PDH Academy

Ethics for Florida Professional Engineers

Course Material and Final Exam

<u>Ethics for Florida Professional Engineers</u>

Objectives of the Course:

1. Define Engineering Ethics.
2. Recognize the existence of professional codes of ethics, or professional value systems, to protect humans and the profession.
3. Identify professional responsibility, related limitations, and proactive responsible actions.
4. Analyze the concept of sustainable development and the relationship between engineering and the environment.
5. Review the source, and effect, of public concerns on technology advancement.

Concepts and Definitions

Engineering ethics can be defined as the set of common standards of conduct and professional dimensions shared by engineering professionals, with promoting responsible practice as one of its goals. Other goals include providing a framework for critical analysis and understanding the evolution of non-technical issues and contemporary topics affecting engineers and their profession. In addition, engineering ethics allows the integration between the technical side of engineering and the societal and human dimensions of the profession. This promotes the development of professional aspects like: societal impact assessment, technical and public education improvement, public informing and responsibility, citizenship, and stewardship.

<u>Code of Ethics</u>

Engineering ethics are usually documented in a written form known as the "Code of Ethics." Codes of ethics are provided by professional organizations as an agreed upon guide for its members, in matters related to their professional practice. However, a code of ethics is more than just a guide. It is actually an agreement between the public and the professionals to promote and protect public health and welfare which helps solidify public trust in the profession. A code of ethics also aims at advancing the profession by requiring continuous improvement and update of skills and knowledge by its members to stay competent in the profession. From a bigger picture, a code of ethics provides a medium for professionals to discuss and understand the evolution of the profession and its ethics as well as the reasoning for a professional to adhere to professional standards. These standards include both the technical and ethical sets.

Codes of ethics for engineers are available from most of the engineering professional organizations like: the American Society of Mechanical Engineers (ASME), the Institute for Electrical and Electronic Engineers (IEEE), the American Institute of Chemical Engineers (AIChE), and the National Society of Professional Engineers (NSPE). Some of these professional organizations, like the ASME and IEEE, have made their codes of ethics part of the professional society policies. Nevertheless, the one code of those which can be used by any engineer is provided by the NSPE.

A closer examination of these codes shows that all of them share similar fundamentals including the following:

1. A clear commitment to hold paramount the health and welfare of humans.
2. An obligation to protect the dignity and right of consent of human subjects.
3. An understanding of engineering endeavors as managing the unknown within a societal context resulting in risks and liability.
4. A profound acceptance of accountability for the results of engineering projects.
5. An obligation to protect and advance the engineering profession.

However, while sharing the same concepts, these codes from the different engineering organizations have different flavors and minor differences related to the engineering type they represent. For example: while both codes of ethics for civil engineers and computer engineers focus on health and welfare of the public as to be held paramount, the code for civil engineers would add a focus on sustainable development of resources, while the code of ethics for computer engineers would add a focus on data security and privacy issues. These codes can become very handy in the process of analyzing and understanding ethical dilemmas related to the profession. However, engineering codes of ethics should not be mistakenly used as a recipe substituting for sound judgment, or as a legal document constituting law.

Ethical does not necessarily constitute legal and vice versa. For example: If the Environmental Protection Agency (EPA) laws state that no contaminant should be disposed of in a natural lake with a concentration of more than 10 Parts Per Million (PPM), then disposing of the same contaminant at a concentration of 6 PPM might be legal, but is it completely ethical to do so? A clear cut answer to this question is not easy to find. In fact, to answer this question it might be necessary to find more facts and gather more information to understand the context of the problem. Once the facts have been streamlined, codes of ethics can be brought in to the discussion for reflection and testing of the findings, to help formulate the most ethical solution. Yet, this solution would most probably be a compromise, or a middle ground solution, that would use some ethical theory or concept in addition to the professional codes of ethics. As was mentioned before, engineering ethics do not stop at just doing the right thing when the right thing is obvious, but they go deeper and further in helping to resolve very complex ethical problems related to the professional practice of engineering in the context of society and humanity. Moreover, engineering ethics is not an ad hoc topic; the ethical context of an engineering project should be discussed from the beginning. In the following sections some fundamental ethical theories will be presented in a summarized format to help understand the basis for codes of ethics and ethics related decisions.

