2021 Renewal - ETHICS FOR PROFESSIONAL ENGINEERS

Florida Board of Professional Engineers
Approved Course No. 0010224

1 PDH Hour

This course is divided into 3 Major Areas

- Area 1 — Professional Ethics
- Area 2 — Engineers in an Organization
- APPENDIX — National Society of Professional Engineers Code of Ethics for Engineers

A test is provided to assess your comprehension of the course material – 12 questions have been chosen from each of the above sections. You will need to answer at least 9 out of 12 questions correctly (>70%) in order to pass the overall course. You can review the course material and re-take the test if needed.

You are required to review each section of the course in its entirety. Because this course information is part of your Professional Licensure requirements it is important that your knowledge of the course contents and your ability to pass the test is based on your individual efforts.

Course Description:

This course is intended to familiarize Florida Professional Engineers with how understanding Ethics in the practice of Engineering is important. This course will consider Ethics in the responsibility of the Engineering profession as compared to an individual's Ethics. Case studies will be reviewed with discussion specific to real cases involving Engineers. In conclusion, the National Society of Professional Engineers Code of Ethics for Engineers in included for reference.

How to reach Us …

If you have any questions regarding this course or any of the content contained herein you are encouraged to contact us at Easy-PDH.com. Our normal business hours are Monday through Friday, 10:00 AM to 4:00 PM; any inquiries will be answered within 2 days or less. Contact us by:

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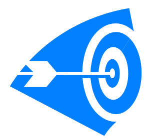
Refer to Course No. 0010224,
2021 Renewal - ETHICS FOR PROFESSIONAL ENGINEERS

Here's How the Course Works…

What do you want To do?	LOOK For This!
Search for Test Questions and the relevant review section	 Q1 Search the PDF for: Q1 for Question 1, Q2 for Question 2, Q3 for Question 3, Etc… (Look for the icon on the left to keep you ON Target!)

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12 TEST QUESTIONS

Q1: Which individual presented the ethical theory that promotes the benefit of the greatest good:
(A) John Locke
(B) Aristotle
(C) Immanual Kant
(D) John Stuart Mill

Q2: An Engineers professional decisions can impact:

(A) public health and safety
(B) business practices
(C) politics
(D) All of the above

Q3: Who was the contractor that faced Ethical Dilemmas regarding engineering issues and reporting them in the Space Shuttle Explosion in 1986.

(A) Morton Thiokol
(B) Boeing
(C) Raytheon
(D) Honeywell

Q4: Which definition best describes a Moral Dilemma:

(A) A conflict in a person to choose between two or more persons rights
(B) A conflict in a person to choose a moral wrong that he or she knows is wrong
(C) A conflict in a person to choose between two or more actions and the person has moral reasons for choosing each action
(D) A conflict in a person to choose between two or more actions where a choice has to be made between two or more persons rights

Q5: An Engineer fabricates some of the data presented in a Pilot Testing program because he believed his client would stop the program otherwise. This is what type of moral dilemma:
(A) Principle of Informed Consent
(B) Data Integrity and Proper Representation
(C) Conflict of Interest
(D) Accountability to Clients and Customers

Q6: Brainstorm ideas and Enumerating the outcomes of various decisions best describes which STEP in facing Moral Dilemmas in Engineering:

(A) Step 1 - Identify the Problem
(B) Step 2 - Identify the Potential Issues Involved
(C) Step 3 - Evaluate Potential Courses of Action
(D) Step 4 - Obtain Consultation

Q7: In Case 3, what could have management done that would have resolved the Ethical Dilemma:

(A) contact the customer and request an extension of the delivery date
(B) work overtime to ship the machines on time as agreed
(C) complete the work, even if delivery was late, and pay the contract damages
(D) All of the Above

Q8: In which type of organization is information most openly shared between Managers and Engineers:

(A) Engineer-Oriented Companies
(B) Customer-Oriented Companies
(C) Finance-Oriented Companies
(D) A and B

Q9: All of the following are components of an acceptable Engineering Code of Ethics EXCEPT:

(A) Written Pledge of Ethics
(B) Fundamental Canons
(C) Rules of Practice
(D) Professional Obligations

