - shuttle flight that exhibited the worst O-ring blow-by.
- July 1985 - Thiokol orders new steel billets for new field joint design.
- January 27, 1986 - night teleconference to discuss effects of cold temperature on booster performance.
- January 28, 1986 - *Challenger explodes 72 seconds after liftoff*
Key Issues

HOW DOES THE IMPLIED SOCIAL CONTRACT OF PROFESSIONALS APPLY TO THIS CASE?

WHAT PROFESSIONAL RESPONSIBILITIES WERE NEGLECTED, IF ANY?

SHOULD NASA HAVE DONE ANYTHING DIFFERENTLY IN THEIR LAUNCH DECISION PROCEDURE?
NASA managers were anxious to launch challenger due to

- Competition from European Space Agency to prove the space transportation system’s cost effectiveness and potential for commercialization
- scheduling backlogs
- Political pressure: As President Reagan had to give state of union address and it was mainly about education were he was expected to mention shuttle.

Shuttle rocket boosters (SRBs) are the key elements that produce enough thrust to overcome earth’s gravitational pull and achieve orbit. Its attached each side of fuel tank. Its drawback was that once ignited it cannot be turned off or controlled. The joints where booster segments are joined together is known as field joints. Each joint is sealed by two O-rings, the bottom ring known as the primary O-ring, and the top known as the secondary O-ring. The purpose of the O-rings is to prevent hot combustion gasses from escaping from the inside of the motor.
LAUNCH DELAYS

• The first delay of the Challenger mission was because of a weather front expected to move into the area, bringing rain and cold temperatures.
• The second launch delay was caused by a defective micro switch in the hatch locking mechanism and by problems in removing the hatch handle.
• It was convinced that there were cold weather problems with the solid rocket motors. Almost half of the shuttle flights had experienced O-ring erosion in the booster field joints.

ENGINEERING DESIGN

• Increasing O-ring compression in order to decrease Joint Rotation was taken for analysis where Joint rotation is the opening of gap between the tank and clevis which was caused due to ballooning of cylinder and changes were made in the design.

• A new problem was deducted after the flight of the second shuttle mission. Examination of the booster field joints revealed that the O-rings were eroding during flight. Study was conducted about the effects of O-ring resiliency at low temperatures. New steel billets were ordered for the redesign of the tank.
The Solid Rocket Boosters
BEFORE LAUNCH

• Engineers gave a presentation to convince that the cold weather would exaggerate the problems of joint rotation and delayed O-ring seating. The lowest temperature experienced by the O-rings in previous mission was 53°F. So they asked to delay the launch as O-ring erosion was found at this temperature.

• The managers seemed to believe the O-rings could be eroded up to one third of their diameter and still seat properly, regardless of the temperature. The new recommendation stated that launch was recommended, even though the engineers had no part in writing the new recommendation.

THE LAUNCH

• During the night, temperatures dropped to as low as 8°F. In order to keep the water pipes in the launch platform from freezing, safety showers and fire hoses had been turned on. Some of this water had accumulated, and ice had formed all over the platform.

• The ice inspection team thought the situation was of great concern, but the launch director decided to go ahead with the countdown.
• The key personal who had to authorize the launch were not aware of the teleconference about the solid rocket boosters that had taken place the night before.

• Eight hundredths of a second after ignition, the shuttle lifted off. Engineering cameras focused on the right-hand booster showed about nine smoke puffs coming from the booster aft field joint. Before the shuttle cleared the tower, oxides from the burnt propellant temporarily sealed the field joint before flames could escape. Fifty-nine seconds into the flight, *Challenger experienced the most violent* wind shear ever encountered on a shuttle mission. The glassy oxides that sealed the field joint were shattered by the stresses of the wind shear, and within seconds flames from the field joint burned through the external fuel tank. Hundreds of tons of propellant ignited, tearing apart the shuttle. One hundred seconds into the flight, the last bit of telemetry data was transmitted from the *Challenger*

**ISSUES FOR DISCUSSION**

The Challenger disaster has several issues which are relevant to engineers.

