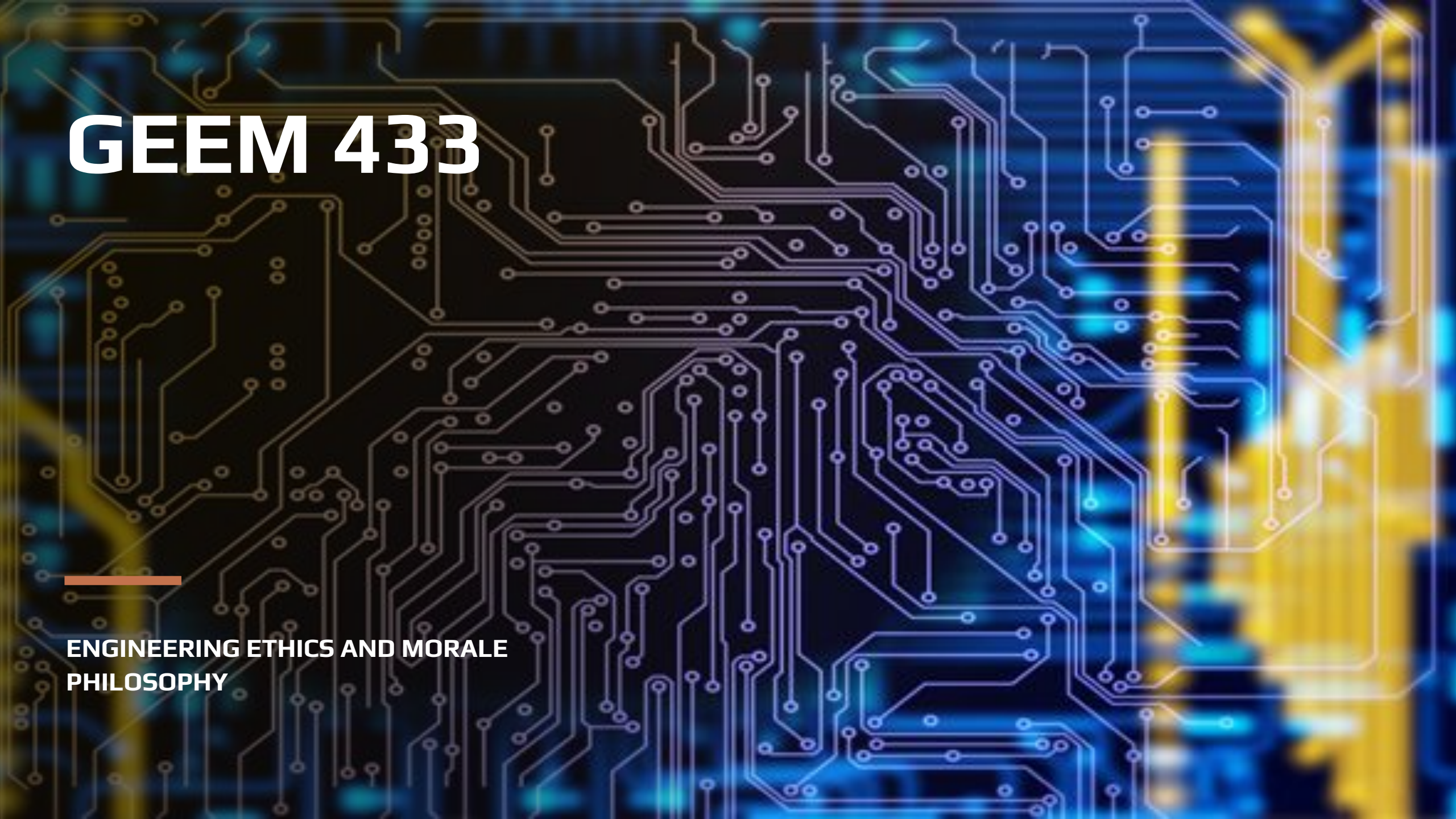

GEEM 433
ENGINEERING ETHICS AND MORALE
PHILOSOPHY

Marks Distribution at a glance

- Total Available Points:

- Class Tests:
- Midterm Exam:
- Final Exam:
- Case Studies:
- Group Presentation:

What will be covered in this course

Course Content

- **Engineering Ethics:** Introduction to Ethics; Theories of Ethics; Principles of Engineering Ethics; Ethical expectation: Employers and employees, Inter-professional relationship,
- **Standards and codes:** Fundamental Canons, NSPE (National Society of Professional Engineers) codes, IEEE codes of conduct, ACM codes; Institutionalization of ethical conduct. Ethical Dilemmas, Choices (Whistleblowing),
- **Computer Ethics:** Computer Crime and Cyber Security, Privacy and Confidentiality issues in CSE, Legal Framework in CSE-Copyright laws, ICT Act, Right To Information (RTI), Patents, and Royalty etc. Ethical Challenges for CSE Engineers with the Advancement of Technology;
- **Case studies** related to ethical issues in ICT and other Engineering disciplines.
- Introduction to **Philosophy of Engineering**, metaphysics, epistemology, axiology, and logic.

What will be covered in this course

- This course motivates engineers to perform under a standard of **professional behavior** that requires compliance to the **highest principles of ethical conduct** and **managing resources and decisions** effectively.
    - Part of professional ethics is the understanding of the ethics of other professions: how they interact and what can be expected from them as correct ethical behavior. It improves the profession, helps set better rules for the future, and shapes the way people think and act ethically.

Scenario:

- An engineering firm is hired to design a smart **healthcare monitoring system** in partnership with a hospital. The engineers must work closely with medical professionals and data privacy officers.

- Professional Behavior & Ethical Conduct?
- Outcome?

What will be covered in this course

Scenario:

- An engineering firm is hired to design a smart healthcare monitoring system in partnership with a hospital. The engineers must work closely with medical professionals and data privacy officers.

- Professional Behavior & Ethical Conduct:
  - The engineers ensure patient data is encrypted
  - They respect the doctors' ethical obligation
  - Avoid unethical vendors

- Outcome:

By understanding and respecting the ethics of the **medical profession**, the engineers contribute to a solution that is **technically sound**, **ethically responsible**, and **socially beneficial**.