Q10: Which Engineering Society has developed a Code of Ethics that applies to ALL Engineering Disciplines:

(A) American Society of Mechanical Engineers
(B) American Engineering Society
(C) National Society of Professional Engineers
(D) National Society of Engineering Professionals

Q11: NPSEs Code of Ethics includes a Fundamental Canon, similar to Responsibility Rules as promulgated by the FBPE, that Engineers only perform services:

(A) as the delegated engineer
(B) where they will not be considered negligent
(C) as the responsible engineer
(D) only in areas of their competence

Q12: In following the NSPE Professional Obligations an Engineers shall give credit for engineering work to those to whom credit is due. Which is an example of following this Professional Obligation:

(A) Naming of a fellow engineer who is responsible for a particular design element
(B) decision not to duplicate a client design without written permission
(C) continuing professional development throughout your career
(D) all of the above

END OF TEST QUESTIONS

Ethical Theories and History

Engineering is a Profession …

1. Satisfies an indispensable social need
2. Requires trust, discretion, judgment
3. Applies knowledge and skill not possessed by the public
4. Promotes professional ideas
5. Has standards of admission
6. Employs a code of ethics, ensuring appropriate conduct and competence

… With Roots of Ethics in Philosophy

Q1

Aristotle (384-322 BCE)

Aristotle proposed the "Golden Mean ethical theory" where the solution to a problem is found by analyzing the reason and the logic. And such an analysis, "Mean value of solution" can be found which is between the extremes of excess and deficiency. The goal is to reach a proper balance between extremes in conduct, emotion, desire and attitude to find a golden mean between the extremes of too much (excess) and too little (deficiency).

Example: a possible solution to the problem of environmental pollution is neither (1) decreasing industrialization and civilization or (2) neglect the environment completely – rather a "mean" solution that would be to work towards controlling the pollution generated by industrialization.

Problem: application of the "Golden Mean ethical theory" will vary from one person to another based on their individual powers of reasoning

Aristotle's view of Ethics:

- Character and virtue were most important
- Focused on the moral character of the individual
- Defined proper function of individuals
- Act virtuously over time in all aspects of life
- Development of moral character will prepare the individual for ethical challenges

For Engineers: Devotion to high ideals of honor and professional integrity (Moral Character)

Immanuel Kant (1724-1804)

Immanual Kant proposed a duty-based ethical where every person has a duty to follow which is accepted universally, with no exceptions. Kant observed that everyone is bound to follow some moral laws and though we have a chance to do anything, it is the choice we make to be morally sound. Four virtues fall under Kant's ethics:

(1) Prudence: every individual has a life that should be respected and every individual has duties which should be done without any exception
(2) Temperance: this is the voluntary self-restraint from temptations that might lead to the violation of duties and ethics - No false promises can be made that contradict the principles of duties
(3) Fortitude: the basic sense of having tolerance
(4) Justice: Every individual is a human being with a set of intrinsic values and morals - truth and fairness should always be kept in mind

An example of Kant's duty based ethics is expecting all people to be honest, kind, generous and peaceful

Problem: how can universal application of ethics based on people being honest, kind, generous and peaceful be expected

Kant's view of Ethics:

- Duty and ethics – do not be concerned with one's character
- Duty to act ethically - Follow one's conscience and no other inclinations
- Duties are absolute and unconditional - Tell the truth
- Treat others with respect

For Engineers: Duty to the public welfare is paramount (Duty)

John Stuart Mill (1806-1873)

John Stuart Mill proposed an ethical theory called Utilitarian ethics where the happiness or pleasure of a greatest number of people in the society is considered as the greatest good. According to Mill, an action could be considered morally "right" if its consequences lead to happiness of people and wrong if they lead to their unhappiness.

An example of Utilitarianism would be consideration of the cost-benefit analysis in engineering. In a typical cost-benefit analysis, the good and bad consequences of some action or policy are identified in terms of a monetary aspect. The total good is weighed against the total bad and then compared with the results to similar tallies of the consequences of alternative actions or rules. This evaluation supports the idea of maximizing total benefits against total costs.

