PROFESSIONAL ETHICS IN ENGINEERING

DR. K. PRIYA VERTHINI

What is Value

- Values are the foundation of an individual person's ability to judge between right and wrong. Values include a deep-rooted system of beliefs that guide a person's decisions. They form a personal, individual foundation that influences a particular person's behavior.

Examples of Values

- There are examples of values everywhere in your daily life. For example, if your value system is founded upon **honesty**, you would probably choose to study for a difficult test rather than cheating for a passing grade. However, if you value **achievement** and **success** over honesty, you may decide to cheat on the exam instead. This relates to which value is "worth more" to the individual.
- Other examples of values include:
- a person who values **integrity** admits that they stole a piece of candy
- someone who values **friendship** drops everything to help a friend
- people who value a **healthy lifestyle** make sure they have time to work out in the morning

Examples of Values

- a person who values **success** works late nights to achieve a promotion
- someone who values **commitment** may be more willing to go to marriage therapy than to file for divorce

- These values form our personality types. They also help us make decisions that affect the course of our lives. When these values are shared by others in our community, they are known as morals.

Moral

- Morals, also known as *moral values*, are the system of beliefs that emerge out of core values. Morals are specific and context-driven rules that govern a person's desire to be good. They can be shared by a larger population, but a person's moral code may differ from others' depending on their personal values.

Examples of Morals

- We make moral decisions based on personal values all the time. An example of a moral in the example above is determined by a person's value of honesty: **cheating is bad**. Someone who values success more than honesty may behave by another moral: **cheating is fine**.
- Additional examples of morals include:

- It is **bad** to steal candy (based on a value of honesty).
- Helping a friend is a **good** thing to do (based on a value of friendship).
- It is **bad** to skip a workout (based on a value of a healthy lifestyle).
- Working late at night is a **good** thing to do (based on a value of success).
- Saving your marriage is a **good** way to move forward (based on a value of commitment).

MORAL

- *Moral dilemmas* occur when morals conflict with each other. For example, what if a daughter couldn't afford the life-saving medicine her dying mother needed, but she had access to the medicine storeroom?
- Her core values might tell her stealing is wrong. However, her morality would tell her she needs to protect her mother. As such, the daughter might end up doing the wrong thing (stealing, as judged by her values) for the right reasons (saving her mother, as judged by her morals)

ETHICS

- Ethics and morals are very similar. In fact, many ethicists consider the terms to be interchangeable. However, there are slight differences in how they affect our lives.

- While morals are concerned with individuals feeling "good" or "bad," ethics determine what behaviors are "right" or "wrong." Ethics dictate what practical behaviors are allowed, while morals reflect our intentions. Consider morals as the rulebook and ethics as the motivator that leads to proper or improper action.

ETHICS

- You're most likely to see a code of ethics in the business or legal fields. These areas are much more black and white than personal values or morals since they set rules for employees and citizens in a society. For example:
- Doctors are held to a strict code of ethics when they swear the Hippocratic Oath. They are bound to the rule "do no harm," and can be held accountable if they do cause harm to their patients.
- An organization like PETA, which stands for “People for the Ethical Treatment of Animals," pursues legal action against those who do not treat animals in an ethical way.
- Employees often sign a code of ethics, which includes keeping important matters confidential and not stealing from the workplace — both of which would be fireable offenses.

ETHICS

- Defense lawyers are ethically bound to defend their clients to the best of their ability, even if they are morally opposed to their clients' crimes. Breaking this ethical code could result in a mistrial or disbarment.
- A student who helps another student cheat on a test is breaking their school's ethics. Even though they are doing it for a moral reason (helping a friend), they are committing an ethical violation and can be punished.
- Ethics are basically an institution's attempt to regulate behavior with rules based on a shared moral code. Violating ethics has the same consequence as breaking a rule, while violating one's morals results in personal guilt and shame instead of a societal consequence. Ethical dilemmas occur when an institutional set of ethics conflicts with one's personal moral code.

Morals vs. Ethics

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BASIS FOR COMPARISION	ETHICS	VALUES
MEANING	Ethics refers to the guidelines for conduct that address question about morality.	Value is defined as the principles and ideals, that helps them in making judgement of what is more important.
What are they?	Systems of moral principles	Stimuli for thinking.
Consistency	Uniform	Differ from person to person.
Tells	What is morally correct or incorrect, in the given situation.	What we want to do or achieve.
Determines	Extent of rightness or wrongness of our options.	Level of importance.
What it does	Constrains	Motivates.


Ethic:
You shouldn't betray your friends.
Value:
Friendship
Moral:
Helping friends is good.
Difference Between Ethics, Morals and Values
YOUR DICTIONARY

- **What is professional integrity?**

Professional integrity is **the practice of maintaining appropriate ethical behavior**. It is the practice of showing strong adherence to moral and ethical principles and values such as honesty, honor, dependability and trustworthiness.

A dictionary definition of professional integrity is: "Someone's high standards of doing their job and their determination not to lower those standards."

- https://www.betterup.com/blog/integrity-in-the-workplace

PROFESIONAL INTEGRITY

Dr. K. Priya Verthini

What is integrity

A. A quality of being honest having strong moral principles and moral uprightness.

B. The state of being whole and undivided having internal unity and coherence.

Our inner world drives our outward actions.

1. Integrity is an internal quality.
   "The first thing is to be honest with yourself"
   says Nelson Mandela
2. Other people may or may not notice.

- Work ethics has been understood as a value based on hard work and diligence (doing work carefully and diligence).