What will be covered in this course

- **Objectives**

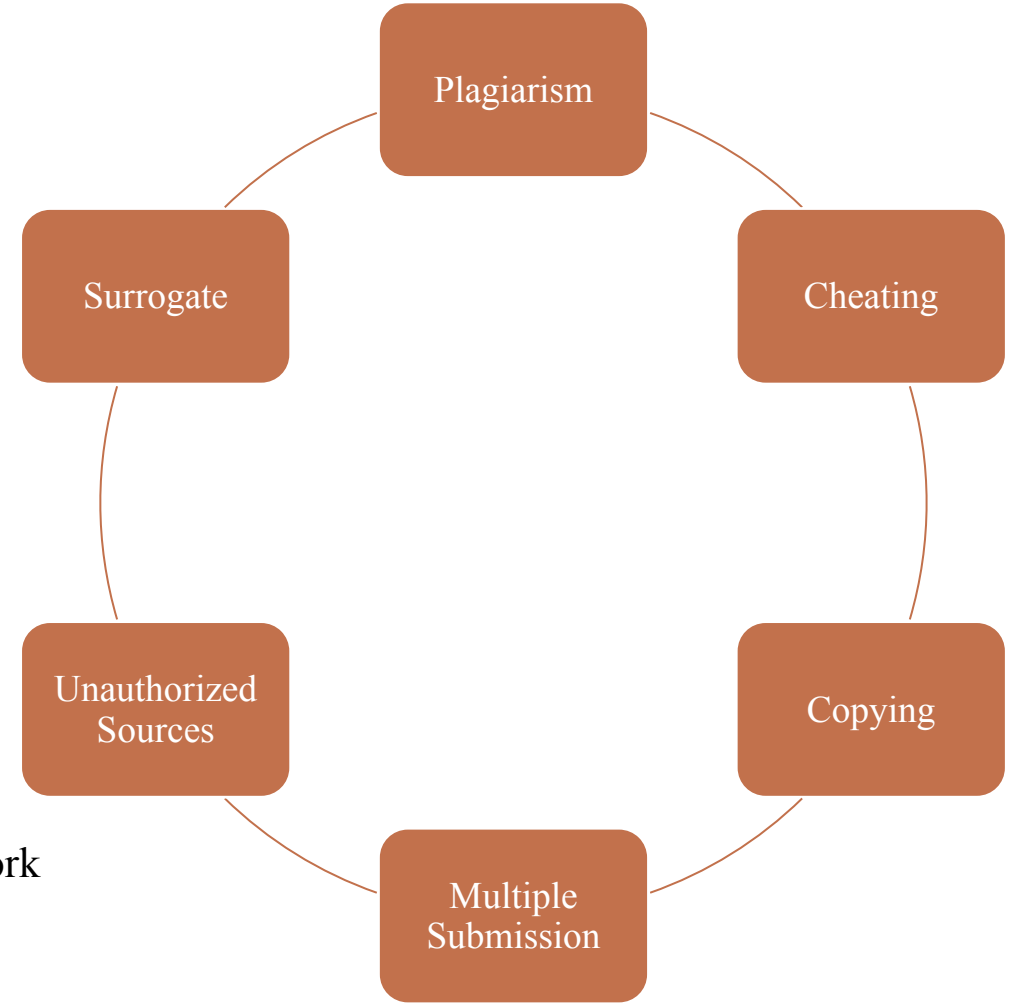
1. To develop a firm ethical base.
2. Understanding Legal Issues & Professional Development
3. Assessing Professional Conduct Codes
4. To identify and analyze practical legal problems commonly encountered in the computing industry.

What Does Ethics Mean?

- Ethics refers to the principles and values guiding individuals or groups in determining right or wrong, good or bad, just or unjust, virtue and vice. It helps people decide how to act in various situations, emphasizing fairness, respect, and responsibility.

Student Code of Ethics

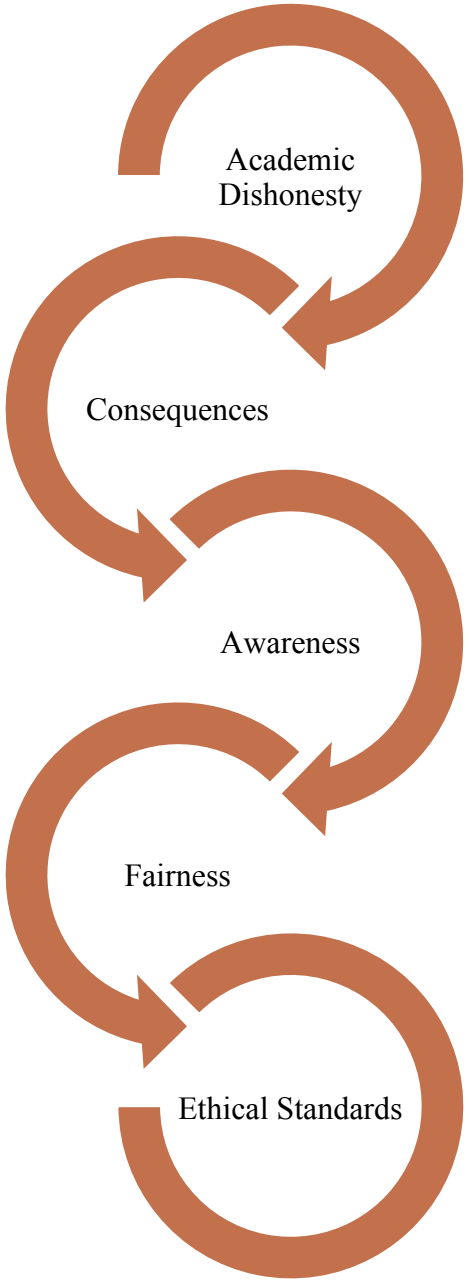
- **Plagiarism**
  Using someone else's words, code, or ideas **without credit**.
- **Cheating**
  Using **unauthorized help or resources** during exams or assignments.
- **Copying**
  Submitting work that was **copied from a classmate** or letting someone else copy yours.
- **Multiple Submission**
  Submitting the **same work for more than one course or assignment** without permission.
- **Unauthorized Sources**
  Using **external services or people** to complete your academic work without permission.
- **Surrogate**
  Having **someone else complete work or attend exams** on your behalf.



Student Code of Ethics

- What should we do to maintain the highest Ethical Standards?

- **Avoid Academic Dishonesty**
  Don't cheat, plagiarize, or use surrogates. Always submit your own original work.
- **Understand the Consequences**
  Violations can lead to failing grades, disciplinary action, or expulsion.
- **Raise Awareness**
  Know what counts as unethical behavior (e.g., copying code, unauthorized collaboration).
- **Practice Fairness**
  Treat others' work and efforts with respect. Don't gain an unfair advantage over classmates.
- **Uphold Ethical Standards**
  Follow your institution's code of conduct. Make ethical decisions even when no one is watching.



Ethics

- **Why do we need it?**

- Ensure harmony of the group while providing mutual benefits to the individual
- Basis for how we should treat others
- It overrides self-interests

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Moral Reasoning

- **Moral reasoning is the process of thinking carefully about what is right or wrong, fair or unfair, and good or bad in a situation — especially when it affects other people.**
- It's a way of **making decisions based on values** like:
  - ✔ **Justice** (Is it fair?)
  - ✔ **Equality** (Is everyone treated the same?)
  - ✔ **Freedom** (Are people free to choose?)
  - ✔ **Health and Safety** (Will this harm or help someone?)

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Moral Reasoning

Why It’s Important?

- Moral reasoning helps us:
  - ✔ Make **ethical choices**
  - ✔ Stand up for **what’s right**
  - ✔ Understand **consequences**
  - ✔ Become **responsible citizens or professionals**

Social Responsibility

- **Social Responsibility requires taking into consideration the needs of society.**
- **Engineers must consider designing, building, and marketing products that benefit society.**
- **One main connection between ethics and engineering comes from how engineering products and processes affect society and their impacts.**
- Ethics is about doing what's **right**, and engineering affects society—so ethical engineers must care about **people, safety, fairness, and the environment.**

Social Responsibility

- **Thinking Beyond the Project**
  Engineers must ask:
  - "Will this product be safe?"
  - "Is it environmentally friendly?"
  - "Does it help people or harm them?"
- **Examples of Social Responsibility in Engineering:**
  - **Designing energy-efficient buildings** to reduce environmental impact.
  - **Creating affordable medical devices** so more people can get treatment.
  - **Developing apps** that protect user privacy and data.

