Introduction

What Does Ethics Mean?

Ethics refers to the **principles and values** that guide people in deciding what is:
✅ Right or Wrong
✅ Good or Bad
✅ Just or Unjust
✅ Virtue or Vice

It helps individuals and groups act with **fairness, honesty, respect, and responsibility** in different situations.

Student Code of Ethics

Students must follow ethical behavior in academics. Common violations include:

1. **Plagiarism** – Using someone else's work, words, or code without credit.
2. **Cheating** – Using unauthorized help or materials during exams or assignments.
3. **Copying** – Submitting someone else's work or letting others copy yours.
4. **Multiple Submission** – Submitting the same work for more than one course without permission.
5. **Unauthorized Sources** – Using external help (e.g., online services or others) without approval.
6. **Surrogate** – Having someone else do your work or attend exams for you.

Maintaining the Highest Ethical Standards

To uphold academic integrity:

1. **Avoid Academic Dishonesty** – Always submit your **own original work**.

2. **Understand the Consequences** – Cheating or plagiarism may lead to **failing grades, suspension, or expulsion**.

3. **Raise Awareness** – Know what behaviors count as **unethical** (e.g., copying code or unauthorized collaboration).

4. **Practice Fairness** – Treat others' efforts with respect; don't seek unfair advantage.

5. **Uphold Ethical Standards** – Follow your institution's **code of conduct**, even when no one is watching.

Why Do We Need Ethics?

- Promotes **harmony and cooperation** in society.

- Ensures **mutual benefit** for individuals and communities.

- Provides a **basis for how we treat others**.

- Encourages people to **put others' welfare above self-interest**.

Moral Reasoning (নৈতিক যুক্তি)

Moral reasoning means carefully thinking about what is **right or wrong**, **fair or unfair**, and **good or bad** — especially when decisions affect others.

It involves values such as:
✔ **Justice** – Is it fair?
✔ **Equality** – Is everyone treated equally?
✔ **Freedom** – Do people have a choice?
✔ **Health & Safety** – Will it harm or help others?

Why It's Important

Moral reasoning helps us:
✅ Make ethical choices

✅ Stand up for what's right
✅ Understand consequences
✅ Become responsible citizens and professionals

Social Responsibility

Social responsibility means considering how our actions affect society.
For engineers, this means **designing and building** things that **benefit people and protect the environment**.

Engineering Connection

- Engineering directly impacts society — safety, health, environment, and fairness.
- Therefore, engineers must make decisions that are **ethical and socially responsible**.

Thinking Beyond the Project

Engineers should ask:

- Is this product **safe**?
- Is it **environmentally friendly**?
- Does it **help people**?

Examples:

- Designing **energy-efficient buildings** to reduce pollution.
- Creating **low-cost medical devices** for poor communities.
- Developing **apps that protect user privacy**.

Ethics in Engineering

Ethics is central to engineering because:

a) Engineers have a **social responsibility** to ensure public safety and welfare.
b) This responsibility creates **professional duties** and obligations.

Typical Ethical Issues in Engineering

Issue	Meaning	Example
Safety	Ensuring systems do not harm users	Refusing to approve an unsafe bridge design
Acceptable Risk	Balancing innovation and safety	Testing self-driving cars before release
Compliance	Following laws and standards	Meeting environmental emission rules
Confidentiality	Protecting private or sensitive data	Keeping user information secure
Environmental Health	Minimizing harm to nature	Using eco-friendly materials
Data Integrity	Ensuring accuracy and honesty in data	Refusing to falsify research results
Conflict of Interest	Avoiding personal gain influencing work	Not approving your brother's company's project
Honesty/Dishonesty	Being truthful in reports and communication	Reporting flaws instead of hiding them
Societal Impact	Considering public welfare	Developing affordable clean-water systems
Fairness	Treating all groups equally	Building unbiased AI systems
Accounting for Uncertainty	Being honest about unknown risks	Informing users about model limitations

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Code of Ethics – Final Thoughts

- The **Code of Ethics** is **not a law**, but a **moral guide**.
- Engineers don't need to **memorize** it — they must **understand and apply** it.
- It serves as a **moral compass**, helping engineers make ethical decisions in real-life work.