➢ One of the most important issues deals with engineers who are placed in management positions. It is important that these managers not ignore their own engineering experience, or the expertise of their subordinate engineers.
Another issue is the fact that managers encouraged launching due to the fact that there was insufficient low temperature data. Since there was not enough data available to make an informed decision, this was not, in their opinion, grounds for stopping a launch. This was a reversal in the thinking that went on in the early years of the space program, which discouraged launching until all the facts were known about a particular problem.

The first canon in the ASME Code of Ethics urges engineers to "hold paramount the safety, health and welfare of the public in the performance of their professional duties." Every major engineering code of ethics reminds engineers of the importance of their responsibility to keep the safety and well being of the public at the top of their list of priorities. Although company loyalty is important, it must not be allowed to override the engineer's obligation to the public.
A multinational company is one which is incorporated in one country (called the home country); but whose operations extend beyond the home country and which carries on business in other countries (called the host countries) in addition to the home country. It must be emphasized that the headquarters of a multinational company are located in the home country.

A multinational corporation is known by various names such as: global enterprise, international enterprise, world enterprise, transnational corporation etc.

**Features of Multinational Corporations (MNCs):**

1. Huge Assets and Turnover:
2. International Operations Through a Network of Branches:
3. Unity of Control:
4. Mighty Economic Power
5. Professional Management:
6. Better Quality of Products:
7. Aggressive Advertising and Marketing:
Advantages of MNCs from the Viewpoint of Host Country

1. Employment Generation
2. Automatic Inflow of Foreign Capital
3. Proper Use of Idle Resources
4. Improvement in Balance of Payment Position
5. Technical Development
6. Managerial Development
7. End of Local Monopolies
8. Improvement in Standard of Living
9. Promotion of international brotherhood and culture
Limitations of MNCs from the Viewpoint of Host Country

1. Danger for Domestic Industries:
2. Repatriation of Profits:
3. No Benefit to Poor People
4. Danger to Independence:
5. Disregard of the National Interests of the Host Country
6. Misuse of Mighty Status
7. Careless Exploitation of Natural Resources:
8. Selfish Promotion of Alien Culture
9. Exploitation of People, in a Systematic Manner
Environmental Ethics
What is environmental ethics???

- Part of environmental philosophy
- Extending traditional boundaries of ethics from solely including humans to include non-human world.
Definitions

• **Moral Standing:** To ask if an entity has moral standing is to ask whether the well-being of that entity should be taken into account by others.
  - Your interests and well-being must be weighed when deciding what is permissible to do.
Definitions

• Moral Duties
  – That which is owed by moral agents to those with moral standing.
  – Example: It is wrong to kill girl children because we have a moral duty toward them
Fundamental question

- What duties do humans have with respect to environment and why??
  - Does the environment have moral standing?
  - Must look at criteria for moral standing

- What moral duty do we (moral agents) have toward those with moral standing?
  - Different ethical positions suggest different moral duties.
Who should be considered for moral standing???

- All human beings...
- Many of the concerns we have regarding the environment appear to be concerns because of the way they effect human beings.
Extending moral standing

- Sentience, the ability to feel pain
  - Therefore extend moral standing to animals
Extending moral standing

• Being alive
  – Therefore extend moral standing to animals and plants:
  – All living things.
Extending Moral Standing

• Being part of nature
  – Therefore extend moral standing to the
    • earth
    • ecosystems
    • rocks
    • rivers
    • plants animals
    • the entire natural world
Ethical Positions

• Anthropocentrism: Human centered morality
  – Only humans have intrinsic value and moral standing.
  – The rest of the natural world has *instrumental value* (use to humans).
Anthropocentrism