Ethics in Engineering

Ethics is part of engineering for two main reasons.

a) **Engineers need to be socially responsible when building products and processes for society.**

b) **Social responsibility requires professional responsibility through obligations and duties.**

Typical Ethical Issues Encountered

- Safety
- Acceptable risk
- Compliance
- Confidentiality
- Environmental health
- Data integrity
- Conflict of interest
- Honesty/Dishonesty
- Societal impact
- Fairness
- Accounting for uncertainty, etc.

Typical Ethical Issues Encountered

- **Safety**

  Ensuring systems or products do not harm users.

  → *Example*: An engineer refuses to approve a bridge design that doesn't meet load requirements.

- **Acceptable Risk**

  Balancing innovation with the risk it brings.

  → *Example*: Launching a self-driving car only after extensive safety testing.

- **Compliance**

  Following laws, regulations, and standards.

  → *Example*: A factory follows environmental laws to limit emissions.

- **Confidentiality**

  Protecting sensitive or private information.

  → *Example*: A software developer keeps user data secure and does not share it with advertisers.

Typical Ethical Issues Encountered

- **Environmental Health**
  Considering the impact of engineering activities on the environment.
  → *Example*: Using eco-friendly materials in construction projects.
- **Data Integrity**
  Ensuring data is accurate, secure, and not manipulated.
  → *Example*: A data analyst refuses to falsify research results under pressure.
- **Conflict of Interest**
  Avoiding situations where personal gain affects professional judgment.
  → *Example*: A government engineer steps aside from approving a project submitted by their brother's company to avoid a conflict of interest.
- **Honesty/Dishonesty**
  Being truthful in reporting, design, testing, and communication.
  → *Example*: Reporting flaws in a software system instead of hiding them.

Typical Ethical Issues Encountered

- **Societal Impact**

  Thinking about how a project affects society.

  → *Example*: Developing affordable water purification systems to improve public health in rural communities.

- **Fairness**

  Ensuring equal treatment and access for all.

  → *Example*: Developing AI algorithms that are fair to all demographic groups.

- **Accounting for Uncertainty**

  Being transparent about unknowns, risks, or limitations.

  → *Example*: Clearly communicating the limits of a predictive model to users.

Code of Ethics – Some thoughts!

- **It is not a legally binding document.**
- **It is not something that engineers need to memorize.**
- **It is something engineers should understand and live by in their works**
- **However, in the beginning knowing the code is a guide to understanding how to apply it.**

GEEM 433

Engineers: Professionals for the Human Good

ENGINEERING ETHICS AND MORALE PHILOSOPHY

Some Thoughts!

- **A person's profession is a part of personal identity.**
- **Engineering is a profession.**
- **Engineering codes and guidelines from leaders in the field require engineers to work for the public good. This means improving people's well-being, welfare, and quality of life through their work.**

  - ***Promoting the well-being of the public,*** not engaging in professionally prohibited actions, preventing harm to the public, and actively promoting the public's well-being.
  - ***In designing for well-being,*** engineers must keep in mind the social context of engineering and technology and the need for a critical attitude toward technology.

DRIVERLESS CARS!

It is easy to understand the advantages that driverless cars offer: reducing traffic collisions, providing better transportation for the elderly and disabled, lowering fuel consumption, and increasing traffic flow.

On the other hand, they raise many social, legal, and ethical questions. Perhaps the most obvious question is who should have responsibility for accidents.

The first fatal accident of a driverless car occurred in Williston, Florida, on May 7, 2016. A person in a Tesla driverless car was killed when a truck made a left turn in front of the car. The car went under the truck's trailer without braking, likely because neither the autopilot nor the driver saw the white side of the trailer against the bright sky.

DRIVERLESS CARS!

- **Where should moral responsibility and legal liability lie in this case?**

-> In this case, moral responsibility and legal liability are complex. Investigation revealed that the driver did not operate the Tesla according to the instructions and Tesla also did not have a system to check if the driver was ready to take over the control of the car when needed. There's also the question of how realistic it is to expect a driver to stay fully alert when an autopilot system is installed.

- **Liability and responsibility are not the only questions raised by driverless cars.**
  - **How safe are they?**
  - **What kinds of information should be given to drivers before they purchase or use these vehicles?**
  - **How should the potential problems of hacking and terrorism be handled? (To handle the risks of hacking and terrorism with driverless cars, strong security measures are needed.)**
  - **What about the potential loss of driving-related jobs? Should there be retraining for other jobs?**

Questions of Responsibility and Moral Issues

- Questions about responsibility aren't just related to driverless cars; they arise in engineering disasters like the Challenger and Columbia space shuttle accidents.
- There are important moral issues regarding how technology affects the environment and how engineers manage risks. These concerns matter to engineers not just because they design the technologies but also because being an engineer involves professionalism, which has a strong moral aspect.
- Engineers must think carefully about their responsibilities and the impact of their work on society and the environment.

The two components of professionalism are:

(1) expertise in a certain area (accounting, law, medicine, engineering, etc.) and

(2) adherence to moral guidelines, usually laid out in a formal code of ethics.

Failure in either of these areas means one is deficient as a professional.

Three Stages in the Development of Professional Identity

- **Independent Operator.** Professionalism is meeting fixed and clearly defined guidelines and expectations that are external to one's character.
- **Team-Oriented Idealist.** Rather than identifying professionalism with fixed rules and behaviors, professionalism is about meeting the expectations of other professionals, especially those who are admired.
- **Self-Defining Professional.** At this level, a person's values are fully mixed with their profession's values. Professionalism becomes part of who they are. This stage is often not fully achieved until mid-life.

What is a Profession?

- **The use of profess and related terms in the Middle Ages was associated with the public profession of a way of life that carried strict moral rules (religious and ethical duties).**
- **By the late seventeenth century, the term "profession" moved away from its religious meaning and became more secular. It started to describe people having right qualifications and skills to offer valuable services to others, such as doctors, lawyers, or teachers.**
- **Three approaches to professionalism are especially important in understanding the concept and can be useful in understanding professional identity:**
  - **Sociological Account**
  - **Social Contract Account**
  - **Morally Permissible Account - offered by philosopher Michael Davis.**

What is a Professionalism?

Sociological Account - Society gives professionals (like doctors, engineers, lawyers) special status because they serve the public with expert knowledge..