- Work ethics is a set of moral principles or values that an employee abides by and uses in their job performance. It covers an employee's behavior and attitude towards their job, career, and the workplace

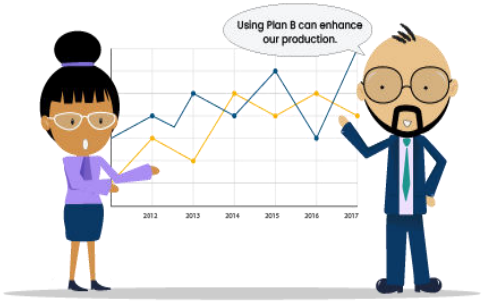
WHY WORK ETHICS IS IMPORTANT

- A strong work ethic within the company serves as a behavioral model for the right way of working. It supports and fosters a productive working culture.

- Employees with a strong work ethic are highly driven and often far exceed their peers in terms of achieving company goals.

1. Clear Goals and Objectives

2. Proper Mentoring



3. Set a Good Example

4. Create the right Work Environment

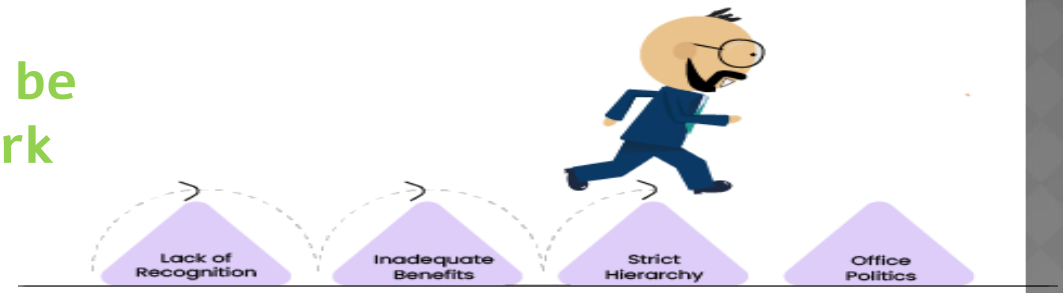
5. Discipline

6. Understand your Employees' Needs

7. A Culture of Constant Feedback

8. Eliminate Obstacles

Are the steps need to be taken main proper work ethics



ELEMENTS OF WORK ETHICS

1. **PROFESSIONALISM**
   - Being professional involves everything from how you dress and present yourself in the business world to the way you treat others. Professionalism basically embodies all the other elements of a strong work ethic.
2. **ACCOUNTABILITY**
   - You take personal responsibility for your actions and outcomes in every situation. As well as avoid making excuses when things don't go as planned. Your mistakes should be taken as learning experiences and the ability to always better yourself must be upholded.
3. **RESPECTFULNESS**
   - Whether you're serving a customer, meeting with a client or collaborating with colleagues, you do your best to respect everyone's opinions, especially under difficult circumstances. This shows you value people's individual worth as well as their professional contributions.

ELEMENTS OF WORK ETHICS

4. **DEDICATION**

- You don't stop until the job is done, and done right. When you're fully dedicated, you have to strive to achieve the best results alongside putting in the extra hours to get things right.

5. **DETERMINATION**

- You don't let obstacles stop you, and enthusiastically embrace challenges You know that your job as an entrepreneur is to solve your clients' problems. With that, continuously seek better and more innovative answers.

6. **HUMILITY**

- You acknowledge everyone's contributions, and freely share credit for accomplishments. You show gratitude to colleagues who work hard, and appreciation to your loyal clients. And, while you always take your work seriously, you strive always to maintain a sense of humor about yourself.

7. **DEPENDABILITY**

- This relates closely to when you are always on time and prepared for meetings. Not only that but also have the ability to deliver your work on time. With no doubt, your customers, colleagues and clients will appreciate the stability you portray.
- All in all a strong work ethic is very relevant to any business as it can set the work productivity in a business. The smallest of things will always make a world of a difference, in this case, it can definitely utilize a sense of belonging in the work environment.

SERVICE LEARNING

- **Service-learning** is an educational approach that combines learning objectives with community service in order to provide a pragmatic, progressive learning experience while meeting societal needs.

- *Defined as*

- *"Service-learning is a pedagogy integrating academically relevant service activities that address human and community needs into a course. Students connect knowledge and theory to practice by combining service with reflection in a structured learning environment".*

Qualities of service learning

- Integrative - (mixing things or people together that were formerly separated). A situation to learn how the society is.
- Reflective
- Contextualized
- Strength based
- Lifelong

SERVICE LEARNING

- **Direct Service**
- Involves student engagement with the client population on an interpersonal level. The engagement is performed at the site of service. Examples of direct service include tutoring, reading to the elderly, coaching a youth activity in a low-income area.
- **Indirect Service-Learning**
- Students fulfill a community need identified by a community partner without engagement with the client population. Examples of indirect service may include planning fundraising activities for a community organization, developing a social media strategy for a community action group, designing posters or flyers for a local nonprofit, building low-income housing, cleaning a community park.
- **Research-Based Service-Learning**
- A type of service that involves collaboration with a community partner to conduct research that addresses community issues or needs. Partners may be nonprofit groups, government agencies or community leaders. Examples of community-based research projects would include testing water reports provided to a local community, auditing energy use in public housing, gathering data for a community grant application, gathering research that assists in the development of a video for a nonprofit or government agency.
- **Advocacy-Based Service-Learning**
- A type of service where students create awareness or educate others on public topics that are of concern to the community partner and/or the greater community. Examples of this type of service would include planning and executing public forums that address community issues, writing and distributing information that illuminates a problem experienced by the community, helping to draft legislation that helps solve a community need, organizing a letter-writing initiative that addresses a social issue.

