Engineering Ethics*

What is engineering ethics?

(1) the study of moral issues and decisions confronting individuals and organizations involved in engineering.

(2) the study of related questions about moral conduct, character and relationships of peoples and organizations involved in technological development.

*Adapted from material provided by Abouzar Dastmalchi and the National Society of Professional Engineers

What are the purposes for Code of Ethics for Engineers?

• Provide positive stimulus for ethical conduct
• Helpful advice concerning the primary obligation of “engineers”
• Guideposts in interpreting ethical dilemmas

Code of Ethics that Apply to Computer Engineers?

• IEEE Code of Ethics
• IEEE-CS/ACM Software Engineering Code of Ethics and Professional Practice
• National Society of Professional Engineers Code of Ethics
Preamble NSPE Code of Ethics

• Engineering is an important and learned profession.
• Engineers are expected to exhibit the highest standards of honesty and integrity.
• The services provided by engineers require honesty, fairness and equity, and must be dedicated to the protection of the public health, safety, and welfare.
• Engineers must perform under a standard of professional behavior that requires adherence to the highest principles of ethical conduct

General Rules

1. Hold paramount the safety and welfare of the public.
2. Perform services only in areas of their competence.
3. Issue public statements only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves ethically, and lawfully so as to enhance the honor and usefulness of the profession.
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 the 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 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 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 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.
Rules of Practice

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 opinions 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, unless they have prefaced their comments by explicitly identifying the interested parties on whose behalf they are speaking, and by revealing the existence of any interest the engineers may have in the matters.

Rules of Practice

4. Engineers shall act 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, 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 in connection with the work for which they are responsible.
   d. Engineers in public service as members or employees of a 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 accept a contract from a governmental body on which a principal or officer of their organization serves as a member.
Rules of Practice

5. Engineers shall avoid deceptive acts.
   a. Engineers shall not falsify their qualifications or permit misrepresentation of their or their associates' 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, or past accomplishments.
   b. Engineers shall not offer, 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 influencing 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.

Professional Obligations

1. Engineers shall be guided in all their relations by the highest standards of honesty and integrity.

2. Engineers shall at all times strive to serve the public interest.

3. Engineers shall avoid all conduct or practice that deceives the public.

4. Engineers shall not disclose, without consent, confidential information concerning the business affairs or technical processes of any present or former employer on which they serve.

5. Engineers shall not be influenced in their professional duties by conflicting interests.
Professional Obligations

6. Engineers shall not attempt to obtain employment or advancement by untruthfully criticizing other engineers.

7. Engineers shall not attempt to injure or falsely the professional reputation of other engineers. Engineers who believe others are guilty of unethical shall present such information to the proper authority for action.

8. Engineers shall accept personal responsibility for their professional activities, provided, however, that 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.

9. Engineers shall give credit for engineering work to those to whom credit is due, and will recognize the proprietary interests of others.

The Engineering Design Process*

The "Engineering Design Process" is a general outline of steps that aid in the development, construction and/or manufacture of a targeted product

In Computer Engineering it is a detailed developmental process, that often involves the careful creation of both hardware and software based entities that must interact with the outside world using mechanical sensors and actuators.

*Adapted from material provided by Joshua Davidson and J. Jow.
Stages for a Design

- Requirements Definition
- Conceptual Design
- Detailed Design
- Fabrication and Assembly
- Testing
- Final Product Support

Requirement Definitions

Four Main Areas in CPE

- Functional
- Electrical Interfaces
- Physical Interfaces
- Environmental

Note: Few engineering problems are sharply defined with clearly specified requirements; instead, much of engineers' effort is devoted to the identification of the problem in broad terms. This is one of the most important parts of the design process which requires good communication between the Engineers and the customer.
Conceptional Design

How is the system going to operate, i.e. what function is it to perform?

Examples:
- How are the power supplies going to be used?
- Are there going to be switches or status displays?
- How is the data going to be read and processed?

Environmental Considerations

Deals with the environmental aspects.

Examples:
- Is it going to be operating inside or outside?
- Is it only going to be operated on sunny or rainy days?
- What temperature are we operating at?
- Does it need to be on a stable surface?
- What level of vibration will the device tolerate?
Safety Considerations

- Is it likely that over the lifetime of the product will it be come unsafe to humans, animal life or the environment?
- How can this product be misused that would result in it becoming unsafe?
- What level of confidence do we have that the product is safe and how do we verify that our level of confidence is justified?

Cost Considerations

- What is our budget?
- How quick to we need to get our product to market?
- What quantity of the product are we planning to produce?
Interfaces

How is the system to be controlled and what are the interface standards that we are to be used between subsystems?

Examples:
Voltage & Current levels, Packet formats, Logic Family to be employed, analog conditioning methods employed, etc.

Detailed Design

Low Level System Design?

Examples:
- Schematic Capture Hardware Description Language captured designs?
- Object oriented or functional software development
- Low level system driver development
**Fabrication and Assembly**

- PC Board Creation, Component Placement, Soldering
- ASIC Fabrication
- Machine Shop work
- Silk screen
- Painting
- Mounting
- Prototype creation (possibly rapid prototyping using FPGAs)

**Testing**

- **Acceptance Tests**
  Test each requirement of the system during the product development phase.

- **End Tests**
  Performed with customer present and if possible at the destination the system is going to be residing at.

- **Manufacturing Tests**
  Continuously performed during production to insure that manufacturing flaws are not present.
Product Support Stage

- Involves continuous manufacturing test and verification

- Possible redesign and retrofit of failed or improperly designed components may be required throughout the life cycle of the product