Social Contract Account - **Professionals have an unspoken agreement with society: "We give you trust, money, and respect — in return, you behave responsibly and work for the public good."**

- **On the one hand, professionals agree to attain a high degree of professional expertise, offer good service to the public, and follow ethical rules in their work.**
- **On the other hand, the public agrees to let professionals enjoy above-average wages, have social respect and prestige, and enjoy a considerable degree of freedom to regulate themselves.**
- **The idea of such an agreement creates a strong sense of responsibility on a professionals or a developing professional**

Morally Permissible - **A profession is a group of individuals working in the same field who voluntarily choose to serve the public by pursuing a morally desirable goal, such as helping others or promoting the public good. Davis' definition emphasizes that a profession consists of more than one person and includes a public element, serving as a way for people to earn a living and occupy their working hours. People enter the profession willingly, and it focuses on achieving a morally beneficial goal, such as curing the sick or promoting the well-being of society.**

Characteristics of a Profession

- **Extensive Training: Requires a significant period of intellectual training, usually obtained at a college or university.**
- **Specialized Knowledge: Professionals possess knowledge and skills essential for the well-being of society.**
- **Monopoly on Services: Only qualified individuals can offer certain professional services, and they control how others can enter the field and get trained.**
- **Workplace Autonomy:** Professionals take decisions based on their judgment, not just based on orders from others**.**
- **Ethical Standard: A set of rules about right and wrong, usually written in code of ethics, to ensure public well-being.**

Engineering as a Profession

Engineering is clearly a profession by all three accounts.

- First consider the Sociological Account.
- Extensive Training: Becoming an engineer requires high level of training in the college or university.
- Specialized Knowledge: Possessing knowledge and skills is vital for engineers for the well-being of society.
- Monopoly on Services: The engineering profession does not have complete control over the practice of engineering, because, in some countries, such as the United States, one does not have to be a registered professional engineer (PE) in order to practice engineering.
- Workplace Autonomy: Engineers often have more autonomy in the workplace than many non-professionals.
- Ethical Standards: Engineers have ethical codes that ensure public safety, sustainability, and ethical practices.

Engineering as a Profession

Engineering is clearly a profession by all three accounts.

Social Contract Account

- Engineers are highly skilled professionals who provide competent services. While engineers have ethical codes to follow, losing their Professional Engineer (PE) registration for unethical behavior doesn't necessarily stop them from working in their field. Unlike other professions where losing a license means you can't practice, many engineers aren't required to be licensed to continue their work.
- However, engineers still enjoy high wages and significant social status as part of the benefits of their profession.

GEEM 433

Engineers: Professionals for the Human Good

ENGINEERING ETHICS AND MORALE PHILOSOPHY

What is the Public Good?

- "Engineers should hold paramount the **safety, health, and welfare of the public**, as the NSPE code states. Probably, the most fundamental term here and certainly the most ambiguous and controversial is **welfare.**"

  - The term welfare appears to have several equivalents in engineering codes, such as **well-being and quality of life.**

    - The Preamble (introduction) to the NSPE code says that **"engineering has a direct and vital impact on the quality of life for all people.** The code of the Association for Computing Machinery obligates (compulsory) its members to "**contribute to society and human well-being**."

What is the Public Good? Cont'd

Code of the American Society of Civil Engineers affirms that engineers should utilize **"their knowledge and skill for the enhancement of human welfare and the environment".**

Finally, part of the introductory statement of the code of the Institute of Electrical and Electronics Engineers states that its members recognize **"the importance of our technologies in affecting the quality of life throughout the world".**

> Assuming the equivalence of these terms, we shall take well-being as our term of choice and say that **promoting the well-being of the public is the primary responsibility of the engineering profession**

So, what is Well-being?

No doubt, engineers have always assumed that their work contributes to the human good or what we have now called human well-being. But, until recently, little explicit(clear) consideration has been given to this goal. It is even conceivable(understandable) that engineers may one day be asked in some formal way to determine the well-being impact of their work, just as they now are often asked to determine the environmental impact.

The mandate(command) to engineers to promote human well-being or quality of life in their professional work is clear, but more guidance about the nature of well-being is needed.

Well-being - Psychologist Martin Seligman

Five elements of well-being include:

1. **Positive emotion,**
2. **Enjoyment of activities in which one can be absorbed,**
3. **Connection to something larger than oneself,**
4. **Accomplishment in projects or work, and**
5. **Positive relationships.**

These elements are closely related to the concept of happiness.

These ideas, however, may be somewhat difficult to relate to engineering. One possible way around this issue which may sometimes be useful is to take advantage of the widely discussed Capabilities Approach (CA).

Two important developers in economics Amartya Sen and philosopher Martha Nussbaum. According to Sen and Nussbaum,

- **We do not have to determine what well-being is, but rather step back a little and ask what conditions are necessary for the realization of some of the most commonly recognized elements of well-being, regardless of how individuals or even experts may define it.**

extra

- **Positive emotion** – Experiencing feelings like joy, gratitude, and optimism.
- **Enjoyment of activities** – Engaging in activities that allow deep focus and absorption.
- **Connection to something larger** – Feeling a sense of purpose or belonging to a greater cause.
- **Accomplishment** – Achieving goals or succeeding in work and personal projects.
- **Positive relationships** – Building meaningful and supportive relationships with others.

Well-being & Engineering

Astronaut Neil explained - Even though each of us may have our own concept of what comprises quality of life, we can probably agree that certain living conditions are essential to a preferred quality in our own lives.

If we look at the capabilities suggested by CA(Capabilities approach) writers that are most closely related to engineering, we get a clue what some of these living conditions might be:

- **Having food, shelter, and water,**
- **Having satisfying human relationships (communication, the Internet),**
- **Having free movement and expression (highways, air travel, the Internet, telephone, etc.), and**
- **Having a satisfactory relationship to the natural world (environmental preservation).**

Promoting Well-being – Prohibited Actions

Many rules in ordinary or nonprofessional ethics identify what we should not do. For example, ethical guidelines prohibit actions like dishonesty, stealing, and murder. Prohibitions are a prominent part of professional ethics, including engineering ethics. Approximately 80 percent NSPE code consists of rules that clearly or indirectly tell us what we should not do.

Examples of Prohibited Actions from the NSPE Code(next page)

Examples of Prohibited Actions from the NSPE Code

- **Do not reveal privileged information (II,1,c)**
- **Do not associate with dishonest professionals (II,1,d)**
- **Do not aid the unlawful practice of engineering (II,1,e)**
- **Do not accept compensation from two parties on the same project (II,4,b)**
- **Do not participate in governmental decisions related to your own work (II,4,d)**
- **Do not solicit work from a governmental body on which a member of your firm has a position (II,4,e)**
- **Do not falsify your qualifications (II,5,a)**
- **Do not give bribes (II,5,b)**
- **Do not be influenced by conflicting interests (III,5)**
- **Do not unjustly injure the reputation of another engineer (III,7)**

Conform-
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Promoting Well-being – Prohibited Actions

Many parts of the NSPE code don't seem negative at first but actually focus on setting limits and rules.

Section II.1.b states that engineers shall approve only those engineering documents that conform with applicable standards. In other words, engineers shall not approve engineering documents that are not in conformity with applicable standards.

However, this doesn't imply that engineers must approve every document that does meet the standards. There are likely additional criteria that must also be met for an engineering document to be approved.

Promoting Well-being – Prohibited Actions

There are several good reasons for the prohibitive(strict) tone of the NSPE code and many other engineering codes.