Civic Virtue

- Civic virtue is morality or a standard of righteous behavior in relationship to a citizen's involvement in society
- Civic virtue is the harvesting of habits important for the success of the community
- Eg. voting

RESPECT FOR OTHERS

- Respect, also called esteem, is a positive feeling or action shown towards someone or something considered important or held in high esteem or regard.
- It is also the process of honoring some one by exhibiting care, concern or consideration for their needs or feelings.
- Eg…conveying thanks or wishing them

How to respect others

- Listening to the other person (at time of clashes)
- Being empathetic, understanding each other and putting ourselves in their shoes.
- Apologizing to each other when we make mistakes
- Complying with and respecting laws and regulations
- Respecting the privacy and intimacy of others
- Being grateful.

Caring and Sharing

- Caring includes feelings, relationship, protecting others and causing least damage to others.
- Caring is feeling for others.
- It includes showing respect to the feeling of others and also respecting and preserving the interests of all others concerned

sharing

- Sharing means ‘sharing of feeling, ideas thoughts, resources and profits. Sharing is always mutually beneficial.
- Sharing is voluntary and it cannot be driven by force, but motivated successfully through ethical principles.
- Sharing should be genuine, legal, positive, voluntary and without any expectation in return.

ENGINEERING ETHICS AND PROFESSIONALISM

DR. K. PRIYA VERTHINI

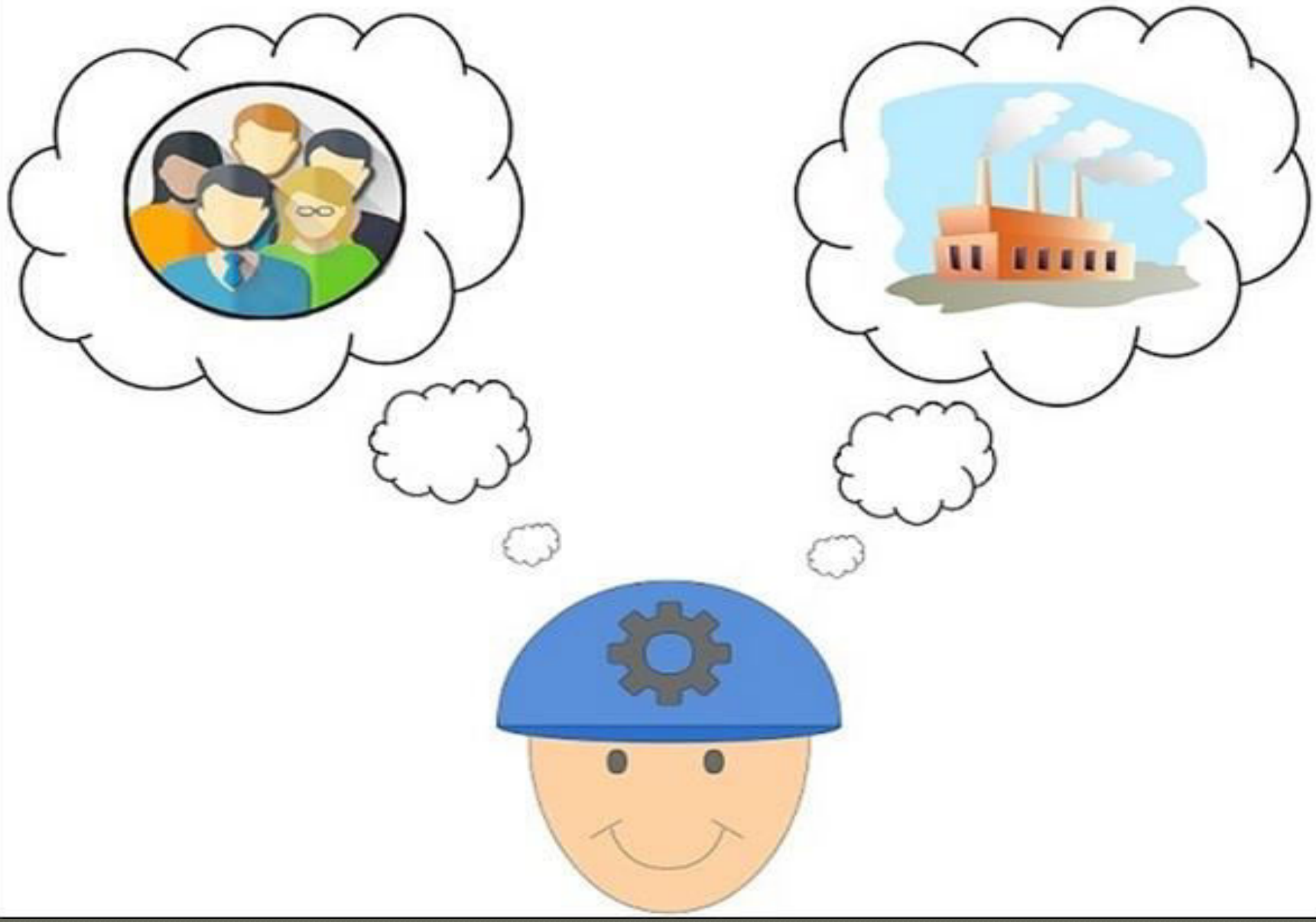
INTRODUCTION

- Every profession has its particular rules, regulations, or you could say principles.
- A person when choosing a job must know that specific profession. Ethics means principles of something. In different roles, they have ethics according to their knowledge about the situation, how people belonging to that profession should behave.
- Professional ethics is guidance for people working in a particular profession that tells them what they supposed to do and what they are not supposed to do while working there.

- Journalists or anyone related to media has a great responsibility for transparency.
- Anyone who is in the field of law and justice is required to abide by its rules and ethics.
  Here, the lawyers or anyone in the legal area should balance their duty to prosecute criminals and defend the clients. It should be under the obligation of ethics to uphold the law and be truthful regarding it.
- There is so much responsibility on the shoulders of Engineers. They are the one building houses, dams, highways, any gadget or even a car. They have to be honest enough while designing and making them.