Mills' view of Ethics:

- Utilitarianism
- Actions are ethical if they promote maximum happiness – the focus is on the consequences of decisions
- There is little concern about the means to achieve maximum happiness – the end justifies the means
- Principles, duties, character of the decision maker do not apply

For Engineers: Provide fairness to associates, employers, clients, subordinates, and employees (consequences of decisions)

Merging these typical Ethical Theories an engineer is better prepared to (1) understand Moral Dilemmas, (2) justify professional obligations and ideas, and (3) relate ordinary morality to professional morality. This becomes the basis for Ethical Decision Making:

Step 1: Identify the ethical issue(s)

Step 2: Identify he relevant stakeholders

Step 3: Interpret the facts

Step 4: Evaluate the information

Step 5: Set realistic objectives

Step 6: Identify options for meeting your objectives

Step 7: Evaluate your options

Step 8: Justify your decision

Ethics for Professional Engineers

Ethics Definition: moral principles that govern a person's or group's behavior

Consider an article originally appearing in the trade journal "Issues in Ethics" IIE V1 N1 (Fall 1987): Sociologist Raymond Baumhart asked a group of business people, "What does ethics mean to you?" Among their replies were the following:

"Ethics has to do with what my feelings tell me is right or wrong."
"Ethics has to do with my religious beliefs."
"Being ethical is doing what the law requires."
"Ethics consists of the standards of behavior our society accepts."

Let's examine each response for discussion:

"Ethics has to do with what my feelings tell me is right or wrong."

Many tend to equate ethics with feelings. But being ethical is not a matter of following one's feelings, in fact, a person following his or her feelings may absolutely refuse to do what is right or correct.

"Ethics has to do with my religious beliefs."

While most religions advocate some form of high ethical standard, ethics is not confined to religion nor is it the same as religion.

"Being ethical is doing what the law requires."

Being ethical is not the same as following the rules of law. Specifically, while laws often incorporate ethical standards, laws can absolutely deviate from ethical. Consider segregation laws in the 1960's?

"Ethics consists of the standards of behavior our society accepts."

In society, most people accept the current standards of the society as in fact to be ethical. But in reality an entire society can become ethically corrupt. Nazi Germany in World War II – this is a good example of a morally corrupt society, ethically corrupt society as a whole.

So then, What exactly is Ethics? Ethics is three things:

1. Ethics refers to well-founded standards of right and wrong that prescribe what we "ought to do" in terms of rights, obligations, benefits to society and fairness.
2. Ethics deals with the moral choices that are made by each person in his or her relationship with other people.
3. Ethics includes standards relating to rights of all people, such as the right to life, the right to freedom from injury, and the right to privacy.

Section 1: ETHICS IN ENGINEERING vs INDIVIDUAL'S ETHICS?

Q2

In the professional workplace of engineering, engineers face a range of situations daily from Ethical Issues, to Questionable Engineering Practices, to flat out Clearly Wrong Engineering practices. Following are examples in each category:

Ethical Issues	Questionable Engineering Practices	Clearly Wrong Engineering Practices
- Public Safety - Bribery and Fraud - Environmental Protection - Fairness - Honesty in Research/Testing - Conflicts of Interest	- Forging – " inventing some or all of the research data - Conflicts of interest (such as accepting gifts) - Actual gifts, potential, or even apparent	- Lying - Deliberate deception - Withholding information - Failure to seek out the truth - Revealing confidential or proprietary information

But when we focus on Engineering Ethics versus an Individual's Ethics an Engineer can prevent grave consequences to the public good due to faulty ethical reasoning and to provide meaning to engineers' endeavors. By studying Engineering Ethics we can:

- Increase awareness of the importance of ethics and make Engineers aware of the moral implications of their professional decisions in the workplace
- Reinforce that an Engineers professional decisions can impact public health, safety, business practices and even politics
- Improve an Engineer's Ability to think critically and independently about moral issues
- Help Engineers apply moral thinking to situations that arise in the course of professional engineering practice

This in turn leads Engineers to desirable outcomes such as:

- Increased Ethical Sensitivity
- Increased knowledge of relevant standards of conduct
- Improved Ethical judgment
- improved Ethical will-power (i.e., a greater ability to act ethically when one wants to)

Section 2: <u>ETHICS IN ENGINEERING</u>

But in the course of the practice of engineering an engineer solves problems. And as we all know there are no perfect solutions and any implemented solution sometimes creates a new problem. This new problem may be small, i.e. an engineer develops a software algorithm that meets your client's expectations but requires so much memory that your computer needs a hardware upgrade. Or the new problem could be large, a programming choice to save program memory by omitting the first two digits of the year during the 1900s. These actions lead to the Y2K scare at the end of 1999.