Applications

Concepts

A moral dilemma results from a situation where two or more ethical rulings or moral options are applicable but point in opposing directions. Complexity in these situations stems usually from three main sources:

1. Lack of facts: where information is scarce and details are missing to point at a particular ethical principle that could be applied to the situation.
2. Interpretation differences: where different persons disagree regarding the applicability and interpretation of ethical principles, especially in authority structured relationships.
3. Conflicting logic: where two or more ethical principles are applicable to the situation but point in opposing directions.

Therefore, when analyzing ethical problems to find a solution, a deep understanding of the issues and a great deal of investigation to find the facts is required. To arrive at this understanding, facts have to be collected aiming at finding the whole truth, or at least get as close as possible to the truth. Of course, not everyone will agree on the "truth," but further research helps clarify the situation. Following this step an attempt should be made to reach an agreement regarding the applicable ethical concepts and the meaning or interpretation of these concepts.

An agreement is not always possible, but further analysis helps to bring it closer. The final solution would probably never be the most ideal ethical solution, but rather a compromised position by all parties that is the closest possible to the best ethical solution. Therefore, being one of many correct solutions, the ethical problem under consideration can be considered an open ended problem. Engineering design problems are usually open ended problems, making ethical dilemmas analogous to engineering design. Consequently, these types of problems have the following properties:

1. They have more than one correct solution.
2. They require applying a large body of knowledge to formulate a solution.
3. They require significant utilization of analytical skills.
4. They require multiple iterations at every step to arrive at a solution satisfactory to the initiation criteria.

Legal vs. Professional Responsibility

Conforming to professional standards helps protect the public and the engineer from possible accidents and safety concerns, as well as legal ramifications. However, engineers should be aware of the boundaries and limitations of their legal and professional responsibility. This is particularly important when problems occur resulting in grave legal and liability questions. To fulfill this professional responsibility engineers can follow a model known as ***reasonable care.*** Proper understanding of this model is necessary to avoid actions which can be taken advantage of in case of disasters and problems. Since the very nature of engineering will always involve occurrences which have never been accounted for previously, and to properly identify and understand reasonable care, an analysis of the legal precedence and views in this regard might be helpful. For this purpose, a part of the law known as "Tort Law" is examined. Tort Law is the part of the legal system that addresses legal injuries or wrongs in the course of practicing a profession. It is also known as the malpractice law. This law defines & accepts a ***professional standard of care***, or reasonable care, as that which: relies on, but not restricted to, the standard operating procedures of a profession, and ordinary job responsibility. Accordingly, this definition is also open to some interpretation and subjectivity depending on the circumstances and evidence in the case at hand. Therefore, most codes of ethics support a broader principle of care that goes as far as recommending that one should avoid even contributing to producing harm by action or inaction. Codes of ethics emphasize that engineers are privileged to be able to see the potential for harm and to be able to prevent it.

Moral responsibility usually parallels legal liability. This brings in another term that needs definition which is ***liability***. The simplest definition of liability is: deserving punishment for causing harm. The severity of the punishment is usually decided through a legal process that considers the degree of harm and gives weight to the cause for inflecting harm, which can be one of three levels: intentional harm, reckless harm, and negligent harm. In liability cases against professionals, rarely any professional is proven to have caused intentional harm, and very few cases result in proving that harm was caused recklessly. In fact most of the professional liability cases would reveal that the cause of harm was negligence.

Since engineering ethics provide a higher calling than legal regulations, in terms of protecting the health and welfare of the public, codes of ethics strongly emphasize a responsibility fulfilment model known as ***Good Works***. Good works is the model that calls for going above and beyond the call of duty to insure staying multiple steps away from unexpected disasters. In comparison to reasonable care, which is the basis for obligation responsibility, good works would be an extension of reasonable care. Good works encourages finding and exploiting opportunities for going beyond minimum responsibility requirements, which is a desirable character of engineers that lies in the abstract commendable area.