Professional Ethics

- Professional Ethics are the guiding principles that are to be followed by or expected to be followed by the people in that profession.
- These principles in any company or group can be termed as ethics.
- professional ethics are to be applied by the people of a particular profession if they can be based on the duties that they have to follow, their skills and specific knowledge



Professional Ethics

- Professional ethics is a set of ethical standards and values a practicing engineer is required to follow.
- It sets the standard for professional practice.
- At present, its essential – as it helps students deal with issues they will face

Senses of engineering ethics

Senses means what are the perspectives or views of engineering ethics.

Normative sense and descriptive sense

1. Normative sense means knowing moral values, finding accurate solutions to moral problems and justifying moral judgments in engineering practices.
   - Study of decision, policies and values that are morally desirable in the engineering practice and research and
   - Using codes of ethics and standards and applying them in their tractions by engineers.
2. Descriptive sense: refers to what specific individual or group of engineers believe an act, without justifying their beliefs or actions.

MORALITY

- Morality means principles concerning right and wrong or good and bad behavior.

- The term morality concerns with

(a) what ought or ought not to be done in a given situation,

(b) what is right or wrong in handling it,

(c) what is good or bad about the persons, policies and principles involved in it?

VARIETY OF MORAL ISSUES

MICRO ISSUES:

This approach addresses typical, everyday problems that the engineers face in the professional life. In other words, micro ethics describes ethical issues that may affect an engineers professional and personal life.

MACRO ISSUES:

This approach deals with all societal problems that engineers encounter during their career. In other words, macro ethics discusses ethical issues concerning all societal problems that engineers might encounter.

VARIOUS MORAL PROBLEMS

- Organisation oriented issues
- Clients or customers oriented issues
- Competitors oriented issues
- Law, government and public agencies oriented issues.
- Professional societies oriented issues: engineers should follow strictly the various codes of ethics by various professional societies such as National society of professional engineers (NSPE), the Institute of Electrical and Electronics Engineers (IEEE), and American Society of Mechanical Engineers (ASME).in order to perform standard professional behaviour.
- Social and environmental oriented issues.
- Family oriented issues.
-

TYES OF INQUIRY

- Inquiry means an investigation.
- Engineering ethics also involves investigation into values, meaning and facts.

- Inquiries in Engineering Ethics are of 3 types:
  1. Normative inquiries
  2. Conceptual inquiries
  3. Factual or descriptive inquires

Normative Inquiries

- These inquiries are mostly helpful to identify the values which guide the individuals and groups in taking a decision. These are meant for identifying and justifying some norms and standards of morally desirable nature for guiding individuals as well as groups.

Examples;

1. when an engineer should attempt whistle blowing ?
2. why must some engineering information kept confidential?

Conceptual Inquiries

These are meant for describing the meaning of concepts, principles, and issues related to Engineering Ethics. Eg., what is safety, risk, bribe, how safety is related to risk.

FACTUAL AND DESCRIPTIVE INQUIRES

These help to provide fact for understanding and finding solution to value based issues.

Factual / Descriptive Inquiries

These help to provide facts for understanding and finding solutions to value based issues. The engineer has to conduct factual inquiries by using scientific techniques.

These help to provide information regarding the business realities such as engineering practice, history of engineering profession, the effectiveness of professional societies in imposing moral conduct, the procedures to be adopted when assessing risks and psychological profiles of engineers.

The information about these facts provide understanding and background conditions which create moral problems. These facts are also helpful in solving moral problems by using alternative ways of solutions.

MORAL DILEMMAS

- Moral dilemmas have two or more folding - moral obligations, duties, rights, goods or ideals come into disagreement with each other.

Causes for moral dilemmas:

Problem of vagueness
Problem of conflicting reasons and
Problem of disagreement.

Steps in confronting MORAL DILEMMAS

i) Identify the relevant moral factors and reasons.
ii) Gather all available facts that are pertinent to the moral factors involved.
iii) Rank the moral considerations in the order of their importance as they apply to the situation.
iv) Consider alternative course of action, tracing the full implications of each, as ways of solving dilemma.
v) Talk with colleagues, seeking the suggestions and perspectives of the dilemma.
vi) Arrive at a carefully reasoned judgment by weighing all the relevant

vii) moral factors and reasons in light of facts.

MORAL AUTONOMY

- Moral autonomy is the philosophy which is self governing or self determining.
- The moral autonomy is the ability to think critically and independently about moral issues and apply this moral thinking to situation that arise during the professional engineering practice.
- Moral autonomy helps in improving self determination.

- A person becomes morally autonomous by improving various practical skills listed below:
- i) Proficiency is recognizing moral problems and issues in engineering.
- ii) Skill in comprehending, clarifying and critically assessing arguments on opposing sides of moral issues.
- iii) The ability to form consistent and comprehensive viewpoints based upon consideration of relevant facts.
- iv) Awareness of alternate responses to issues and creative solutions for practical difficulties.
- v) Sensitivity to genuine difficulties and subtleties
- vi) Increased precision in the use of a common ethical language necessary to express and also defend one's views adequately.
- vii) Appreciation of possibilities of using rational dialogue in resolving moral conflicts and the need for tolerance of differences in perspective among orally reasonable people.
- viii) A sense of importance of integrating one's professional life and personal convictions i.e. maintaining one's moral integrity.

Steps for Moral Autonomy

- Ability to relate the problem with the problems of law, economics and religious principles.
- Skill to process, clarity and understand the arguments against the moral issues.
- Ability to suggest the solutions to moral issues.
- Must have the imaginative skills to view the problems from all the viewpoint.
- Tolerance while giving moral judgment.