- We can best protect nature by looking out for human needs.
  - Ex: Ducks Unlimited preserves wetlands
  - Ex: pollution diminishes our health.
  - Anthropocentric ethics have never played a part in extending moral standing.
  - But granting of moral standing to future generations have considered necessary.
Ethical Positions

• Sentio-centrism: Sentient-being centered morality
  – All and only sentient beings (animals that feel pain) have intrinsic value and moral standing.
  – The rest of the natural world has instrumental value.
  – Both humans and sentient animals have rights and/or interests that must be considered.
Ethical Positions

• **Biocentric Individualism:** Life-centered morality
  
  – All and only living beings, specifically *individual organisms* (not species or ecosystems) have intrinsic value and moral standing.
  
  – Humans are not superior to other life forms nor privileged, and must respect the inherent worth of every organism.
  
  – Humans should minimize harm and interference with nature: eat vegetarian since less land needs to be cultivated.
Ethical Positions

- Eco-centric Holism: ecosystem centered morality
- Albert Schweitzer
- We are part of land.
- Food chains conduct energy upward from soil, death and decay brings it back to soil.
- Individuals must be concerned about the whole community of life/nature,
- Humans should strive to preserve ecological balance and stability.
Patriarchal Dualisms

- Greek, Roman, Hebrew:
  - Humans are separate from
    - and superior to nature
  - Human, mind, rationality, and man
    - are linked and superior
  - Nature, body, feelings, and woman
    - are linked, and inferior
  - Justifies domination by men over
    - Nature
    - Women

Aristotle
Ecofeminism

- Rejects Patriarchal Dualisms
  - The domination of nature by men is wrong
    - is similar to and related to the domination of women by men.
  - Must break the pattern of "power over" relationships
    - will benefit both women and the natural world.
Deep Ecology

• Humans are deeply connected with nature.
• If humans *identify with* nature, then taking care of the natural world will become part of taking care of one's self.
Radical Ecology

- Extending moral standing is not sufficient
- We have to change very way we live and function, both as society and individuals
Bioregionalism

- Lead a simple life with local production of food and other products by people that you know
  - Increases environmental awareness and caring
  - decreases exploitation of the environment and people.
Computer Ethics
What is computer ethics???.

- a part of practical philosophy which concerns with how computing professionals should make decisions regarding professional and social conduct
Issues of computer ethics

• Intellectual property rights such as copyrighted electronic content, privacy concerns, and how computer affects society. Intellectual property rights is works created by inventors authors and artists

Example: It is easy to access someone’s personal information on a computer system, computer ethics would advise such an action is unethical.
Categorising Intellectual Property

- **Industrial property**: Which includes inventions (patents), trademarks, industrial designs, commercial names, designations and geographic indications.

- **Copyright**: Which include literary and artistic works such as novels, poems, and plays, films, musical works, artistic works, such as drawings, paintings, and photographs.
Copy rights

• Copy right is a legal concept, enacted by most governments, giving creator of original work exclusive rights to it, usually for a limited time.
Advantages and limitations of copyright laws

• Can protect intellectual property
  Example: novels, poems etc
• Protects only form of expression of ideas, not ideas themselves
  -once an online work has been produced any one can develop similar work based on that ideas.
• For works made available over communications network, the copyright protects original authorship.
NETIQUETTES

• About various risks related to using internet
• Real people exist behind computers
  - you are dealing with people, not machines. So think twice before you press send button in mail/chat
  - keep these people in mind when saying something on network.
• Protect your privacy
  - Be aware of risks, fraud and false information which exists on internet
  - Protect your personal information to keep someone from using it in unethical way
• Avoid spamming
  - Spamming is sending unsolicited bulk and/or commercial messages over internet.
  - Spamming is bad if it is intended to destroy and is done by infringing on right of privacy of others
Help making network better

• Try to make a contribution to network
  - Example: try to write articles or blogs on a topic of your interest. Try to share your views on certain subjects so some other people will benefit from you.
  - Try to share links of relevant topics
Ten Commandments of Computer Ethics

