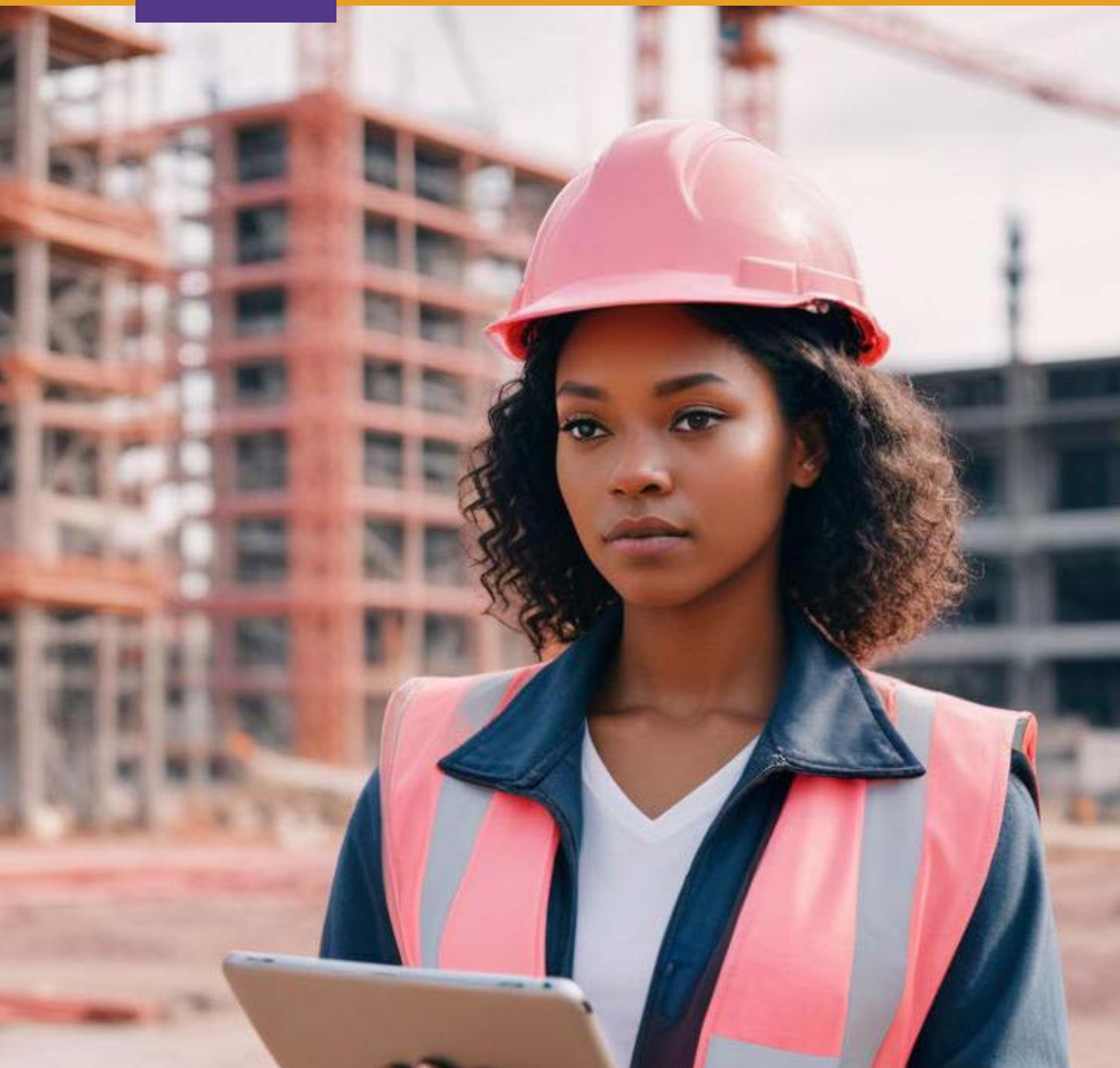
Engineering Year 1

SECTION 3

PROFESSIONAL ETHICS



ENGINEERING PRACTICE

Ethics and Professional Practice

Introduction

Welcome to the section on engineering ethics and professional practice. Ethics in engineering refers to the moral principles and standards that guide professionals in making decisions and carrying out their work responsibly, considering the impact on individuals, communities, and the environment. Ethical behaviour in engineering is characterised by the adherence to a code of conduct that upholds fundamental values such as honesty, integrity, accountability, and respect for human rights. It ensures that engineering practices prioritise safety, sustainability, and the greater welfare of humanity. Conversely, unethical behaviour in engineering encompasses actions that breach professional standards and occur when professionals deviate from these moral principles and use their knowledge or skills to pursue self-interest, engage in fraudulent activities, compromise safety standards, or ignore the potential negative consequences of their work. Unethical practices in engineering can lead to disastrous outcomes, endangering lives, damaging the environment, and eroding public trust in the profession. In this section, learners will explore the relevance of ethics in engineering practice by delving into several key aspects of ethics. It examines how ethical considerations play a pivotal role in ensuring safety and reliability in engineering projects, maintaining public trust, fostering sustainable development, and addressing social and cultural implications.