Kohlberg's Theory of Moral Development

- Lawrence Kohlberg – A psychologist belong to Harvard University
- Defined - "Moral development as development of individual's sense of justice".

- 3 levels and 6 stages

PRE-CONVENTIONAL LEVEL

- This can be understood as the first level of moral thinking, which is generally found at Elementary school level. The thinker at this stage tends to think and behave based on the **direct consequences** that might occur. There are two sub-stages in this.

1. Avoid Punishments

- A thinker at this stage generally thinks and believes that the judgment are to be made as per the socially acceptable norms as they are said so by some higher official (a teacher or a parent). This is a child-like obedience, in order to avoid punishments.
- These thoughts are based on the idea that the protagonist should not disobey the law or rules.

2. Self–interest

- A thinker at this stage, shows interest in making decisions according to the rewards they get in exchange. This second stage is characterized by a view that right behavior means acting in one's own best interests.
- In this stage, they tend to follow the rules of authority because they believe that this is necessary to ensure positive relationships and societal order.

CONVENTIONAL LEVEL

- This can be understood as the second level of moral thinking, which is generally found at the primary and high school level. The thinker at this stage tends to think and behave based on the **want to please others.** There are two sub-stages in this.

1. Getting people to like them

- At this stage, the ideas of the society are considered. This level can be that where the protagonist behaves on account of the moral grounds which people decide for decision making. This decision may or may not support the law. Whatever the result is, the thinking process is based on how to impress others or society and on how to please the people around.

2. Maintain functioning in society

- A thinker at this stage, considers to follow the rules for the good of the society. The moral grounds on how people in the society will consider the job done will be the priority, because the thinker believes that a social order is maintained by abiding by the rules.
- Hence a thinker sticks to the idea that the protagonist should follow the moral values. The thinker's behavior is driven by the authority while his thinking conforms to the social order.

POST-CONVENTIONAL LEVEL

- This can be understood as the third level of Moral thinking, which is generally found after the high school level. The thinker at this stage tends to think and behave based on a **sense of justice**. There are two sub-stages in this.

1. Reject rigidity of laws

- In this level, the thinker uses his moral thinking skills at a commendable pace. He starts to feel for the protagonist based on moral grounds. He also might have an opinion that the rules have to be changed according to humanitarian values. The thinker rejects the rigidity of the existing laws and rules at this stage.

2. Sense of justice

- This is the pinnacle stage of Moral development where the thinker feels a sense of justice for the protagonist. The thinker has great moral values that he keeps himself free from the external factors that might influence his thinking process.

- These are the three main sections of moral development proposed by Lawrence Kohlberg.

The Heinz Dilemma

- Heinz's wife was dying from cancer
- Doctors advised that there's only one drug that can save her
- The chemist demanded 10 times the cost to make the drug
- Heinz couldn't afford it
- Chemist didn't listen to Heinz's begging and pleas
- Heinz stole it from his premises that night.

Pre- Moral

1. Obedience and Punishment

Younger children – rules and absolute

Mr. Heinz is wrong as stealing is wrong

2. Individualism and Exchange

Rules are not necessarily rigid and always right

Druggist was unfair and Mr. Heinz was correct.

Conventional

1. Good Interpersonal Relationships

- People /young adults
- Family, community, trust and compassion
- Mr. Heinz was correct

2. Maintaining Social Order

- Emphasis on the social order and the social system
- not following laws would mean chaos
- Mr. Heinz was wrong

Post conventional

1. Social Contract and Individual Rights

- People understand there can be multiple perspectives and multiple types of society
- No simple definition of good society
- human rights and law are different aspects.
- Mr. Heinz was right because he save a life

2. Universal Principle (Discarded)

- People have their moral guidelines which may not tie in with the society
- Act accordingly and defend principles.

Ethics second unit

Cont.,

Gilligan's Theory

- This is an advancement of Kohlberg's theory. It had been observed that Kohlberg's theory was proposed based on the moral thinking of privileged white men and boys. Hence this theory was popularized by taking both male and female thinking capabilities into account.

- **Carol Gilligan**, a psychological theorist was born on Nov 28, 1936 in the New York city. She pursued her doctorate degree in Social Psychology from the Harvard University. Gilligan was a research assistant for Lawrence Kohlberg, but she eventually became independent and criticized some of his theories.

1. Pre-conventional level

- A person in this stage cares for oneself to ensure survival.
- Though the person's attitude is selfish, this is the transition phase, where the person finds the connection between oneself and others.

2. Conventional level

- In this stage, the person feels responsible and shows care towards other people.
- Carol Gilligan believes that this moral thinking can be identified in the role of a mother and a wife. This sometimes leads to the ignorance of the self.

Post-conventional level

- This is the stage, where the principle of care for self as well as others, is accepted.
- However, a section of people may never reach this level.
- According to the Carol Gilligan's theory of moral development, changes occur due to the **change of self** rather than the **critical thinking**. It was stated that the post-conventional level of Kohlberg is not attained by women. But Carol Gilligan researched and found that the post-conventional level of thinking is not being easy for women to go through because they **care** for the relationships.

- **Care-based Morality**
- Care-based morality is the kind of thinking found in women. This is based on the following principles.
- More emphasis is given to inter-connected relationships and universality.
- Acting justly focuses on avoidance of violence.
- Women with this are usually interested in helping others.
- More common in girls because of their connections to their mothers.
- Because girls remain connected to their mothers, they are less inclined to worry about issues of fairness.

- **Justice-based Morality**
- Justice-based morality is the kind of thinking found in men. This is based on the following principles.
- They view the world as being composed of autonomous individuals who interact with one another.
- Acting justly means avoiding inequality.
- Individuals with this are usually interested in protecting individuality.
- Thought to be more common among boys because of their need to differentiate between themselves and their mothers.
- Because they are separated from their mothers, boys become more concerned with the concept of inequality.