As we practice engineering, our decisions are generally guided by the project management principles of cost, quality, and schedule. As we all know, change one of these variables, the others will also be changed. But as engineers and people, our decisions are also guided by our moral values and our concern and respect for others. Engineers are also influenced by local, state, and federal laws.

And concerns for Ethics in Engineering and Professional Practice are very well highlighted when some highly public event occurs such as a bridge failure, some engineering disaster happens, or even worse yet when human lives are lost. But most engineering failures are much more involved than simple technical miscalculations and involve the failure of the design process or even an overall management culture. Consider a very high profile event in 1986:

1986: Challenger Space Shuttle Explosion

Q3

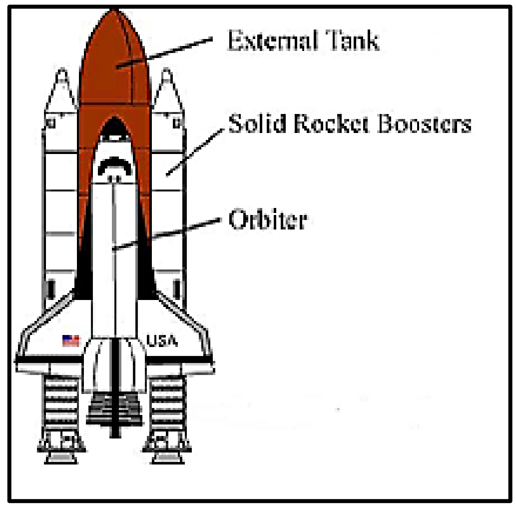
The New York Times Abstract:

> ***Cape Canaveral, FL, January 28—The space shuttle Challenger exploded in a ball of fire shortly after it left the launching pad today, and all seven astronauts on board were lost.***

BACKGROUND:

Space Shuttle Design:

The concept of a completely reusable space shuttle was first discussed in the 1960s before the Apollo lunar landing spacecraft had flown. Over time the National Aeronautics and Space Administration (NASA) developed the concept of a reusable orbiter with an expendable external fuel tank carrying liquid propellants for the orbiters' engines and two recoverable solid rocket boosters. The reusable orbiter was called the Space Shuttle.



The Space Shuttle's two solid-propellant rocket boosters and the external fuel tank were attached to the orbiter. They rocket boosters provided most of the total thrust at liftoff with the rest coming from the orbiters' three main engines. Just after liftoff when the solid rockets have exhausted their fuel, explosives separate the boosters from the external tank. The solid rocket boosters were made up of several subassemblies that were joined together in sections with key joints. Joint sealing was provided by rubber O-rings, which were installed during motor assembly.

O-ring design and degradation issues were well known to NASA and the contractor Morton Thiokol and it was understood that failure of the O-rings could lead to blow-by of combustion gases and failure of the solid rocket boosters and possible loss of life or the vehicle.

The Accident:

During the flight lift off on January 28, 1986, cold weather had reduced O-ring resiliency on one of the rocket boosters causing a gas leak at a key joint. Leaking hydrogen from the rocket booster ignited and exploded engulfing the shuttle in flames. All of the astronauts on board the orbiter were killed.

AFTERMATH:

In the aftermath of the disaster, President Ronald Reagan appointed an independent commission to investigate the accident. The mandate of the investigation was to determine the probable causes of the accident and to develop recommendations for corrective action. The commission concluded that neither Morton Thiokol nor NASA responded adequately to internal warnings about the faulty seal design. Some specific conclusions included:

1. The joint test and certification program was inadequate.
2. NASA and Thiokol accepted escalating risk apparently because they "got away with it last time".
3. NASA's system for tracking Flight Readiness failed in that, despite the history of O-ring issues, the flight was still permitted.
4. Analysis of flight history and O-ring performance would have revealed issues with the O-rings in low temperatures.