• Thou shalt not use a computer to harm other people.
• Thou shalt not interfere with other people's computer work.
• Thou shalt not snoop around in other people's computer files.
• Thou shalt not use a computer to steal.
• Thou shalt not use a computer to bear false witness.
• Thou shalt not copy or use proprietary software for which you have not paid (without permission).
• Thou shalt not use other people's computer resources without authorization or proper compensation.
• Thou shalt not appropriate other people's intellectual output.
• Thou shalt think about the social consequences of the program you are writing or the system you are designing.
• Thou shalt always use a computer in ways that ensure consideration and respect for your fellow humans.
ENGINEERS AS MANAGERS
“Many people going through the transition to manager feel ineffective and frustrated, but it doesn’t have to be that way, Engineers are uniquely qualified to be managers and leaders, in large part because they understand systems-thinking so well. Once you understand that organizations are simply systems of people, you’ve got it made.”

B. Michael Aucoin, IEEE Senior member
What is Engineering Management?

→ a specialized form of management that is required to successfully lead engineering or technical personnel and projects.
→ can be used to describe either functional management or project management.
Important skills to have

- Good communication skills
  90 percent of a manager’s job involves communicating through making presentations at meetings, responding to e-mail and phone calls, and visiting customers

- Handling conflicts with staff members
  When differences of opinion are expressed in a healthy way with a good process, it leads to better products and services

- Concentrating on the customer
  Engineers like to do things that are technically elegant, but that’s not necessarily what customers are most interested in
CONSULTING ENGINEERS
What is consulting engineering?

-a professional service that provides independent expertise in engineering, science and related areas to governments, industries, developers and construction firms
Consultants

- Individuals who typically work for themselves but may also be associated with a consulting firm.

- They, for a fee, give advice or provide a service in a field of specialized knowledge or training.

- Can play a multi-faceted role:
  - for example, as advisors, fixers, bosses, generalists, stabilizers, listeners, advisors, specialists, catalysts, managers or quasi-employees.
✔ Bringing in an expert can save time, effort and money

✔ Meets the companies’ needs of short-term technical expertise

  - for eg., when the company may not have anyone on staff capable of solving the specific problem

✔ Hiring a consultant with experience in a given area can cut days, weeks or even months off a project schedule

✔ Also, a consultant can help the staff avoid mistakes they may otherwise make.
In a consulting engineering company you will find people with:

- every kind of technical specialization
- a wide range of ages and experience levels
- business, financial and administrative expertise
- construction knowledge and experience
- managerial expertise
- business development skills
- project managers
ENGINEERS AS EXPERT WITNESSES AND ADVISORS
What is an Expert Witness?

Unlike *fact witnesses* whose testimony can describe only personal observations, experience or knowledge, expert witnesses are allowed, even expected, to express opinions about matters in which they have been accepted as having special knowledge that the average person does not possess.

Expert witnesses are needed to interpret technical information for people who do not have the knowledge to evaluate it, understand its meaning and apply it to the process of making a decision about the matter at hand.
Why do we need Experts?

- Clarity
- Determination of Liability
- Assessment of Quantum
- Resolution
- Narrowing differences
- Guidance for Court
- Interpretation and implementation of Judgments
Mr Justice Cresswell summarised the duties of experts in the Ikarian Reefer 1993 2 LILR 68, 81-82.

This states:

- Expert evidence presented to the court should be, and should be seen to be, the independent product of the expert uninfluenced as to form or content by the exigencies of litigation.
- An expert witness should provide independent assistance to the court by way of objective unbiased opinion in relation to matters within his expertise.
- An expert witness should state the facts or assumptions upon which his opinion is based. He should not omit to consider material facts which could detract from his concluded opinion.
- An expert witness should make it clear when a particular question or issue falls outside his expertise.
• If an expert’s opinion is not properly researched because he considers that insufficient data is available, then this must be stated with an indication that the opinion is no more than a provisional one.