Example of Gilligan's Theory

A group of moles give shelter to a porcupine. But they are being continuously stabbed by the porcupine's quills. Now, what should they do?

- The **Pre-conventional** level of thinking states that to think for the good of oneself, either the moles or the porcupine only can live there. The other has to leave the place.
- According to the **Conventional** level of thinking, which brings a transition, from self to the good of others and which might even lead to sacrifice, either the moles or the porcupine has to sacrifice and again this leads to a stage where only moles or the porcupine can live in the burrow.
- According to the **Post-conventional** level of thinking, which states that the good of both the parties has to be considered, both the moles and the porcupine come to an agreement that both will have separate places in the same burrow, where they limit to behave themselves and will not cause any trouble to other. This helps both of them to live in the same place with peace.

Cont.

- The researchers found that the solution to this scenario is different with different individuals; gender also plays an important role. The thinkers were observed viewing the problem in two different perspectives, the care-based and the justice-based.
- In a **Justice-based perspective**, the solution to the problem is viewed as a conflict between two individual groups. Only one of them can have the property. Either moles or the porcupine will get the place in the burrow. Hence the solution to the dilemma, is not a resolution of the conflict, it is a verdict.
- In a **Care-based perspective**, the approach differs. The problem is viewed as a difficult situation faced by both the parties together, rather than a fight between both of them. Hence the solution is sought in a way around the problem or to remove the problem completely. The solution may sound compromising but not damaging. The relationship will still be the same, after the resolution.
- Researchers found that Justice-based perspective is pre-dominant among males while Care-based prospective is among females.

Consensus

- This is that state where people come into agreement with the judgement given by getting convinced with the moral reasons. This will leave the persons with a feel that justice has been done, the verdict may favor any party.

Controversy

- This is that state where the persons involved in an issue are not satisfied by the verdict and might feel that it was decided on partial interests. This will leave the people with a sense of dissatisfaction that justice was not done, which might lead to another conflict.

Profession

- Profession means a job or an occupation, that helps a person earn his living. The main criteria of a profession involves the following.
- **Advanced expertise** – The criteria of a profession is to have sound knowledge in both technical aspects and liberal arts as well. In general, continuing education and updating knowledge are also important.
- **Self-regulation** – An organization that provides a profession, plays a major role in setting standards for the admission to the profession, drafting codes of ethics, enforcing the standards of conduct and representing the profession before the public and the government.
- **Public good** – Any occupation serves some public good by maintaining high ethical standards throughout a profession. This is a part of professional ethics where each occupation is intended to serve for the welfare of the public, directly or indirectly to a certain extent.

Professionals

- A person who is paid for getting involved in a particular profession in order to earn a living as well as to satisfy the laws of that profession can be understood as a Professional. The definition of a professional is given differently by different experts in the field. Let us see the following definitions –
- *"Only consulting engineers who are basically independent and have freedom from coercion can be called as professionals."* **– Robert L. Whitelaw**
- "Professionals have to meet the expectations of clients and employers. Professional restrains are to be imposed by only laws and government regulations and not by personal conscience." **– Samuel Florman**
- *"Engineers are professionals when they attain standards of achievement in education, job performance or creativity in engineering and accept the most basic moral responsibilities to the public as well as employers, clients, colleagues and subordinates."* **- Mike martin and Ronald Schinzinger**

- **Models of Professional Engineers**
- An engineer who is a professional, has some tasks to perform by which he acts as any of the following, which can be termed as Models of Professional Engineers.
- **Savior –** A person who saves someone or something from any danger is called a Savior. An engineer who saves a group of people or a company from a technical danger can also be called a **Savior**. The Y2K problem that created problems for computers and computer networks around the world was solved by engineers who were the saviors.
- **Guardian –** A person who knows the direction towards a better future is known to be the Guardian for the same. An engineer who knows the direction in which there is scope for the technology to develop can also be called a **Guardian**. This engineer provides the organization with innovative ideas for technological development.
- **Bureaucratic Servant –** A person who is loyal and can solve problems when they occur using his own skills, is a Bureaucratic servant. An engineer who can be a loyal person to the organization and also the one who solves the technical problems the company encounters, using his special skills can be termed as a **Bureaucratic servant**. The company relies on his decision-making capability for the future growth.

- **Social Servant** – A person who works for the benefit of the society without any selfish interest and does not work on any business grounds, is called a Social servant. An engineer who receives a task as part of the government's concern for the society considering the directives laid by the society and accomplishes the assigned tasks can be termed as a **Social Servant**. He knows what the society needs.
- **Social Enabler or Catalyst** – A person who makes the society understand its welfare and works towards the benefits of the people in it, is a Social Enabler. An engineer who plays a vital role in a company and helps company along with society to understand their needs and supports their decisions in work can be termed as a **Social Enabler or Catalyst**. This person quickens the procedure and helps maintain good environment in the company.
- **Game Player** – A person who plays a game according to the rules given is a Game player in general. An engineer who acts as neither a servant nor a master, but provides his services and plans his works according to the economic game rules in a given time, can be termed as a **Game player**. He is smart enough to handle the economic conditions of the company.

THEORIES ABOUT RIGHT ACTION (Ethical Theories)

- Types of ethical theories: Depending upon the ethics a person is intended to follow, four theories were postulated by four different philosophers

1. Golden Mean Ethics
2. Duty Based Ethics
3. Right Based Ethics
4. Utilitarian Ethics

The Golden Mean Ethical Theory

- This theory was proposed by Aristotle
- This theory proposes - The solution to a problem is found by analyzing the reason and the logic
- What is Golden Mean?
- The Golden mean virtue can be understood as the virtue of reaching a proper balance between extremes in conduct, emotion, desire and attitude
- This theory pharsed by Aristotle states that virtues are tendencies to find the golden mean between the extremes of too much (excess) and too little (deficiency) with regard to particular aspects of our lives.