Some Recommendations from the Commission included:

1. The shuttle management structure should be reviewed and a new safety advisory panel established that reports directly to the program manager.
2. NASA should establish an Office of Safety, Reliability and Quality Assurance, reporting directly to the NASA Administrator that would have direct authority for safely, reliability, and quality assurance throughout the agency.
3. NASA should eliminate the tendency to "not communicate" at Marshall Space Flight Center through changes in personnel and the organization itself.

AN ENGINEERING ETHICS PERSPECTIVE:

- A Thiokol engineer, Roger Boisjoly, had previous knowledge of the cold temperature effects on O-ring resiliency and excessive blow-by combustion gases at the field joints
- Roger Boisjoly was part of an O-ring investigation task force formed in August 1985 (prior to the accident)
- The night before the ill-fated launch, there was a scheduled teleconference to discuss Thiokol's concern about low temperatures expected during the launch the next day. Boisjoly presented his O-ring data and Thiokol management recommended that the launch be delayed until outside temperatures were higher
- NASA leadership was not happy with the decision to delay the launch

- A private meeting was later held between NASA and Thiokol and Thiokol later stated that although temperature effects were a concern, the data was inconclusive, so a launch was recommended.

What do you think - Did Boisjoly act Ethically?

Boisjoly later testified at the shuttle presidential commission that after the accident he experienced a hostile work environment at Thiokol. In 1988, Boisjoly received the American Association for the Advancement of Science's Scientific Freedom and Responsibility award "for his exemplary and repeated efforts to fulfill his professional responsibilities as an engineer by alerting others to life-threatening design problems of the Challenger space shuttle and for steadfastly recommending against the tragic launch of January 1986" (AAAS. 2005).

Section 3: MORAL DILEMMAS

Q4

For many Americans, they vividly remember what they were doing when they first heard about the Challenger Explosion. They remember where they were. But while not all events are as public and even known, everyday Engineers face similar types of ethical challenges as Boisjoly. These are called Moral Dilemmas.

A **moral dilemma** is a conflict in a person has to choose between two or more actions and the person has moral reasons for choosing each action. A situation in which, whatever choice is made, a person commits a moral wrong. Either:

Do Something Morally Right	→	Bad Outcome
Do Something Morally Wrong	→	Good or Better Outcome

Here are some of the types of ethical dilemmas engineers specifically encounter at work or our profession.

- **PUBLIC SAFETY AND WELFARE**

  Q5

  Engineering projects may directly impact public safety and as such Engineers are obliged to inform their supervisors of project risks so that these risks can be communicated to the public.

- **DATA INTEGRITY AND PROPER REPRESENTATION**

  Engineering analysis always starts with careful acquisition of engineering data and any misrepresentation of this data or data analysis could disrupt a project. Misrepresentation of data could take the form of fabrication (inventing data or results), falsification (manipulation of data or results), or plagiarism (appropriation of another's results without proper credit).

- **TRADE SECRETS AND INDUSTRIAL ESPIONAGE**

  An engineer or employee who discloses trade secrets, even after leaving for another employer, could be committing Industrial espionage by publicizing such trade secretes without consent

- **GIFT GIVING AND BRIBERY**

  Accepting a gift from a vendor or offering a gift to a customer to secure business has the potential to be perceived as a bribe. Engineers and employees should follow company policies in accepting or giving gifts. In any case, any conflict of interest or appearance of impropriety should be avoided.

- **PRINCIPLE OF INFORMED CONSENT**

  Informed consent refers to the right of each individual potentially affected by a project or outcome of a project to participate to some degree in the decision making concerning that project. Example: workers should be informed of the hazards that they are exposed to in their workplace.

- **CONFLICT OF INTEREST**

  Conflict of interest refers to the potential to distort good judgment while serving more than one employer or client. When this potential exists, an engineer should openly admit to these relationships in order to prevent impropriety.

- **ACCOUNTABILITY TO CLIENTS AND CUSTOMERS**

  Notwithstanding an engineer's primary responsibility to protect public safely, the engineer should also responsibly perform tasks for the client or company.