Professionalism

Some Thoughts on Professionalism and Ethics

- A person's **profession is part of their identity** — it reflects who they are.
- **Engineering** is a **profession**, not just a job.
- **Engineering ethics** require engineers to work for the **public good** — improving people's **safety, welfare, and quality of life**.
- Engineers must:
  - **Promote public well-being**
  - **Avoid harmful or unethical actions**
  - **Prevent harm** and **actively improve society**
- While designing for people's well-being, engineers must **consider the social impact** of technology and **stay critical** about how it affects human life.

Driverless Cars – Ethical and Moral Issues

Advantages

- Reduce accidents
- Help elderly and disabled people
- Lower fuel use
- Increase traffic efficiency

Problems & Questions

- Who is responsible when an accident happens?

- How safe are these vehicles?
- What information should users know before buying?
- How to protect against **hacking or terrorism**?
- What about **job loss** for drivers — should retraining programs be offered?

Example Case

- **First fatal accident:** Williston, Florida, May 7, 2016.
  A Tesla on autopilot failed to detect a truck's white trailer and crashed.
    - The **driver** didn't follow Tesla's safety instructions.
    - **Tesla** also lacked a system to check if the driver was ready to take control.
    - Raises the question: *How alert can a driver stay when a car drives itself?*

Moral Responsibility in Engineering

- Responsibility questions appear in **driverless cars** and **engineering disasters** like the **Challenger** and **Columbia** shuttle accidents.
- Engineers face **moral issues** such as:
    - Environmental impact of technology
    - Risk management
- Engineering is not only about **technical skill**, but also about **moral responsibility** and **professional ethics**.

Two Main Components of Professionalism

1. **Expertise** – having deep knowledge and skill in one's field.
2. **Moral Conduct** – following ethical rules and acting responsibly.

Failing in either area means one is **not a true professional**.

Three Stages of Developing Professional Identity

1. **Independent Operator**
    - Follows clear external rules and guidelines.
2. **Team-Oriented Idealist**
    - Focuses on meeting the expectations of respected peers.
3. **Self-Defining Professional**
    - Fully integrates **personal values** with **professional values** — professionalism becomes part of their character.
    - Usually reached **later in life**.

What Is a Profession?

- In the **Middle Ages**, a "profession" meant following a strict moral or religious way of life.
- By the **17th century**, it became a **secular concept** — people with skills and qualifications offering valuable services to society (like doctors, lawyers, engineers, teachers).

Three Main Approaches to Understanding Professionalism

1. Sociological Account

- Society gives professionals **special respect and status** because they **serve the public** using **expert knowledge**.

2. Social Contract Account

- There's an **unspoken agreement** between professionals and society:
    - **Professionals** promise **expert service**, **ethical behavior**, and **public benefit**.
    - **Society** rewards them with **trust**, **respect**, **good income**, and **autonomy** (freedom in their work).

3. Morally Permissible Account (Michael Davis)

- A **profession** is a group of people who **voluntarily** work toward a **morally good goal** (like curing the sick or improving society).
- It's about **serving the public**, **earning a living**, and **working together** toward ethical aims.

Key Characteristics of a Profession

Characteristic	Meaning
Extensive Training	Long, formal education (usually at university)
Specialized Knowledge	Deep expertise that benefits society
Monopoly on Services	Only qualified members can provide certain services
Workplace Autonomy	Freedom to make professional decisions
Ethical Standards	Clear rules about right and wrong (Code of Ethics)

Engineering as a Profession

Engineering meets all criteria of a true profession:

Sociological View

- **Training:** Requires higher education and strong technical foundation.
- **Knowledge:** Engineers use science and design for society's benefit.
- **Monopoly:** Partial — not all engineers need official registration (like PE license).
- **Autonomy:** Engineers often decide based on their own expertise.
- **Ethics:** Engineers must follow codes ensuring **safety**, **sustainability**, and **honesty**.

Social Contract View

- Engineers provide expert, ethical service to the public.
- Even though not all need licenses, they still enjoy **social respect**, **good income**, and **trust**.
- Society expects engineers to act **responsibly** and **serve humanity** in return.

Engineers: Professionals for the Human Good

Designing for Well-being – Social Context (Simplified)

Introduction

Engineers mainly promote **human well-being through design**.
When designing, engineers must consider two key principles:

1. **Technology operates within a social context.**
2. **Engineers must maintain a critical attitude toward technology.**

Every technology affects society in both positive and negative ways.
Therefore, engineering design can be viewed as a form of **social experimentation**, where the public becomes part of the test for new innovations.