• If the expert cannot assert that the report contains the truth, the whole truth and nothing but the truth without some qualification, that qualification should be stated in the report.

• If, after exchange of reports, an expert witness changes his view on a material matter having read the other side’s expert’s report, or for any other reason, such change of view should be communicated (though legal representatives) to the other side without delay and (where appropriate) to the court.

• Where expert evidence refers to photographs, plans, calculations, analyses, measurements, survey reports, or other similar documents, they must be provided to the opposite party at the same time as the exchange of reports.
MORAL LEADERSHIP
• There is a need for moral leadership in engineering. Leadership should not be confused with headship, i.e. being the head of a group.

• A person may be a leader even without being the head of the group. Moral leadership implies the ability to direct, motivate, organize, creatively manage, or in other ways move groups towards morally valuable goals.

• One of the main avenues for moral leadership is through involvement in professional societies, which are vested with the task of furthering technical knowledge and representing engineers collectively, but also play the significant role of helping in establishing high standards of moral integrity.
These societies provide a forum for communicating, organizing, and mobilizing change with a moral dimension within and by large groups.

Leadership can also be displayed through community service. Engineers can come forward to provide voluntary service to needy groups, and initiate discussions between engineers and disadvantaged groups to find ways in which the needs of specific individuals and groups may be met.
SAMPLE CODE OF ETHICS
• Morality may be defined as the standards of conduct that apply to all members of society. Every individual in a rational society is expected to conform to these standards. E.g. respect for the rights of others; fairness in dealings; honesty; considering the welfare of others etc.

• Professional ethics, on the other hand, are those standards of conduct that every member of a profession is expected to follow. E.g. honesty, loyalty, confidentiality, knowledge, diligence, protecting public safety and health etc.

• Code of ethics provides a framework for ethical judgment; is a starting point for ethical decision making; expresses commitment to ethical conduct shared by all members of a profession; and defines roles and responsibilities.

• However, code of ethics is neither a substitute for sound moral judgment, nor a legal document, nor a legal document, whose breach may invite legal procedures like arrest.
Code of ethics helps by establishing ethical behavior as the norm. It serves as a reminder of how to act in specific situations. It acts as a safeguard against pressures to act unethically, and strengthens the individual by indicating there is a collective sense of correct behavior. It also serves to highlight the profession’s commitment to responsible conduct.
ASME (American Society of Mechanical Engineers) Code of Ethics of Engineers

ASME requires ethical practice by each of its members and has adopted the following Code of Ethics of Engineers as referenced in the ASME Constitution.

**The Fundamental Principles**

Engineers uphold and advance the integrity, honor and dignity of the engineering profession by:

1. Using their knowledge and skill for the enhancement of human welfare;
2. Being honest and impartial, and serving with fidelity the public, their employers and clients; and
3. Striving to increase the competence and prestige of the engineering profession.
The Fundamental Canons

• Engineers shall hold paramount the safety, health and welfare of the public in the performance of their professional duties.
• Engineers shall perform services only in the areas of their competence.
• Engineers shall continue their professional development throughout their careers and shall provide opportunities for the professional and ethical development of those engineers under their supervision.
• Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest or the appearance of conflicts of interest.
• Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.
• Engineers shall associate only with reputable persons or organizations.
• Engineers shall issue public statements only in an objective and truthful manner.
• Engineers shall consider environmental impact in the performance of their professional duties.
PREAMBLE

Engineers affect the quality of life for all people in our complex technological society. In the pursuit of their profession, therefore, it is vital that engineers conduct their work in an ethical manner so that they merit the confidence of colleagues, employers, clients and the public. This IEEE Code of Ethics is a standard of professional conduct for engineers.