However, no one can blame an engineer for not doing good works since it is not part of their duty. Nevertheless, if done, good works are admirable. One precaution associated with good works is that an engineer performing it must accept the extra responsibility associated with it since professional performance is now expected.

Proactive and Responsible Actions

Engineers are educated as professionals to perform their duties with ethics in mind. However, maintaining this attitude and understanding in action is not an easy task, especially considering the facts that engineers are human. Humans' actions are directed by their frames of mind and their attitude, which might not help realize the long term gains or losses behind a certain action, compared to the quick recognition of short term gains or losses associated with a contradicting action. There are many influential elements that stem from a human frame of mind and attitude, which sometimes results in a diversion from performing a responsible action. Awareness of these elements can help a great deal in correcting the actions of a professional. These elements include:

1. **Internal element:** self-centering, self-interest, and self-deception.
2. **Surrounding element:** Peer pressure, desire for acceptance, and groupthink.
3. **Intellectual element:** Ignorance and poor educational updates, as well as the lack of appreciation of the different perspectives and the big picture.

These barriers do not just work against an individual professional engineer when trying to act responsibly, but also exert the same effect on an entire organization. Recall that the majority of professional engineers work within bigger organizations which have their own authority structures. Management style within an organization could provide an environment that encourages or discourages these barriers to grow and affect performance. Successful organizations usually encourage and grow a culture of dissent, to empower professionals towards ownership of their actions and their consequences. Ultimately, this would enable the organization to find out its mistakes and errors quickly and efficiently, and consequently correct these errors in the way of continuous improvement. Moreover, most organizations now have their own codes of ethics and guidelines for employees to decide if an action is acceptable or not. In engineering organizations, most of those codes agree with the professional engineers' codes of ethics from professional organizations, with some added flavor related to the locality. In case there are none, an engineer can be one of the initiators of this culture by introducing awareness classes and seminars that will allow this organization and colleagues to learn and gain awareness about ethics and societal dimensions of engineering.

Integrity and Honesty

As mentioned previously, integrity is emphasized by ethical theories and engineering codes of ethics as an expected base for professional action and judgment. In application, integrity implies honesty and reliability, which are required by engineering ethics as essential bases for professional actions and judgment. The definitions of these words can be traced through their linguistic roots where the dictionary defines them as follows:

1. **Honesty**: Sincerity, fairness, and freedom from deceit or fraud.

2. **Integrity**: Adherence to moral principles, wholeness, and soundness of moral character.
3. **Reliability**: Trustworthiness, predictability, and dependability.

In the context of practicing professional engineering, many regulations and professional expectations rely on, and deal directly with, the concept of integrity and honesty. Examples of these situations include the following:

A. **Full disclosure:** Engineering codes of ethics stipulate that information needed for the informed consent of an individual should be provided in full. The order of priority is always to protect the public and society, then the client, and finally the engineer's interests. Failure to inform those whose decisions are impaired by the absence of the information would invoke the honesty part of an engineer's code of ethics and might lead to undesirable legal consequences. However, the way to produce this information, particularly if a client's interest or the interests of an engineer would become in jeopardy, is a typical ethical dilemma. Resolving such a dilemma usually requires significant effort to arrive at a compromising solution that is mutually acceptable by all parties.

B. **Confidentiality:** Confidential information will reach the engineer either directly from the client or by accidental discovery during the course of performing work for the client. This information can be subject to abuse in two forms: the first form is when confidentiality is broken while the action is not warranted, and the second form is when confidentiality is not broken although the higher obligation to the public requires it. The limits for these two forms are highly controversial but engineers should be aware of them.

C. **Conflict of interest:** This situation exists when a professional judgment is subject to influences, loyalties, or other interests. Conflict of interest also tends to make the judgment less likely to benefit the client than the client is justified in expecting. The professional context is important for this concept to apply as conflict between interests in two different sports does not really pertain to this concept. Moreover, protected interests in case of invoking this concept should be morally and legally legitimate. There are three types of conflict of interest:

   i. **actual**: which exists in a real situation,
   ii. **potential**: which seems anticipated based on the current events and where they are leading, and;
   iii. **apparent**: which might seem like a conflict of interest exists, but in reality there is none.