- **First, it makes sense that professionals, like engineers, should prioritize not harming others. It's important to avoid causing harm before trying to do good.**
- **Second, these codes are mostly written as clear rules that can be enforced through penalties by professional organizations or even the law. It's easier to enforce rules that specify what not to do rather than rules that ask for more open-ended and positive actions.**
- **For example, a rule that tells engineers to avoid conflicts of interest is much easier to enforce than a broader requirement like ensuring the safety, health, and welfare of the public.**

Extra -2nd point

•**Clear Rules are Easier to Enforce:** If a rule clearly states that engineers should not have conflicts of interest, it's straightforward to check if an engineer has followed this rule. For example, if an engineer is found to have accepted money from a company while also working on a project for that company, it's clear that they broke the rule.

•**More Open-Ended Requirements are Harder to Enforce:** On the other hand, if a rule says engineers should "prioritize public safety," it's much harder to measure if they are actually doing this. There are many ways to interpret what "prioritizing public safety" means, making it tricky to decide if an engineer has followed the rule or not.

Prohibited Actions as Prerequisite for well-being

Protection from harmful actions is an essential prerequisite for well-being, no matter how it is defined. Taking just three examples-

(1) **If engineers are dishonest, they can mislead clients.**

(2) **If engineers have their professional judgment corrupted by conflicts of interest, they may make biased decisions.**

(3) **If engineers do professionally incompetent work, it can lead to failures or accidents.**

In all these cases, clients or employers suffer because they don't receive honest, fair, and competent advice. This reduces their ability to use engineering services to achieve their goals.

Overall, when engineers avoid these harmful actions, it helps improve the well-being of the public.

Promoting Well-being – Preventing Harm to the Public

Engineers are obligated not only to abide by code prohibitions to avoid causing harm but also to actively prevent harm caused by technology or by other engineers in some situations.

Prevention of harm usually involves:

(1) identifying and disclosing potential harms and

(2) attempting to prevent them.

These actions, while mostly about stopping harm, also have a positive position. They often involve courage and require effort to stand up and prevent harm to the public. In any case, they both protect and promote well-being.

Promoting Well-being – Preventing Harm to the Public

Different engineering codes explain the duty to prevent harm in different ways. Some are more specific. For example, **Canon 1** of the **IEEE Code of Ethics** clearly says:

- Engineers must take **responsibility** for decisions that affect public **safety, health, and welfare**.
- They must also **quickly disclose** (inform) if they find any **risks** that could harm people or the environment.

This means engineers cannot ignore or hide dangers. They have a duty to act honestly and responsibly to prevent harm.

Promoting Well-being – Preventing Harm to the Public (Case 82-5)

The NSPE's Board of Ethical Review appeared to recognize the category of preventive action in its decision on case 82-5, which was submitted by one of its members. In this case, an engineer was terminated because he repeatedly protested his employer's actions, believing the employer was wasting taxpayer money on a defence contract. The Board cited section II.1.a. of the NSPE code operative at that time, which reads:

Engineers shall at all times recognize that their primary obligation is to protect the safety, health, property and welfare of the public. If their professional judgment is overruled, under circumstances where the safety, health, property, or welfare of the public are endangered, they shall notify their employer or client and such other authority as may be appropriate.

The Board also cited section III.2.b of the code at the time, which stated that Engineers shall not complete, sign, or approve plans or specifications that are unsafe for public health and welfare, or that do not meet accepted 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.

Extra

HERE'S AN EXAMPLE TO ILLUSTRATE THIS PROVISION:

AN ENGINEER IS WORKING ON THE DESIGN OF A BRIDGE, AND DURING THE PROJECT, THEY DISCOVER THAT A KEY SAFETY FEATURE IS BEING IGNORED TO CUT COSTS. THE ENGINEER RECOMMENDS INCLUDING THE SAFETY FEATURE, BUT THEIR SUGGESTION IS OVERRULED BY THEIR EMPLOYER, WHO WANTS TO PROCEED WITHOUT IT TO SAVE MONEY.

ACCORDING TO THE CODE, IF THE ENGINEER BELIEVES THAT THIS DECISION ENDANGERS LIVES OR PROPERTY, THEY ARE OBLIGATED TO NOTIFY THEIR EMPLOYER. IF THE EMPLOYER IGNORES THE CONCERN, THE ENGINEER SHOULD INFORM A HIGHER AUTHORITY, SUCH AS A GOVERNMENT SAFETY AGENCY OR A PROFESSIONAL BODY, TO ENSURE THE PUBLIC'S SAFETY IS NOT COMPROMISED.

THIS RULE ENSURES THAT ENGINEERS HAVE A DUTY TO ACT IF THEIR PROFESSIONAL JUDGMENT IS IGNORED IN A WAY THAT COULD CAUSE HARM.

Promoting Well-being – Preventing Harm to the Public

The NSPE Code of Ethics has two important rules:

- Engineers must avoid harming the public.
- They should also actively try to prevent harm, when possible.

In **Case 82-5**, an engineer protested their employer's actions, believing they were wasting public money. The **Board of Ethical Review** said:

- The engineer had the **moral right** to protest, based on their personal values.
- But after the engineer informed the proper authorities, they were **not required** to keep protesting or fighting the employer.

This means, engineers should speak up when they see something wrong, but they are **not expected to keep fighting forever**, especially after they have done their duty by reporting the issue.

Promoting Well-being – Preventing Harm to the Public

One of the practical reasons behind this idea is that **continuing to protest** could lead to personal risks for the engineer, like:

- Losing their job (getting fired)
- Damaging their career
- Facing workplace pressure or harassment

The **NSPE Code of Ethics** recognizes this reality. It says the engineer's **duty** is to raise concerns and inform the proper authorities if public safety, health, or welfare is at risk. After that, if they continue to protest, it is based on their **personal choice or moral conscience**, not a strict professional obligation.

Promoting Well-being –Aspirational Ethics

Although engineering codes of ethics place great emphasis on the importance of refraining from certain kinds of behavior (prohibited actions) and engaging in behavior that prevents harm, such provisions do not adequately capture the more positive aspects of engineering.

We call this more positive component of engineering ethics 'aspirational ethics'. Aspirational ethics are about doing more than the minimum required. They encourage engineers to actively improve human well-being, even when it's not specifically required by the rules. Some of these actions are necessary because the codes say so, but others go beyond what's expected. In the next chapter, these extra actions will be called 'supererogatory', meaning they are good to do but not required.

Aspirational ethics ask professionals to exceed the minimum standards of practice and behave in ways that cannot be enforced or covered by codes of conduct. This higher level of ethical behavior is related to moral values and virtues, and it entails more reflection and discussion than mandates(commands) and prohibitions.

GEEM 433

Engineers: Professionals for the Human Good

ENGINEERING ETHICS AND MORALE PHILOSOPHY

Designing for Well-being – Social Context

The primary way in which engineers improve well-being is through design. In designing for well-being, engineers must keep many things in mind.

Two important themes that should govern design:

1. Technology functions in a social context and
2. Engineers must adopt a critical attitude toward technology.

Technologies always function in a social context, and in this context, they have consequences for good or ill.

Another way to state this same idea is to say that engineering is a type of social experimentation.