Technology in a Social Context

Every new engineering creation—such as a bridge, product, or autonomous car—must function within a social environment.
Only after technology interacts with real people, systems, and surroundings can we truly judge whether it improves well-being.

The **autonomous car**, for example, offers clear advantages (like safety and convenience) but also introduces new social and ethical concerns.
Understanding its overall impact requires observing how it performs **within society**, involving users, operators, regulators, repairers, and others.

Thus, **technology and society influence each other** in a **two-way relationship**:

- Technology **shapes society** by changing behavior and lifestyles.
- Society **shapes technology** by setting values, needs, and priorities.

Effects of Technology

1. Impact on Behavior and Work

Technology directly influences how people behave and work.

- **Speed bumps** force safer driving.

- The **printing press** transformed European society and triggered the **Protestant Reformation**.

- Advances in **military technology** have changed how wars are fought.

- Some jobs (like bank tellers or travel agents) have declined, while others (like programmers) have emerged.

2. Impact on Social Relationships

Technology also reshapes **social connections** and communication.

- Many young people feel anxious if they go hours without receiving messages, while older generations may find that peaceful.

- **Social media platforms** (e.g., Facebook, MySpace) redefine what it means to have a "friend" or a "relationship."
  In short, technology not only changes communication but even influences how we **define human relationships**.

Effects of Social Context on Technology

Social values and cultural forces also drive **technological development**.
This relationship is studied in **Science and Technology Studies (STS)** — an interdisciplinary field combining sociology, history, and philosophy.

STS research shows:

- Technical problems often have **multiple possible solutions**.
- The final choice usually depends not just on technical efficiency but also on **social and ethical values**.

For example:

- What counts as “**efficient**” or “**effective**” often includes social judgments.
  In engineering, efficiency is seen as a technical ratio of energy input to output.
  Yet, whether something is considered “efficient” also depends on **user needs, preferences, and moral standards**.

Another example:

- **Child labor** was once seen as “efficient,” but society later rejected it as **immoral**.
  Children were redefined as **learners and consumers**, not workers.
  Thus, what counts as “technically efficient” changed based on evolving **social values**.

Over time, many **design standards** that were once debated—like safety and environmental protections—became **non-negotiable norms**.
These social decisions are now built into the very definition of **good design**, especially in industries like automotive manufacturing.

Adopting a Critical Attitude Toward Technology

A balanced view lies **between technological optimism and pessimism**.
Engineers must recognize that technology brings both **benefits and risks**, and their responsibility is to **maximize the good while minimizing harm**.
This requires a **critical attitude** toward the technologies they create.

Example: Social Networking

Philosopher **Shannon Vallor** highlights both the value and dangers of social networking technologies.
She acknowledges that online platforms can support people dealing with illness, trauma, or isolation, but warns that they can also harm **communicative virtues** — the moral qualities essential for healthy relationships.

These virtues include:

- **Patience**
- **Honesty**
- **Empathy**
- **Fidelity**
- **Reciprocity**
- **Tolerance**

Vallor argues that the internet may discourage the growth of these virtues, especially in young people.

Vallor’s Three Key Communicative Virtues

1. **Patience:**
   In real friendships, patience means staying engaged even when interactions are dull or difficult.
   Online, it’s easy to end communication instantly (“gotta run” or a simple click), which undermines true patience.

2. **Honesty:**
   Authentic relationships require openness and truthfulness.
   Yet, social media allows people to **misrepresent themselves**, harming genuine connections.

3. **Empathy:**
   Real compassion usually comes from **face-to-face encounters**—seeing emotions, hearing tone, or offering physical comfort like a hug.
   These human experiences are lost in online interactions.

Balancing Benefits and Harms

Vallor doesn’t suggest eliminating social media but urges a **balanced approach**:

- Preserve the benefits of connectivity.
- Reduce negative psychological and social effects.
- Encourage responsible design that supports authentic communication.

Ultimately, it is the **responsibility of engineers, designers, and technologists** to create systems that support moral and emotional well-being, not just convenience and profit.

Conclusion

Designing for well-being means recognizing that:

- **Technology and society are deeply interconnected.**
- **Social values shape what engineers build**, and **technologies reshape how society lives.**
- Engineers must **design responsibly**, thinking not only about technical efficiency but also about **ethical, social, and emotional impacts**.

In short, designing for well-being is about ensuring that **technological progress truly serves humanity** — enhancing lives while protecting the moral and social fabric of society.