ARTICLE I

Engineers shall maintain high standards of diligence, creativity and productivity, and shall:

1. Accept responsibility for their actions;
2. Be honest and realistic in stating claims or estimates from available data;

3. Undertake engineering tasks and accept responsibility only if qualified by training or experience, or after full disclosure to their employers or clients of pertinent qualifications;

4. Maintain their professional skills at the level of the state of the art, and recognize the importance of current events in their work;

5. Advance the integrity and prestige of the engineering profession by practicing in a dignified manner and for adequate compensation.
ARTICLE II

Engineers shall, in their work:

1. Treat fairly all colleagues and coworkers, regardless of race, religion, sex, age or national origin;
2. Report, publish and disseminate freely information to others, subject to legal and proprietary restraints;
3. Encourage colleagues and co-workers to act in accord with this Code and support them when they do so;
4. Seek, accept and offer honest criticism of work, and properly credit the contributions of others;
5. Support and participate in the activities of their professional societies;
6. Assist colleagues and co-workers in their professional development.
ARTICLE III

Engineers shall, in their relations with employers and clients:

1. Act as faithful agents or trustees for their employers or clients in professional and business matters, provided such actions conform with other parts of this Code;

2. Keep information on the business affairs or technical process of an employer or client in confidence while employed, and later, until such information is properly released, provided such actions conform with other parts of this Code;

3. Inform their employers, clients, professional societies or public agencies or private agencies of which they are members or to which they may make presentations, of any circumstance that could lead to a conflict of interest;
4. Neither give nor accept, directly or indirectly, any gift, payment or service of more than nominal value to or from those having business relationships with their employers or clients;

5. Assist and advise their employers or clients in anticipating the possible consequences, direct and indirect, immediate or remote, of the projects, work or plans of which they have knowledge.
ARTICLE IV

Engineers shall, in fulfilling their responsibilities to the community:

1. Protect the safety, health and welfare of the public and speak out against abuses in these areas affecting the public interest;

2. Contribute professional advice, as appropriate, to civic, charitable or other non-profit organizations;

3. Seek to extend public knowledge and appreciation of the engineering profession and its achievements.
1. 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 their professional duties.

2. Engineers shall perform services only in areas of the competence.

3. Engineers shall issue public statements only in an objective and truthful manner.

4. Engineers shall act in professional matters for each employer or client as faithful agents or trustees, and shall avoid conflicts of interest.
5. Engineers shall build their professional reputation on the merit of their services and shall not compete unfairly with others.

6. Engineers shall act in such a manner as to uphold and enhance the honor, integrity, and dignity of the engineering profession and shall act with zero tolerance for bribery, fraud, and corruption.

7. Engineers shall continue their professional development throughout their careers, and shall provide opportunities for the professional development of those engineers under their supervision.
INSTITUTION OF ENGINEERS (INDIA)
CODE OF ETHICS

1. A Corporate Member shall utilise his knowledge and expertise for the welfare, health and safety of the community without any discrimination for sectional or private interests.

2. A Corporate Member 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. A Corporate Member shall act only in the domains of his competence and with diligence, care, sincerity and honesty.

4. A Corporate Member 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. A Corporate Member shall not falsify or misrepresent his own or his associates' qualifications, experience, etc.
6. A Corporate Member, 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. A Corporate Member shall maintain utmost honesty and fairness in making statements or giving witness and shall do so on the basis of adequate knowledge.

8. A Corporate Member shall not directly or indirectly injure the professional reputation of another member.

9. A Corporate Member shall reject any kind of offer that may involve unfair practice or may cause avoidable damage to the ecosystem.
10. A Corporate Member shall be concerned about and shall act in the best of his abilities for maintenance of sustainability of the process of development.

11. A Corporate Member 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.
IIMM (Indian Institute of Materials Management)

CODE OF ETHICS

The code of Ethics to be observed by member of IIMM is given as under:

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, to denounce all forms and manifestations of commercial bribery and to eschew anti-social practices.
4. To accord a prompt and courteous reception, so far as conditions will permit, to all who call upon a legitimate business mission.

5. To respect one’s obligations and those of one’s organization consistent with good business practice.