- **FAIR TREATMENT**

  Engineers are entitled to a fair work environment where treatment is based on merit (nondiscrimination) and any form of harassment is not tolerated. Company policies should be outlined in an employee handbook.

Section 4: FACING MORAL DILEMMAS IN ENGINEERING

Moral dilemmas often test our character and our commitment to the greatest good for the greatest number of people. Sometimes moral dilemmas are simply complicated decisions that must be evaluated before choosing a course of action. And at times, moral dilemmas are simply choices we have to make which challenge our ability to makes fair and just choices.

Q6

STEPS TO RESOLVING AN MORAL DILEMMA

Step 1: Identify the Problem
Step 2: Identify the Potential Issues Involved
Step 3: Evaluate Potential Courses of Action
Step 4: Obtain Consultation
Step 5: Determine the Best Course of Action

Step 1: Identify the Problem
- Gather as much relevant information as possible
- Talk to all of the parties involved
- Clarify if the problem is legal, moral, ethical or a combination of these

Step 2: Identify the Potential Issues Involved
- List and describe the critical issues
- Evaluate the rights, responsibilities and welfare of those affected by the decision
- Consider basic moral principles of autonomy, beneficence, non-maleficence and justice
- Identify any competing principles
- Ascertain the potential dangers to the individuals, public

Step 3: Evaluate Potential Courses of Action
- Brainstorm ideas
- Enumerate the outcomes of various decisions
- Consider the consequences of inaction

Step 4: Obtain Consultation

- Check with Colleagues or a supervisor to add an outside perspective.
- You must be able to justify a course of action based on sound reasoning which you can test out in consultation with others

Step 5: Determine the Best Course of Action

- Map out the best way to resolve the problem
- Consider if anyone should know about the problem

Section 5: INDIVIDUAL CASES OF MORAL DILEMMAS

Case 1: Electrical Engineer

Dilemma(s): Data Integrity and Proper Representation; Accountability to Clients and Customers

Description: An Electrical Engineer working for a large computer company found a bug in computer code used in some calculations that resulted in rounding errors in the calculations. By the time bug was found a large number of the computers had been shipped (about 25,000). A patch was eventually created but by this time a total of 100,000 computers had been shipped. Sales projections called for well over 1,000,000 computers of this type could be sold.
A meeting was held with management, sales, and engineering. The choices were let the existing customers know of the problem and offer a replacement or do nothing and not let the existing customers know at all.

Management made the final decision to be upfront with their customers who had already purchased the computers. A letter was sent to the customers describing the problem and to let them know that a solution was available. In the end only a small fraction of the customers requested the replacement.

In this case management did the "right" thing, but the outcome could have been different with no communication to the customers.

Case 2: Engineering Manager

Dilemma(s): Fair Treatment

Description: An Engineering Manager was asked to select an individual engineer in his group to be laid off as the company workload had recently dropped. The Engineering Manager was advised by Senior Management to pick the person that would be least needed for specific projects that were planned for the next 2 years. Based on this criteria the Engineering Manager had two choices (1) a young engineer or (2) a foreign engineer who was in the country on an H1B Visa.

The Engineering Manager rationalized that the younger engineer could probably get a job more easily while the H1B Visa engineer would be forced to return to his home country where he may not be able to work. HR provided additional guidance that because H1B Visas are issued to foreign workers whose specialized skills cannot be found among U.S. workers, it would be illegal to layoff an American worker over a foreign worker.

The Engineering Manager felt sympathy for the foreign engineer but made the choice to lay him off.

In this case the Engineering Manager had to set aside sympathy and follow the law and make the "right" choice based on company needs.

Q7

Case 3: **Mechanical Engineer**
Dilemma(s): Accountability to Clients and Customers

Description: A Mechanical Engineering working for a machine design company noticed several palletized crates were sitting inside the warehouse that had not been opened for nearly 4 months. Inside the pallets were machines that had been sent to the factory for upgrades. Because of other higher customer priorities these machines were not upgraded and as such the upgrades would take several months (a month beyond the customer's deadline). With only two months left on the service contract, Management made the decision to send the machines back to the customer as-is rather than make the upgrades and be forced to make penalty payments for being late.