New Chapter

A Case for Consideration – Cadavers vs. Mannequins (Simplified)

Background

In **1993**, it was revealed that **Heidelberg University (Germany)** had used over **200 cadavers**, including **8 children**, in **automobile crash tests**.
The news caused **public outrage**.

- **Rudolph Hammerschmidt** (Catholic Bishops Conference) said:
  "Even the dead possess human dignity. These tests should use mannequins instead."

- **ADAC**, Germany's largest auto club, agreed:
  "If animal testing is questioned, experiments should use dummies—not human remains."

Similar Cases in the U.S.

In the **United States**, **Wayne State University's Bioengineering Center** also used cadavers for crash testing as part of **CDC research**.
Spokesperson **Robert Wartner** clarified:

> "Cadavers are used only when no other method provides reliable safety data."

Clarence Ditlow, head of the **Center for Auto Safety**, proposed **three conditions** for ethical cadaver use:

1. Data cannot be obtained using dummies.
2. The deceased gave prior consent.
3. The family gives informed consent.

Moral vs. Social Issues

This case shows how **technology can raise moral and social dilemmas**.
There's a conflict between:

- **Public safety and well-being** (benefit of crash data), and
- **Respect for human dignity** (moral respect for the deceased).

The **NSPE Code of Ethics** says:

> Engineers must hold paramount the safety, health, and welfare of the public.

But this leads to a deeper question:
Should engineers use cadavers if it improves safety, or does **human dignity** outweigh potential benefits?

Thus, **professional codes alone** may not solve such complex moral issues — we need **ethical reasoning tools**.

Ethics Toolkit: Tools for Analyzing Moral Problems

To handle ethical dilemmas, engineers can use **moral analysis tools**, like tools in a toolbox.
Each situation may need a different "ethical tool."
Most moral problems involve one or more of these **four components**:

1. **Factual Issues** – What are the actual facts?
2. **Conceptual Issues** – What do key terms mean?
3. **Application Issues** – How do concepts apply to the case?
4. **Moral Issues** – What is right or wrong after balancing values?

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1. Factual Issues

These are **questions about what actually happened** and what facts we need to know to make a decision.

Three Key Claims About Factual Issues:

1. **Moral disagreements often arise from factual disagreements.**
   For instance, people may agree to use cadavers **if** it's proven necessary—but disagree on **whether** it's truly necessary.

2. **Facts can be hard to determine.**
   It may be unclear whether cadaver testing gives better safety results than dummies or computer models.

3. **Decisions are sometimes needed even with uncertain facts.**
   Even if we can't confirm whether cadaver testing truly improves safety, engineers must still decide—
   Should we prioritize **respecting the dead** or **saving lives**?

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2. Conceptual Issues

These concern the **meanings of key terms** in ethical discussions.
To think morally, we must clearly understand what we mean by words like *safety*, *welfare*, *confidentiality*, *bribery*, or *conflict of interest*.

Why It Matters

If people **disagree on definitions**, they can't resolve the issue even if they agree on the facts.
For example:

- An engineer's action might be called a **conflict of interest** under one definition but not under another.

How to Clarify

- It's hard to have perfect definitions in ethics.

- Instead, use **paradigm examples**—clear, obvious cases—to understand the meaning.

Example:
If an engineer buys low-quality, high-cost bolts from his own company, this is clearly a **conflict of interest** because:

> His professional duty (buy best product at best price) conflicts with his personal gain (profit from his own firm).

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3. Application Issues

These involve deciding **whether a concept applies to a particular case**.

Example:
When people say, *"Using cadavers violates human dignity,"*
they're making a **claim about application**—whether the concept of **human dignity** fits this situation.

Causes of Application Disagreements

Disagreements may come from:

1. Unclear **concept meaning** (conceptual issue)
2. Uncertain **facts** (factual issue)
3. Disagreement on **how the concept applies** (application issue)

In this case:

- **Factual issue:** Are cadavers essential for valid safety data?
- **Conceptual issue:** What does *human dignity* mean?
- **Application issue:** Does using cadavers for testing *violate* that dignity?

Summary

Type of Issue	Key Question	Example in the Cadaver Case

Factual	What are the facts?	Do cadaver tests provide better safety data than dummies?
Conceptual	What do key terms mean?	What is meant by “human dignity”?
Application	Does the concept fit this case?	Does cadaver use violate dignity?
Moral	What is right or wrong overall?	Should we prioritize human dignity or public safety?