Rights – based Ethical Theory

- Proposed by John Locke
- According to this theory, the solution to a problem is by realizing that every person has a right to live.
- Live and let live is the philosophy behind this theory. The rights of a person towards life, health, liberty, possession, etc. are taken care of under this theory.

Duty-based Ethical Theory

- The duty based ethical theory was proposed by Immanuel Kant.
- According to this theory, 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.
- There are four virtues that come under this law:
- Prudence> Every individual has duties which should be done without any exception.
- Temperance> The temptations that might lead to the violation of duties and ethics have to be restrained
- Fortitude>sense of having tolerance
- Justice> Truth and fairness

Utilitarian Ethics

- The Utilitarian ethics was proposed by John Stuart.
- According to this theory, the happiness or pleasure of a greatest number of people in the society is considered as the greatest good.
- There are two main types of Utilitarianism. They are-

- 1. Act Utilitarianism- " A particular action is right if it is likely to produce the higher level of good for the most people in a given situation, compared to alternative choices that might be made".
- 2. Rule Utilitarianism – "Right actions are those required by rules that produce the higher level of good for the most people.

SELF INTREST

- Self-interest is nothing but one's personal good.
- It refers to the goodness of oneself in the long run.
- Morality essentially needs a willingness on the part of both individuals and corporations to place some restriction on the pursuit of private self – interests.

CUTOMS AND RELIGION

- When we talk about customs and religions, it concerns with:

- 1. They are related historically
- 2. trust gives an inspiration to be moral
- 3. Motivating right action based on ethical principles
- 4. Helps us to set a higher moral standards.

Uses of Ethical Theories

- Identifying the moral considerations or reasons that constitute a dilemma.
- Provides a precise sense of information
- Rank the relevant moral considerations
- Helps to reach balanced and insightful judgements.

Engineering As Experimentation

Before manufacturing a product or providing a project, we make several assumptions and trials, design and redesign and test several times till the product is observed to be functioning satisfactorily. We try different materials and experiments.

Experimentation plays an important role in the process of designing the product.

Though it is not like an experiment in laboratory **under controlled conditions**, which is done by learning, an engineer should be ready to the same on social scale involving human subjects.

Engineering Projects v/s Standard Experiments

SIMILARITIES

- **Partial ignorance**: (rounding of some values). The project is usually executed in partial ignorance. Uncertainties exist in the model assumed. The behavior of materials purchased is uncertain and not constant.
- **Uncertainty**: The final outcomes of projects are also uncertain, as in experiments. Some times unintended results, side effects (bye-products), and unsafe operation have also occurred.

eg. Unexpected risks, such as undue seepage in a storage dam, leakage of nuclear radiation from an atomic power plant, presence of pesticides in food or soft drink bottle, an new irrigation canal spreading water-borne diseases, and an unsuspecting hair dryer causing lung cancer on the user from the asbestos gasket used in the product have been reported.

cont.,

- **Continuous monitoring**: Monitoring continually the progress and gaining new knowledge are needed before, during, and after execution of project as in the case of experimentation. The performance is to be monitored even during the use (or wrong use!) of the product by the end user/beneficiary.

- **Learning from the past**: Engineers normally learn from their own prior designs and infer from the analysis of operation and results, and sometimes from the reports of other engineers.

DIFFERENCES

- Experimental control – eng. experiements are not under controlled conditions.
- Humane touch – eg., medcial field
- Informed Consent - eg., at the time operations in hospitals
- Close observations

Engineering As Responsible Experimenters

- In the process of developing a product, an engineer generally learns through experimentation.

Responsibility of Engineers in Experimentation

1. conscientiousness (sense of awareness)
2. Comprehensive Perspective (moral ends)
3. Moral Autonomy
4. Accountability (moral Responsibility)

CONSCIENTIOUSNESS

- Being sensitive to full range of moral values and responsibilities relevant to the prevailing situation.
- The willingness to develop the skill and put the efforts needed to reach the best balance possible among those considerations. Engineers must possess open eyes(moral vision) ,open ears(moral listening), and an open mind(moral reasoning).
- Respect foremost the safety and health of the affected.
- The human rights of the participant should be protected through voluntary and informed consent

Cont.,

Comprehensive Perspective

- The Engineers should grasp the context of his work and ensure that the work involved results in only moral ends.

- One should not ignore his conscience, if the product or project that he is involved will result in damaging the nervous system of the people. (or even the enemy, in case of weapon development)

Cont.,

Moral Autonomy

- Moral autonomy means the ability to think critically and independently.

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

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

Cont.,

Accountability

(moral responsibility)

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

- Case:

A chemical plant near a small town is discharging hazardous wastes into the fields nearby. The ground water gets contaminated and significant health problems surface in the community. Since harm is caused to the residents, the action is unethical as per rights ethics. The agriculturists who have the agrarian right of water supply have been over looked. The pollutants may endanger their profession and welfare. Hence, rights ethics also concludes that the action is unethical. The effects of polluted water and the cost to purify the water by the municipality may out weigh the economic benefits of the plant. Hence, the utilitarian analysis leads to the same conclusion. The groundwater harms the people and caused health problems. Hence, discharging the pollutants is unethical as per duty ethics. Generally, because the rights of the individuals should weigh strongly than the needs of the society as a whole, rights and duty ethics take precedence over utilitarian considerations. Caution is necessary in applying theory of virtue ethics. When we use the word ‘honor’, we mean it to be a measure of dignity and integrity. It is a positive virtue. When it points to ‘pride’ it is not a virtue and has a negative connotation. History abounds with examples of war, which have been fought and atrocities were committed on innocent people in order to preserve the honor (pride) of an individual or a nation. In using virtue ethics, we have to ensure that the traits of virtue are actually virtuous and will not lead to negative consequences.