In this case the Management favored one set of customers over another and was not accountable to the needs of all of its customers.

Case 4: **Engineer**

Dilemma(s): Trade Secrets and Industrial Espionage

Description: An Engineer applied for, and was offered, jobs at two separate competing companies (Company A and Company B). In the interview with Company A the Engineer was made aware of a new upgrade to Company A's product line that would surely help take market share from Company B.

The Engineer eventually accepted a job with Company B.

Later while working at Company B, it became known that Company A was launching it's new improved product and there was a lot of discussion within Company A as to what the source of the new improvement was.

Next, the Engineer went into the VP of Engineering to explain how he knew what the upgrade was and while the Engineer had not signed a non-disclosure agreement with Company A, he did not feel it was ethical to divulge Company A's secret. The VP agreed and no one pressured the Engineer to divulge the secret.

In this case the Engineer held the ethical position of not divulging another's trade secrets and the management of Company acknowledged the position by not pressuring the Engineer.

Section 6: <u>ENGINEERING WITHIN AN ORGANIZATION</u>

Q8

Conflicts between employees, including engineers, and managers often occur in the workplace and sometimes it seems like it is difficult for an employee to preserve his integrity in the workplace and even maintain his/her career path. But in order to preserve your career and your integrity, engineers should educate themselves in the ''culture'' of their organization and also adopt some common-sense techniques for minimizing the threats to their careers when making a legitimate protest.

Organizational Culture:

It generally understood that an organization's culture:

(1) Is set at the top of an organization (by high-level managers, the president or chief executive officer of the organization, by directors, and sometimes by owner's and partners)

(2) Can powerfully influence the decisions of members of the organization - i.e. if the organization values success and productivity over integrity and ethical principles

Three Types of Organizational Cultures an Engineer may face:

- Engineer-Oriented Companies

  In this type of firm, generally quality takes priority over other considerations (except safety). Engineers often have a relationship with their managers where negotiation and arriving at consensus was prominent. In this firm, engineers are rarely over-ruled on significant engineering issues and Managers in such companies typically would not withhold information from engineers (although engineers may be suspected to sometimes withhold information in order to cover up a mistake)

- Customer-Oriented Companies

  In this type of firm, decision making is similar to that of engineer-oriented firms with the exception:
  (1) Managers think of engineers as advocates of a point of view different from their own – managers consider factors such as timing and cost, engineers should focus on quality and safety.
  (2) More emphasis is placed on business considerations
  (3) Safety still outranks quality but sometimes quality may be sacrificed to get product out the door
  (4) Communication between engineers and managers may be somewhat more difficult than in engineer-oriented firms - Managers may be more concerned about engineers' withholding information (though consensus is highly valued)

- Finance-Oriented Companies

  In this type of firm, information is more centralized to upper management and this centralization of information has important consequences:
  (1) Engineers may receive less information for making decisions and consequently their decisions are given less weight by managers
  (2) Managers are less inclined to try to reach consensus, and engineers are seen as having a ''staff '' or advisory function

Acting Ethically Without Difficult Choices:

For engineers, acting in an ethical manner is generally easier in engineer-oriented and customer-oriented companies than in finance-oriented companies. In the first two firms, more respect is given to the engineers' values, especially safety and quality. Communication is better, and there is more emphasis on arriving at decisions by consensus rather than by the authority of the managers. But regardless of the organization in which you find yourself, here are suggestions that engineers and employees should follow to act ethically:

- Be encouraged to report bad news
- Adopt a position of ‘‘critical’’ loyalty – give due regard to the interests of the employer but only insofar as this is possible within the constraints of your personal and professional ethics. You can honor the legitimate demands of the organization but also honor the obligation to protect the public
- When making criticisms and suggestions focus on issues rather than personalities
- Keep written records of suggestions and especially complaints
- Keep complaints confidential
- Utilize company provisions for seeking guidance from neutral participants outside of the organization
- Act as quickly as possible to avoid delays

Section 7: <u>ENGINEERING CODE OF ETHICS</u>

Q9

Now we see that Engineering Ethics can greatly affect the public or individually affect an engineer through a moral dilemma.