   Regardless of which type is occurring, engineers should avoid all three types. If avoidance is not possible, then an engineer should reveal the conflict to the client as soon as it is realized. In general, if faced with a situation that seems to bring about a conflict of interest, policies within the company or organization should be followed. If no policy is available in the workplace, the situation should be discussed with a manager. If this solution is not practical or attainable, then a professional engineer should examine their motivations and try to take documented precautions in every step along the way until the situation is resolved.

Environmental Issues and Sustainable Development

Background

Engineering projects are considered a threat to the environment, and many environmental problems have been associated with engineering endeavors. The truth of the matter is that engineering projects have been inadvertently responsible for some environmental issues, but not to the degree presented by the media. At the same time, engineers are always sought to provide solutions to environmental problems, whether it is caused by engineers or not. Therefore, the relation between engineers and the environment is a complex one that has many dimensions.

Engineers have an obligation towards the environment that stems from two bases. The first base is that all private citizens have an obligation to the environment and engineers are private citizens. The second base is that professionals abide by professional ethics and the majority of professional engineering codes of ethics emphasize the engineer's responsibility towards the environment. In a very detailed and elaborate fashion, the American Society for Civil Engineers (ASCE) code of ethics refers to the environment as follows:

"Cannon 1, section f: 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."

This is one of the most explicit references to the environment in an engineering code of ethics. Other professional organizations also share this reference to the environment and sustainability. The word "strive" in the first cannon of the ASCE code of ethics, described above, indicates multiple of levels of action which are required by engineers. This includes examples beyond personal compliance with sustainable development like: informing clients about the consequences of violating sustainable development and informing authorities about violators of sustainable development.

Sustainable Development

Sustainable development is a process of change in which human development activities meet present needs and aspirations without endangering the capacity of natural systems to absorb their effects, and without compromising future generations' ability to meet their needs and aspirations. Human development activities include things like: investment, technology, resource allocation, functioning of institutions, etc.

Engineers play a critical role in sustainable development characterized by the development of technology that conserves natural resources and protects the environment. However, engineers are not capable of doing that alone. Many factors are involved in engineering projects including political, social, and moral factors, which are beyond just environmentally-friendly technology. Knowing that engineers do not function alone, or in vacuum, it becomes obvious that there are other people and entities which need to work with engineers to achieve sustainable development. Nevertheless, the influences of an engineer continue to be significant in any engineering project.

Moral Standing of the Environment

One of the major problems faced by engineers in relation to the environment is based on the lack of consensus over the moral standing of the environment. In other words, is the value of the environment appreciated in itself, apart from human use, or is it a value based on how much the environment is useful to, and appreciated by, human beings? The answer to this question continues to differ, and that reflects on engineering applications and projects trying to incorporate sustainable development. Depending on how the value of environment is seen and considered, in relation to humans, engineering projects will face different levels of challenges in protecting and preserving the environment. In general, western ethical thinking has been anthropocentric in its views; which means that only humans have moral standing. It also means that plants, animals, the environment, and any non-human objects, have a standing depending on how useful they are to humans. However, non-western ethical thinking includes some thoughts on elements surrounding humans as having intrinsic value regardless of their usefulness to humans. Add the emergence of the environmental movement, as well as issues of global change, a new attitude towards the value of nature evolved, which views nature as not just a commodity, but a community to which humans belong. Because of this controversy, most engineering codes of ethics implicitly commit engineers to health related or public welfare elements that are directly influenced by environmental concerns.