Engineering innovations whether consumer products, bridges, or buildings are tested on members of the public.

Think again about the autonomous car. Whether this innovation will promote well being, all things considered, can be known only after it is placed in the social context in which it will function.

Designing for Well-being – Social Context

The autonomous car clearly has many advantages, but it also raises some serious issues.

Whether the advantages will outweigh the disadvantages can only be determined by performing the social experiment of immersing the car in its social context, which is composed of physical objects and tools, knowledge, inventors, operators, repair people, managers, government regulators, and the like.

The social context and technology comprises a two-way causal relationship:

- technology affects society and
- the social context influences the development of technology.

Affect of Technology

Technology affects our behavior in many ways.

- Speed bumps, for example, virtually force us to drive more slowly. The invention of the printing press had an enormous impact on European civilization and was a major factor in the Protestant Reformation.
- It is difficult to deny the effects of the development of the technology of warfare on the conduct of warfare itself.
- Technology also obviously affects the jobs we hold. Some jobs have been diminished in numbers due to technology, such as jobs for bank tellers and travel agents. Others have been created, such as computer programmers.

Affect of Technology

Technology has also affected our social relationships in many ways, sometimes affecting people of different generations differently.

- For many young people, the elapse of several hours with no cell phone call or text message prompts them to wonder whether their friends still care about them, but for many of an older generation, the absence of such communications is a welcome relief.
- Regular use of social networking sites such as Facebook, MySpace, and Bebo almost certainly has an effect on human relationships.
- As is often the case, the technologies probably affect even our definitions of crucial terms in this case, what it means to have a friendship or relationship.

Affect of Social Context in Technology

Social forces also direct the development of technology. One way to understand this is acquainting ourselves with the rapidly growing field of Science and Technology Studies (STS), a discipline created by sociologists, historians, and philosophers. Detailed investigations of technology have shown that there are usually several workable solutions to a technical problem and that social and value factors often determine which solution is adopted.

STS researchers have found that even concepts that are usually thought to have a purely technical definition often have a social and value dimension.

- For example, what constitutes effective functioning or efficiency especially important terms in technology is not determined wholly by technical considerations, but also in part by social considerations.
- In engineering, the efficiency of a device is taken to be a purely quantitative ratio of energy input and energy output. However, in practice, whether a device is considered to work well is a product of the character and interests of a user group.

Affect of Social Context in Technology

Child labor was in some ways more efficient than the use of adults, but when it was decided that the use of child labor was immoral, children were no longer taken into account as a possible source of more efficient labor.

The use of child labor was no longer considered in determining efficiency. Instead, children were redefined as learners and consumers, not laborers. These so-called technical concepts, then, have a social dimension.

Many design standards that were once controversial no longer are, and design standards already incorporate many safety and environmental considerations that probably cannot be justified economically or even by a consideration of trade-offs.

Society has simply made certain decisions that are no longer in dispute. They become part of the definition of what it means to design a product, such as an automobile.

Adopting a Critical Attitude towards Technology

The truth lies between technological optimism and pessimism.

- Creators of technology must recognize that technology can have both desirable and undesirable aspects, and that designers should try to maximize the desirable aspects and minimize the undesirable aspects. This requires a critical attitude toward technology.
- Consider the example of social networking, where the critical attitude is needed. Philosopher Shannon Vallor recognizes the psychological and informational value of social networking sites for people with serious illnesses, for victims of violent crime, or those suffering and alienated in other ways.
- However, she raises concerns about the influence of these same technologies on what she calls the communicative virtues, especially in their early development in young people. These virtues include patience, honesty, empathy, fidelity, reciprocity, and tolerance, and they are the ones necessary, she thinks, for the development of effective and satisfying interpersonal relationships. She worries that the Internet may not be conducive to the development of such virtues.

Critical Attitude - Vallor

Vallor focuses on three of the communicative virtues.

- Patience is an important virtue for sustaining close relationships. One must be willing to remain in communication with a friend, even when it may sometimes be boring or irritating to do so; but on the Internet, we can always say gotta run or just click the person off.
- Honesty in personal relationships is the willingness to offer ones authentic self in relationship with another, but social networking sites offer opportunities for massive misrepresentation of oneself, which is incompatible with genuine friendship.
- Finally, empathy or compassion, although crucial for genuine relationships, usually requires an encounter with the embodied presence of another person, enabling us to see bodily expressions of pain, anger, disgust, or caring.
- The best expressions of sympathy and compassion may be physical touching and embrace, none of which is possible in online relationships.

Critical Attitude - Vallor

The answer to the problems posed by social media is neither to get rid of them nor to view them uncritically.

- Some way must be found, Vallor believes, to minimize these negative effects while preserving the undoubted benefits.
- It is up to the creators of technology and others to solve this problem.
- Whether or not Vallors concerns are well founded and only empirical research can determine this it is reasonable to suppose that social networking technology has affected interpersonal relationships in some way

GEEM 433

Engineers: Professionals for the Human Good

ENGINEERING ETHICS AND MORALE PHILOSOPHY

A Case for Consideration – Cadavers vs. Mannequins

IN 1993, IT WAS PUBLICLY REVEALED that

- Germanys Heidelberg University had in the past **used more than 200 cadavers, including those of 8 children, in automobile crash tests.** This revelation(উন্মোচন) drew immediate protests in Germany.

Rudolph Hammerschmidt, spokesperson for the Roman Catholic Bishops Conference, objected.

- “Even the dead possess human dignity. This research should be done with mannequins”, he said.

ADAC, Germanys largest automobile club, issued a statement saying, In an age when experiments on animals are being put into question, such tests must be carried out on dummies and not on children cadavers.

A Case for Consideration - Cadavers vs. Mannequins

Similar testing has also been conducted in the United States at Wayne States Bio Engineering Center.

Robert Wartner, a Wayne State spokesperson, indicated that the testing has been done as a part of a study by the federal government's Centers for Disease Control.

However, he added, "**Cadavers are used only when alternatives cannot produce useful safety research".**

Clarence Ditlow, head of the Center for Auto Safety, a Washington, DC, public advocacy group, said that **the center advocates three criteria for using cadavers in crash testing:**

(1) **assurance that the data sought by the tests cannot be gained from using dummies,**

(2) **prior consent by the deceased person, and**

(3) **informed consent of the family.**

A Case for Consideration – Moral vs. Social Issues

This case illustrates how technology raises important moral and social issues. Here, we can see a conflict between the **safety and well-being of the public,** which apparently can be enhanced by the use of cadavers, and concerns about the **dignity** of the cadaver.

These moral considerations correspond to two different and sometimes conflicting moral approaches. If we take the code of the National Society of Professional Engineers (NSPE) as representative of other engineering codes, it is clear that simply referring to a professional code is not sufficient to resolve some issues in engineering.

- To be sure, the first Fundamental Canon of the NSPE code says that **engineers must hold paramount the safety, health, and welfare of the public.**
- But **does this directive imply that cadavers should be used for crash testing, or does the consideration of human dignity (rarely mentioned in engineering codes) override considerations of health, welfare, and safety in this case?**

Ethics Toolkit & Moral Problem

In addressing many issues in engineering ethics, we need ethical resources or methods to supplement the codes.