Final Thought

The *Cadavers vs. Mannequins* case shows that **engineering ethics is not just about rules**—it’s about reasoning.
Engineers must combine:

- **Facts** (what is known),
- **Concepts** (what key terms mean), and
- **Values** (what should matter most)

to make decisions that are **technically sound, morally justified, and socially responsible**.

New Chapter

A Case for Consideration – Conflicting Values: Creative Middle-Way Solutions

Common Morality

The work of a **practical ethicist** is similar to that of a **carpenter** — both must know which tools are right for the job.

- A carpenter uses a hammer, saw, or screwdriver as needed.
- Similarly, an ethicist uses different **ethical tools or methods** depending on the situation.

To solve complex moral issues, especially those involving **social policies**, we must look deeper into the **moral beliefs** that guide our decisions.
These shared moral beliefs form what is called **common morality** — the set of moral ideas most people in a society (and perhaps globally) generally accept.

Ross's Prima Facie Duties

Philosopher **W. D. Ross** outlined several basic moral obligations called **"prima facie duties."**

- "Prima facie" means *"at first sight"* — something usually binding but may be **overridden** by a stronger duty in certain cases.
- Ross believed his list was not final but reasonably complete.

Ross's Six Prima Facie Duties:

1. **Duties based on past actions:**
    - **Fidelity:** Keep promises and tell the truth.
    - **Reparation:** Make amends for wrongs done.
2. **Duties of Gratitude:** Show appreciation to parents, mentors, or benefactors.
3. **Duties of Justice:** Support fairness and distribute happiness according to merit.
4. **Duties of Beneficence:** Help improve the condition of others.
5. **Duties of Self-Improvement:** Develop your own knowledge, skills, and character.
6. **Duties Not to Injure Others:** Avoid harming others physically or morally.

Ross's Duties and Engineering Ethics

Engineers also share these moral beliefs, which are reflected in most **codes of engineering ethics**:

- **Fidelity (R1)** and **Gratitude (R2):** Engineers should be honest and loyal to their employers and clients.
- **Justice (R3)**, **Beneficence (R4)**, and **Non-injury (R6):** Engineers must protect public safety, health, and welfare.

- **Self-Improvement (R5):** Engineers should keep improving their professional skills and knowledge.

Four Types of Moral Judgments (Common Morality Perspective)

1. **Permissible:**
   - Morally allowed, but not required.
   - Example: Choosing between two job offers — both are permissible.
2. **Impermissible:**
   - Morally forbidden; one must not do it.
   - Example: An engineer must not hide a conflict of interest.
3. **Obligatory:**
   - Morally required; must be done.
   - Example: An engineer must disclose a conflict of interest.
4. **Supererogatory:**
   - Praiseworthy but not required — goes “above and beyond duty.”
   - Example: Designing a project for a nonprofit organization for free.

Three Levels of Moral Statements

Moral statements can be classified by their **level of generality** — from specific actions to broad moral principles:

1. **Particular Actions:**
    - Judgments about single actions.
    - Example: “Engineer Mike should not have chosen bolts from his own company.”
2. **General Practices:**
    - Judgments about types of actions.
    - Example: “Engineers should never engage in undisclosed conflicts of interest.”
    - Ross’s duties and Gert’s moral rules belong here.
3. **Very General Moral Principles:**
    - Broad criteria for judging all actions.
    - Example: “Actions are right if they promote human welfare and well-being.”

Approaches to Moral Thinking (Michael Davis’s Tests)

Michael Davis proposed several **practical tests** for ethical decision-making — tools that help evaluate moral choices.

Test	Key Question
Harm Test	Does this option cause less harm than any alternative?
Publicity Test	Would I be comfortable if my decision were made public in a newspaper?
Defensibility Test	Could I defend this choice before a committee, my peers, or my parents?
Reversibility Test	Would I think it fair if I were the one negatively affected by this decision?
Virtue Test	What kind of person will I become if I often choose this option?
Professional Test	What would my professional ethics committee say about this option?
Colleague Test	What would my peers think if I described this decision to them?
Organization Test	What would my organization's ethics officer or legal team say about it?

Summary

- **Common morality** provides shared ethical foundations.
- **Ross's duties** explain core moral obligations.
- **Four moral judgment types** clarify when actions are allowed, forbidden, required, or praiseworthy.
- **Three levels of moral statements** organize moral reasoning from specific to universal.
- **Michael Davis's tests** offer practical ways to evaluate decisions and find balanced, ethical solutions.