# Engineering Ethics

# Overview

Ethics?

- The characteristics of morals
- Moral choices made by each person in his/her relationships with other people

# Ethics Defined As:

1. Branch of Philosophy that deals with the general nature of good and bad and the specific moral obligations of and choices to be made by the individual in his/her relationship to others.
2. Rules or standards governing conduct, especially those of a profession.

# Types of Ethics

- Rule-based ethics
- Conditional rule-based ethics
- Utilitarian Ethics
  - Bring the highest good for all, relative to all other decisions.
- Situational Ethics
  - Based on whether it produces the highest good for the person (frowned upon in general).

# Engineering Ethics

The rules and standards which govern the conduct of engineers in their role as professionals

Engineering ethics apply to the specific issues which affect engineering professionals

ABET (Accreditation Board for Engineering and Technology) mandates ethics be included in the engineering curriculum

# IEEE Code of Ethics

- https://www.ieee.org/about/corporate/governance/p7-8.html

# Four ciples

Character

Truthfulness

Manners

Being Honest with Yourself

Behavior

Charity

A Higher

Integrity

Honesty

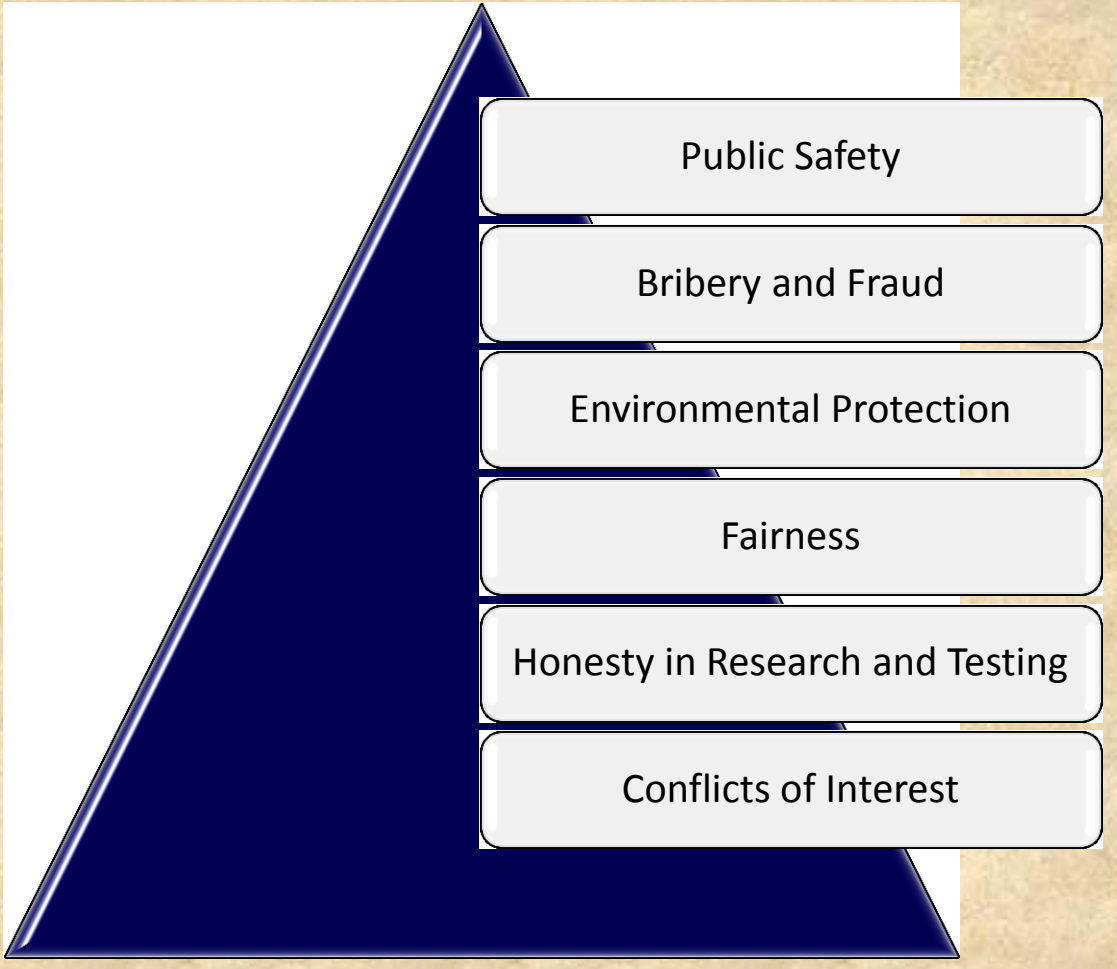
Sympathy

Golden Rule

Caring for others

Love

# Ethical Issues



# Study of Ethics

Helps engineers develop a moral autonomy

- Think critically and independently
- Apply this moral thinking to situations that arise
- Often complex and involve conflicting ethical principles

Must be able to intelligently resolve these conflicts and reach a defensible decision

# Personal vs. Business

## Personal Ethics

- Treatment of others in day-to-day lives

## Business/Professional Ethics

- Relationships between organizations, governments, and groups of individuals
- The complexity of these relationships often pose dilemmas not encountered in personal ethics

# “The Law” and Ethics

Engineering , engineers, and businesses are governed by laws

Legal acts are not always ethical

Ethical acts are not always legal

# Negligence

- The manufacturer had a duty to follow reasonable standards and rules.
- There was a breach of duty (i.e., failure to include safety devices).
- The plaintiff was harmed.
- The breach caused the harm.

# Strict Liability

- The product was dangerous and/or defective.
- The defect existed when it left the manufacturer's control.
- The defect caused harm.
- The harm is assignable to the defect.

# Ethical Dilemmas

- Need to be able to read between the lines when asked to do something that doesn't quite sound 'above-board'.

# Natural Complexity of Ethics

**Problems are often open-ended**

- No unique correct solution