The commitment to non-health-related concerns and intrinsic value of the environment are vague and arguable. A commitment to non-health-related concerns can be extrapolated if these concerns can be related to human welfare. In fact, due to an engineer's inability to operate alone, many factors must be considered like: public attitude, politics, and businesses housing engineers. In addition, technological feasibility must be considered when taking a stand regarding controversial issues. Engineering professional organizations, through codes of ethics, are usually careful not to take sharp sides or positions on controversial political issues and disagreements to ensure that engineers and the profession continue to be viewed as a professional, nonbiased entity. Therefore, the codes of ethics are not specific regarding a strict commitment to the environment. Also, as an advantage, engineers can have their own personal views and opinions about politically and socially loaded topics without having to contradict their own professional guidelines.

To understand the controversy in such situations, the differences in business attitudes towards the environment can be examined. Businesses are divided into three categories, based on their respective attitude towards the environment:

A. **Denial of need for environmental management:** where very few resources are allocated to environmental matters as possible, and significantly more resources are allocated to fight against environmental regulations. Some businesses in this category would go as far as considering paying fines and lobbying for decision makers as the cheaper cost of doing business than to accept the minimum governmental regulations to preserve the environment.
B. **Minimalist environmental management:** where government regulations are accepted as a cost of doing business and societal goodwill, but no extra resources or commitment are provided.
C. **Advanced environmental management:** where the business entity provides full and unwavering support to respond to environmental concerns. These businesses would invest resources to protect the environment and build healthy relationships with surrounding communities affected by environmental concerns and governmental agencies regulating environmental issues.

Businesses belonging to the third category gain the benefits of being 'Good Neighbors' in the community, fulfilling the implied contract with the larger society, and acting as responsible citizens for being a profitable business. They also fulfill self-interest including preventing fines and legal lawsuits while generating goodwill. When it comes to engineers working within these businesses, the last thing needed from their codes of ethics and professional standards is to show them as politically biased or to place pressure on their careers.

Professional Engineers and the Environment

Professional engineers' obligation towards the environment is a true ethical dilemma to which a solution can take one of two opposing directions. These two directions are characterized by two arguments:

A. Engineers' obligation to the environment should be extended beyond health-related factors because people are morally responsible for their actions. In the case of engineers, they influence the environment by projects and, therefore, engineers are responsible for protecting the environment. In addition, the engineering profession can positively influence the attitude and actions with respect to the environment. By refusing projects that are destructive to the environment, modification will ultimately be enforced to protect the environment.

B. Engineers' obligation to the environment should not be assigned for non-health related factors because engineers violate professional responsibility if they do so by speaking outside their area of expertise. When judging influences on the environment, the majority of engineers are handling issues outside the engineering body of knowledge. Moreover, committing to environmental protection beyond health related issues increases divisiveness and weakness of societies and codes. Engineers still disagree on non-health related environmental issues among themselves. Consequently, management support for societies might weaken. Besides that, extending the code into controversial areas makes it sound radical and politically biased and results in ignoring the code. At the individual engineer's level, associated conscience problems might emerge because engineers have individual beliefs on environmental issues, which might require a position contrary to their employer's beliefs, which is not desirable if not needed.

Both of these arguments have merits. Therefore, it is not advisable to oblige engineers to protect the environment when human health is not at stake. However, it is advisable that the code should protect the engineer's right to engage in public efforts to protect the environment and to refuse employers' projects that are environmentally destructive. The minimum measure should always be to abide by governmental laws and regulations related to the environment.

Ethics of Emerging Technologies

As scientific discovery continues to reach new frontiers, engineering and technology continue to evolve and expand at exponential rates, parallel to these scientific discoveries.

Engineering generates technology in the form of products and services that help improve life. However, all new technology which has not been known to the public carry with it speculation and guesses, particularly in terms of effect on life and society. Public opinion and support of engineers is significantly influenced by sobering experiences from previous disasters, and the human imagination. Some examples of these influences include: the discovery that Asbestos is a cause of cancer two decades after it was introduced as an improvement agent in buildings, or myths about robots taking over the world. When these combinations result in misinformation to the public, and to policy makers, detrimental results are realized. The example of cancelling the entire nuclear power generation program in Germany after the disaster of Fukushima comes back to mind. Therefore, informed public and leadership decisions (Public Policy) are keys to a sustainable, ethical, and economical technology development. In other words, public perception based on correct information is as critical as public health for engineering products, and that makes engineering ethics, particularly in the case of emerging technologies, a vital element for success.