These methods should be thought of as analogous to tools in a toolbox.

- Carpenters have many tools at their disposal: hammers, screwdrivers, saws, and so forth. For some tasks, a hammer is appropriate, for others, a screwdriver, and for others, the saw.
- **The carpenter must learn which tools are appropriate for a given task, and this knowledge comes only with experience.**
- We begin with tools for analyzing a moral problem into its **components**. **Most moral problems contain one or more of the following components.**

Tools for analyzing Moral Problems

Most moral problems contain one or more of the following components.

Components:

- **Determining the Facts – Factual Issues**
- **Clarifying the Concepts – Conceptual Issues**
- **Determining How Concepts Apply – Application Issues**

Components of Moral Problem

- **Factual Issues**. Questions about what actually happened — the facts we need to know in order to **understand the situation and make a decision**.
- Conceptual Issues. Questions about the meanings **of terms** relevant to the resolution of a moral problem.
- **Application Issues**. Questions about whether and how a term applies in a situation.
- **Moral Issues**. These are questions about what is morally right or wrong, based on balancing values or principles.

Determining the Facts – Factual Issues

We cannot discuss a moral problem intelligently apart from a knowledge of the facts that bear on the problem.

- We have designated questions about what the facts are as factual issues.
- We might think that the facts of a situation are always beyond dispute, but this is often not the case.

3 Claims About Factual Issues:

1. **Disagreements over facts: many apparent moral disagreements turn out to be disagreements over the relevant facts.**
2. **Difficulty in resolving facts: factual issues are sometimes very difficult to resolve.**
3. **Making decisions despite uncertainty: sometimes we must make decisions about important moral issues, even though some of the relevant factual issues cannot be resolved**

Determining the Facts – 3 Claims of Factual Issues

First, many apparent moral disagreements turn out to be disagreements over the relevant facts. Many people (although certainly not all) would agree that if vital information can be gained only by the use of cadavers, then cadavers should be used, but people might legitimately disagree over whether cadavers are really necessary.

Second, factual issues are sometimes very difficult to resolve. In this case, for example, it may be difficult or even impossible to determine with certainty whether **using information from testing cadavers produces a significant decrease in accidents**, as opposed to using information from other sources, such as computer simulations or testing with dummies.

Third, sometimes we must make decisions about important moral issues, even though some of the relevant factual issues cannot be resolved. Suppose there is simply no way to confirm or deny the claim that cadaver testing results in a higher level of safety. How shall we decide what to do? Should we put greater emphasis on respecting the bodies of dead humans or obtaining data that may save lives? In this case, the controversy shifts to a more direct consideration of moral issues.

Clarifying the Concepts – Conceptual Issues

Responsible moral thinking requires not only attending carefully to facts but also having a good grasp of the key concepts we are using.

- That is, **we need to get as clear as we can about the meanings of key terms.**

For example, public health, safety, welfare, conflict of interest, bribery, extortion, confidentiality, trade secrets, and loyalty are key terms for ethics in engineering, but their meanings are not always obvious.

We call questions about the meanings of terms conceptual issues.

Regarding the meanings of terms conceptual issues,

- **if people disagree about the meanings of such terms, they may be unable to resolve arguments** which make reference to them, even if they agree about all of the facts and moral assumptions.

For example, an engineer's action might be a conflict of interest according to one definition of the term, but not a conflict of interest by another definition of the same term.

Clarifying the Concepts – Conceptual Issues

It would be desirable to have precise definitions of disputed terms;

- but like most terms in ethics, their meanings are somewhat **open-ended.**

In many cases, it is sufficient to clarify our meaning by **thinking of paradigms, or clear-cut examples, of what we have in mind.**

We might, for example, think of an uncontroversial case of a conflict of interest, such as an engineer specifying bolts from a company he owns, even though the bolts are the most expensive and lowest quality on the market.

- From this example, we can draw out a definition of a **conflict of interest**: a situation involving a conflict between a **professional obligation** (e.g., specifying the best product at the best price) and a **private interest** (e.g., promoting the interests of a firm one owns).

Determining How Concepts Apply – Application Issues

When we say that the use of cadavers in crash testing violates human dignity,

- we are saying that the concept of respecting human dignity cannot be correctly applied to the practice of using cadavers for crash testing.

This is a claim about an application issue, that is, a claim about

- whether a given term or expression applies to an individual action or
- a general practice.

Determining How Concepts Apply – Application Issues

Since application issues have to do with whether a concept applies to or fits a situation, disagreements over application issues can occur when there is disagreement over:

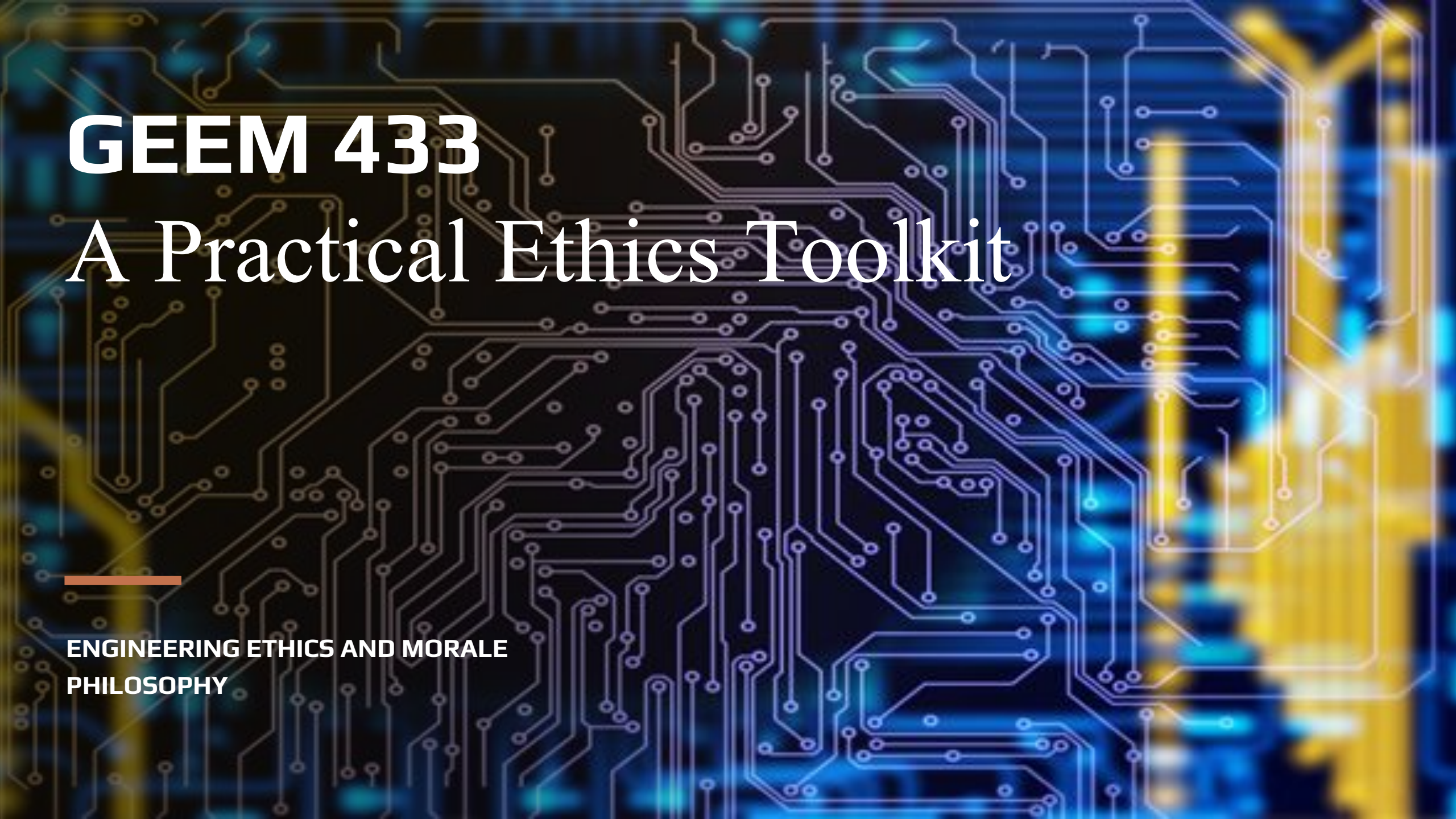
(1) the meaning of the concept to be applied (**conceptual issue**),