- Range of possible solutions

**Good solution requires**

- Analytical skills
- Large body of knowledge

# Example - Calculator

- 17 significant digits calculator
- Uses look-up tables to accelerate calculations
- Betas shipped to customers
- Discovered problem with incorrect entries in the look-up table (5000 chips manufactured)
- Identified by the beta testing
- Error occurs between $13^{th}$ and $17^{th}$ significant digits
- Subtle pressure from management to release

# Example Cont.

- Gather Info
  - Standard precision is typically 10 to 12 significant digits
  - Beyond is considered high-precision
  - 17 significant digits implies specialized application for engineers and scientists

# Example Cont.

- Identify Stakeholders
  - Users of the calculator
  - Public (errors could affect safety of public)
  - Company and employees (monetary harm)

# Example Cont.

- Relevant Ethical Values
  - Release of calculator has potential to endanger the safety of the public (1).
  - Need to be honest in stating claims of calculator precision (3).
  - Potential to injure the reputation of the company and its employees (9).
  - Risk of negligence claims due to the defect being identified prior to the release of the product.

# Example Cont.

- Choices
  - Release the product (potential to harm and truth in advertising)
    - Liability risk and potentially illegal
  - Use chips in a calculator with lower precision if possible (depends on product lines, etc.)
  - Throw away defective chips (take the loss) and verify new inventory works properly
- This should have been caught with proper testing prior to mass production.

# Dilemma of Engineering Ethics

The formal training period shorter for engineers (no post-graduate requirements)

Most engineers are employed, but not licensed

Other professions, such as physicians and lawyers must be licensed by the state before they may practice their profession

License is only required to practice engineering independently

# Gifts vs. Bribes

When is a gift no longer a gift?

Bribery: Something offered or given to someone to induce him/her to act dishonestly

Appropriate vs. Inappropriate Gifts

Refer to written company policy and ethical codes for direction

# Production of Safe Designs

- Comply with applicable laws
- Good Engineering Design
- Explore potentially safer alternative designs
- Anticipate potential misuses or failure of the product (Risk Analysis)

# Professional Rights

- Right to privacy
- Right to participate in activities of one's own choosing outside of work
- Right to reasonably object to company's policies without fear of retribution
- Right to due process
- Right to not participate in activities which he/she considers to be unethical