QUESTION: So how do we apply these basic premises of individual ethics and moral dilemmas to the complex questions of Ethics in Engineering where:

- Rules and Standards are available that govern the professional conduct of engineers
- Engineers face moral issues and decisions both as individuals and members of organizations that are engaged in the practice of engineering
- Engineers are acting in not just an individual capacity but in a professional capacity
- Engineers have social responsibility to not only themselves but their clients and to society as a whole
- Where Engineers must balance cost, schedule, and risk and the activities we lead

Where Engineers face typical Ethical Issues such as:

- Safety
- Levels of “Acceptable” Risk
- Compliance
- Confidentiality

- Environmental Health
- Data integrity
- Conflict of interest
- Honesty/Dishonesty
- Societal Impact, etc

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ANSWER: Apply the principles of individual Ethics to an Engineer's obligations to the public, their clients, employers and the profession and follow a professional code of conduct on moral issues by other Engineers. It can be said we need an Engineering Code of Ethics. An Engineering Code of Ethics has at least three components:

`1. **The Fundamental Canons:** a set of guidelines that articulate the basic components of ethical engineering
2. **The Rules of Practice:** rules that clarify and specify in detail the fundamental canons of ethics in engineering
3. **Professional Obligations:** an elaboration on the obligations specific to engineers

Q10

An Engineering Code of Ethics is not a new concept, in fact many American Engineering Professional societies have prepared original Codes of Ethics for their members dating back to the end of the 19th century. Example: American Society of Mechanical Engineers (1913); American Institute of Chemical Engineers (1913)

The National Society of Professional Engineers (NSPE) adopted its original Code of Ethics in 1946. And since NSPE is the only engineering society that represents engineers across all disciplines, the Code of Ethics (2019) is included in Appendix A as part of this course. The NSPE Code of Ethics is very comprehensive and details not only rules of practice for engineers but also professional obligations.

> NOTE: A good source for a composite collection of Ethic Codes for a number of professions, including historical revisions, can be found through the Illinois Institute of Technology Center for the Study of Ethics in the Professions: http://ethics.iit.edu/ecodes/ethics-area/10

References:

Engineering Ethics: An Industrial Perpective, Gail D Baura, 2006
Illinois Institute of Technology Center for the Study of Ethics in the Professions

Appendix A

National Society of Professional Engineers
Code of Ethics for Engineers (2019 Update)

Preamble

Engineering is an important and learned profession. As members of this profession, engineers are expected to exhibit the highest 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 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.

I. Fundamental Canons

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, 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 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 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 is 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 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 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.

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, 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 in connection with the work for which they are responsible.

d. Engineers in public service as members, advisors, 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 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, associates, joint venturers, 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 or intent of 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, except to a bona fide employee or bona fide established commercial or marketing agencies retained by them.

III. Professional Obligations

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1. ***Engineers shall be guided in all their relations 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 advise 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.
   f. Engineers shall treat all persons with dignity, respect, fairness, and without discrimination.

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

a. Engineers are encouraged 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 are encouraged to extend public knowledge and appreciation of engineering and its achievements.
d. Engineers are encouraged to adhere to the principles of sustainable development [1] in order to protect the environment for future generations.
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 courses, reading in the technical literature, and attending professional meetings and seminar.

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 the 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 others.

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 an 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 considerations, including free engineering designs, from material or equipment suppliers for specifying their product.

b. Engineers shall not accept commissions 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 or questionable methods.***
   a. Engineers shall not request, propose, or accept a commission on a contingent basis under circumstances in which their judgment 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 considerations.
   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 present 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 employ 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 of represented products with products of other suppliers.

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.***
   a. Engineers shall conform with state registration laws in the practice of engineering.
   b. Engineers shall not use association with a non-engineer, a corporation, or partnership as 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 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.

Footnote 1
"Sustainable development" is the challenge of meeting human needs for natural resources, industrial products, energy, food, transportation, shelter, and effective waste management while conserving and protecting environmental quality and the natural resource base essential for future development.

References:
NSPE Code of Ethics for Engineers
https://www.nspe.org/sites/default/files/resources/pdfs/Ethics/CodeofEthics/NSPECodeofEthicsforEngineers.pdf

END OF COURSE