To alleviate these issues, public education and the inclusion of ethics, human aspects, and societal impact, at the very early stages of any new technology development, have become a normally expected step in any engineering endeavor. The idea is not to stop technology or create burdens to engineers, but rather to educate stakeholders, including engineers, regarding the risks and benefits associated with an engineering project, allowing them to make informed decisions. In general, risk associated with any new technology can be categorized as follows:

1. **Life-basics ethics (Risk and "first do no harm" ethics):** This includes concepts like autonomy. Examples of issues under this category include military applications, fear of uncontrolled actions, and health hazards.
2. **Life-quality ethics (Justice and equality ethics):** This includes ideas like the nano-divide associated with nanotechnology have and have-nots, where the gap between rich and poor nations will increase causing potential conflicts.
3. **Life and human definition ethics (Meta-ethics):** This includes the concept of integrity as a human and issues related to human change. Such changes include the enhancement of human abilities and the nature of implants in human bodies.

In summary, emerging technologies come with a huge gap of knowledge by the public leading to one of two issues: risk exaggeration or promise over-expectation. Both of these are forms of misinformation. Informing the public requires educating them about the factual benefits, risks, and limitations of the technology. It also entails clearing out the mythical and imaginary thoughts while setting realistic expectations of what this technology can achieve. Engaging the public early in the process is a prudent step that ensures increased transparency resulting in the generation of public debate and, consequently, public trust.

Course Summary

Engineering professional organizations provide a code of ethics, which is usually of higher calling than legal requirements to practice the profession. This code helps guide engineering decisions to protect the public first, the engineering profession, and the engineer. In general, engineering is the application of science to improve human life. The interaction between the engineering profession and society is extremely deep and intertwined which requires that engineers hold paramount the public safety and welfare as they practice their profession.

Final Exam Questions

1. Which of the following engineering professional organizations provides a codes of ethic?

(a) The American Society of Mechanical Engineers

(b) The Institute for Electrical and Electronic Engineers

(c) The American Institute of Chemical Engineers

(d) All of the above

2. Engineering ethics include ideas and directives related to:

(a) Urban infrastructure

(b) Contracts

(c) Integrity

(d) Corporate business practices

3. Engineering ethics are needed for engineering practice:

(a) To prevent law suits

(b) To win contracts

(c) To increase popularity

(d) To guide the professional practice

4. Good works means:

(a) Going above and beyond the call of duty in reasonable care

(b) Doing excellent work that makes clients proud

(c) Improving engineering products above expectation

(d) All of the above

5. Information needed for the informed consent of an individual should be provided in full. This is known as:

(a) Full disclosure

(b) Confidentiality

(c) Conflict of interest

(d) “Do no harm” ethics

6. Confidential client information includes:

(a) Information obtained by the access right

(b) Information found by the engineer while working for the client

(c) Information obtained by court order

(d) None of the above

7. Conflict of interest which should be avoided by engineers includes:

(a) Actual

(b) Perceived

(c) Apparent

(d) All of the above

8. ____________________ is a process of change in which human development activities meet present needs and aspirations without endangering the capacity of natural systems to absorb their effects, and without compromising future generations’ ability to meet their needs and aspirations.

(a) Meta-Ethics

(b) Environmental Management

(c) Sustainable Development

(d) Environmental Protection

9.____________________________ is where government regulations are accepted as a cost of doing business and societal goodwill, but no extra resources or commitment are provided.

(a) Minimalist environmental management

(b) Denial of need for environmental management

(c) Advanced environmental management

(d) None of the above

10. ________________________ includes the concept of integrity as a human and issues related to human change. Such changes include the enhancement of human abilities and the nature of implants in human bodies.

(a) Life-basics ethics (Risk and “first do no harm” ethics)

(b) Life-quality ethics (Justice and equality ethics)

(c) Life and human definition ethics (Meta-ethics)

(d) None of the above