(2) the facts to which the concept is to be applied (**factual issue**), or

(3) whether the concept applies in the situation **(application issue**).

In this case,

1. A factual issue is whether cadavers are necessary to obtain some types of information relevant to auto safety.
2. Conceptual issue is how we should define human dignity.
3. An application issue is the question whether using cadavers for testing can be considered an example of respecting human dignity



GEEM 433
A Practical Ethics Toolkit

ENGINEERING ETHICS AND MORALE PHILOSOPHY

A Case for Consideration – CONFLICTING VALUES: CREATIVE MIDDLE-WAY SOLUTIONS

Review Case Scenario.

Common Morality

We have seen that the work of the practical ethicist is analogous to the work of a carpenter who uses whatever tools are appropriate to the task at hand.

- A hammer is sometimes appropriate, but at other times, the carpenter needs a saw or a screwdriver.
- Like a skilled carpenter, the practical ethicist must have a command of all of the available tools and use whatever is appropriate for the situation.
- In order to resolve some moral issues especially those involving larger social policies we must look more deeply into the **moral ideas** that lie at the basis of our **moral judgments**.

The most obvious place to look is the stock of **common moral beliefs** which most people in our culture, and perhaps people generally, accept. **We call this set of beliefs common morality.** Several summary accounts of the basic precepts of common morality exist; as you might expect, they are similar.

Ross's Prima Facie Duties

The first account is by philosopher W. D. Ross, who constructed a list of **basic duties or obligations**, which he called **prima facie (at first sight, or before closer inspection)** duties. In using these terms, Ross intended to convey the idea that although any given duty is usually obligatory, it can be overridden by another duty in special circumstances. He disclaimed finality for his list, but he believed it was reasonably complete.

R1. Duties resting on previous acts: (a) Duties of fidelity (to keep promises and not to tell lies), (b) Duties of reparation for wrong done.

R2. Duties of gratitude (e.g., to parents and benefactors)

R3. Duties of justice (e.g., to support happiness in proportion to merit)

R4. Duties of beneficence (to improve the condition of others)

R5. Duties of self-improvement

R6. Duties not to injure others

Ross’s Prima Facie Duties

Which of the following best describes a *prima facie duty* according to W.D. Ross?

A. A duty that is always more important than any other duty.

B. A law that must be followed regardless of circumstances.

C. A duty that only applies in emergencies.

D. A moral rule that applies unless it is overridden by a stronger moral obligation in a particular situation.

Ross's Prima Facie Duties

Engineers, like others, probably share these moral beliefs, and many of them are reflected in engineering codes of ethics.

Most codes enjoin engineers to be **faithful agents of their employees**, and this injunction is reflected in the duties of **fidelity (R1) and gratitude (R2).**

Most codes require engineers to act in ways that protect the **health, safety, and welfare of the public**, and this obligation is reflected in the **duties of justice (R3) and beneficence (R4)**, and especially in the **duty not to injure others (R6).**

Finally, most codes encourage engineers to **improve their professional skills, a duty reflected in R5.**

Ross’s Prima Facie Duties

1. Which two of Ross’s duties are reflected when engineers act honestly and loyally toward their employers?

A. Justice and Beneficence
B. Fidelity and Gratitude
C. Self-improvement and Justice
D. Beneficence and Non-maleficence

2. When an engineer works to protect the health and safety of the public, which duties are being followed?

A. Gratitude and Self-improvement
B. Fidelity and Reparation
C. Justice, Beneficence, and Non-maleficence
D. Fidelity and Beneficence

Ross’s Prima Facie Duties

3. What duty is reflected when engineers try to improve their professional skills?

A. Reparation
B. Gratitude
C. Justice
D. Self-improvement

4. Which of the following is an example of the duty of non-maleficence in engineering?

A. Being loyal to your company
B. Saying thank you to your team
C. Studying a new programming language
D. Designing a system that avoids harming users

Four (04) Types of Moral Judgments (From the standpoint of Common Morality)

1. **Permissible –** One is morally permitted, but not morally required, to perform an action. An engineer might decide to take a job with Company X rather than Company Y, but both actions are permissible. It would also be permissible to take neither job.
2. **Impermissible –** An action that one is morally required not to do. An engineer must not be a part of an undisclosed conflict of interest.
3. **Obligatory –** An action one is morally required to do. An engineer must disclose an actual or a potential conflict of interest.
4. **Supererogatory –** An action that is praiseworthy if one does it but not morally required. An engineer designs a parking lot for a nonprofit organization without charging a fee. Sometimes we call these actions ones that go above and beyond the call of duty.

Moral Statements can usefully be divided into three levels of generality

1. **Particular Actions** – Judgments about the moral acceptability or unacceptability of **an action**. Engineer Mike should not have specified bolts made by a firm in which he has a vested interest.

2. **General Practices or Classes of Actions** – Judgments about the moral acceptability or unacceptability of more general **types of action**. Engineers should never engage in undisclosed conflicts of interest. The duties of Ross and the rules of Gert fall into this category.

3. **Very General Moral Principles or Criteria –** Statements that provide criteria for determining whether any action or class of actions is right or wrong. Actions are right in so far as they promote utility or human well-being.

Approaches to Moral Thinking (Micheal Davis)

Harm Test - Does this option do less harm than any available alternative?

Publicity Test - Would I want my choice of this option published in the newspaper?

Defensibility Test - Could I defend my choice of this option before a Congressional committee, a committee of my peers, or my parents?

Reversibility Test - Would I still think my choice of this option is good if I were one of those adversely affected by it?

Virtue Test - What kind of person would I become if I chose this option often?

Professional Test - What would my professions ethics committee say about this option?

Colleague Test - What would my colleagues say when I describe my problem and suggest this option as my solution?

Organization Test - What would the organization's ethics officer or legal counsel say about my option?