CODES OF ETHICS

The ‘codes of ethics’ exhibit, rights, duties, and obligations of the members of a profession and a professional society. The codes exhibit the following essential roles:

1. Inspiration and guidance.
2. Support to engineers.
3. Deterrence (discourage to act immorally)
4. Education and mutual understanding.
5. Create good public image.
6. Protect the status quo.
7. Promotes business interests

Limitations

- The codes are not remedy for all evils. They have many limitations, namely:

1. General and vague wordings. Many statements are general in nature and hence unable to solve all problems.

2. Not applicable to all situations. Codes are not sacred, and need not be accepted without criticism. Tolerance for criticisms of the codes themselves should be allowed.

3. Often have internal conflicts. Many times, the priorities are clearly spelt out, e.g., codes forbid public remarks critical of colleagues (engineers), but they actually discovered a major bribery, which might have caused a huge loss to the exchequer.

INDUSTRIAL STANDARDS

- Industrial standards are important for any industry. Specification helps in achieving interchangeability.
- Standardization reduces the production costs and at the same time, the quality is achieved easily. It helps the manufacturer, customers and the public, in keeping competitiveness and ensuring quality simultaneously.
- Industrial standards are established by the Bureau of Indian Standards, in our country in consultation with leading industries and services

example

- **ISO 22000 (Food Safety)**
- This standard is focused on the development and implementation of a food safety management system and can help any organization that works in the food chain. This family is used in a variety of organizations directly or indirectly involved with food. These include obvious choices such as restaurants of any kind, as well as food manufacturers, and food transportation services such as caterers.
- With over 26,000 certifications, ISO 22000:2005 is one of the more common standards. It can be applied on its own or integrated with ISO 9001. Competency Management allows organizations to comply with this standard. Businesses must meet all applicable food safety-related statutory and regulatory requirements. This standard provides a framework for organizations to develop, implement, monitor, and continually improve a food safety management system. It is critical to document these food safety management processes.

A BALANCED OUTLOOK ON LAW

- The ‘balanced outlook on law’ in engineering practice stresses the necessity of laws and regulations and also their limitations in directing and controlling the engineering practice.
- Laws are necessary because, people are not fully responsible by themselves and because of the competitive nature of the free enterprise, which does not encourage moral initiatives.
- Laws are needed to provide a minimum level of compliance.

- The following codes are typical examples of how they were enforced in the past:

1. Code for Builders by Hammurabi: Hummurabi the king of Babylon in 1758 framed the following code for the builders:

2. Steam Boat Code in USA: published his results as documents and later as law, which was made by ASME= American Society of Mechanical Engineering.

CASE STUDY:

- THE CHALLENGER
- 1 What happened?
- The orbiter of the Challenger had three main engines fuelled by liquid hydrogen. The fuel was carried in an external fuel tank which was jettisoned when empty. During lift-off, the main engines fire for about nine minutes, although initially the thrust was provided by the two booster rockets. These booster rockets are of the solid fuel type, each burning a million pound load of aluminum, potassium chloride, and iron oxide. The casing of each booster rocket is about 150 feet long and 12 feet in diameter. This consists of cylindrical segments that are assembled at the launch site. There are four-field joints and they use seals consisting of pairs of O-rings made of vulcanized rubber. The O-rings work with a putty barrier made of zinc chromate. The engineers were employed with Rockwell International (manufacturers for the orbiter and main rocket), Morton-Thiokol (maker of booster rockets), and they worked for NASA. After many postponements, the launch of Challenger was set for morning of Jan 28, 1986. Allan J. McDonald was an engineer from Morton-Thiokol and the director of the Solid Rocket Booster Project. He was skeptic about the freezing temperature conditions forecast for that morning, which was lower than the previous launch conditions. A teleconference between NASA engineers and MT engineers was arranged by Allan. Arnold Thompson and Roger Boisjoly, the seal experts at MT explained to the other engineers how the booster rocket walls would bulge upon launch and combustion gases can blow past the O-rings of the field joints

- On many of the previous flights the rings have been found to have charred and eroded. In freezing temperature, the rings and the putty packing are less pliable. From the past data gathered, at temperature less than 65 °F the O-rings failure was certain. But these data were not deliberated at that conference as the launch time was fast approaching. The engineering managers Bob Lund and Joe Kilminster agreed that there was a safety problem. Boisjoly testified and recommended that no launch should be attempted with temperature less than 53 °F. These managers were annoyed to postpone the launch yet again. The top management of MT was planning for the renewal of contract with NASA, for making booster rocket. The managers told Bob Lund “to take-off the engineering hat and put on your management hat”. The judgment of the engineers was not given weightage. The inability of these engineers to substantiate that the launch would be unsafe was taken by NASA as an approval by Rockwell to launch. At 11.38 a.m. the rockets along with Challenger rose up the sky. The cameras recorded smoke coming out of one of the filed joints on the right booster rocket. Soon there was a flame that hit the external fuel tank. At 76 seconds into the flight, the Challenger at a height of 10 miles was totally engulfed in a fireball. The crew cabin fell into the ocean killing all the seven aboard. Some of the factual issues, conceptual issues and moral/normative issues in the space shuttle challenger incident, are highlighted hereunder for further study

Questions based on the case study:

- 1. what is the exact role of engineers when safety issues are concerned?
- 2. who should have the ultimate authority for decision making to order for a launch?
- 3. whether the ordering of a launch be an engineering or a managerial decisions?