At the end of this section, you will be able to:

- Explain ethical and unethical behaviours
- Explain the relevance of ethics in engineering practice
- Distinguish between ethical and unethical behaviours in engineering practice
- Demonstrate ethical behaviour in case study scenarios

Key Ideas

- The engineering profession is governed by ethical standards that regulate engineers' conduct to ensure that their activities and products are healthy and safe to life and the environment. Engineering ethics and professionalism ensure that engineers conduct themselves responsibly, with integrity, and in the best interests of society.
- Engineers must do well to adhere to ethical principles and practices always and desist from all forms of unethical behaviours and ethical violations. To become a successful engineer, one needs to know the engineering ethical principles and consciously adhere to them in all their engineering practices.

ETHICAL BEHAVIOUR IN ENGINEERING

In engineering, ethical and unethical behaviours play a crucial role in ensuring public safety, maintaining professional integrity, and fostering trust within society. Here is a focused look at these behaviours within the engineering context:

Ethical behaviour in engineering involves adhering to professional standards and principles that ensure the safety, well-being, and fairness of all stakeholders. Engineers are responsible for designing and maintaining structures, systems, and products that millions of people rely on daily. Therefore, adhering to ethical principles is crucial.

Key Aspects of Ethical Behaviour

1. **Integrity**: Being honest and transparent in all professional activities, including reporting data and results accurately. It ensures that engineers uphold the highest standards of conduct, contributing to public trust and the overall safety and effectiveness of engineering projects.
2. **Public Safety and Welfare**: They are paramount concerns in engineering, as the work of engineers directly impacts the lives and well-being of the public. Engineers must prioritise these aspects in all their professional activities, ensuring that their designs, projects, and decisions protect and enhance public health, safety, and welfare.
3. **Respect for Diversity:** It is essential for fostering an inclusive, innovative, and effective professional environment. Diversity encompasses a range of characteristics including race, gender, age, cultural background, physical abilities, and more. Embrace diversity and treat all colleagues, clients, and community members with respect, irrespective of their background or beliefs.
4. **Environmental Responsibility:** It involves designing, constructing, and maintaining projects and systems in a manner that minimises negative impacts on the environment. This includes considering the entire lifecycle of a project, from planning and design to construction, operation, and eventual decommissioning. Design and implement engineering solutions that are environmentally sustainable and minimise negative impacts on ecosystems and natural resources.
5. **Quality Workmanship:** Strive for excellence in engineering work, ensuring that designs and constructions are of high quality and meet industry standards.
6. **Innovation and Creativity:** Encourage innovation and creative problem-solving to produce efficient and effective engineering solutions.
7. **Transparency:** Be transparent in communicating project progress, potential risks, and challenges to stakeholders, including clients and the public.
8. **Teamwork:** Collaborate effectively with colleagues, valuing their input and expertise in engineering projects.
9. **Professionalism:** Conduct yourself professionally, adhering to ethical guidelines and maintaining a positive reputation within the engineering community.

10. **Whistleblowing:** Involves reporting any unethical or illegal activities within an organisation or industry to the appropriate authorities or stakeholders.
11. **Confidentiality**: Respecting the confidentiality of proprietary information and not disclosing it without proper authorisation.
12. **Competence**: Performing services only in areas of one's competence and continuously updating skills and knowledge.
13. **Sustainability**: Considering the environmental impact of engineering decisions and promoting sustainable practices.
14. **Fairness and Non-Discrimination**: Treating all colleagues, clients, and the public fairly and without bias.

Examples of Ethical Behaviour in Engineering

a. Designing products and systems that comply with safety standards and regulations.
b. Accurately reporting test results and data without falsification.
c. Refusing to undertake projects for which one does not have the necessary expertise.
d. Disclosing any potential conflicts of interest that may affect professional judgment.
e. Implementing environmentally sustainable practices in project design and execution.
f. Ensuring equal opportunity and non-discriminatory practices in hiring and promotions.

Unethical Behaviour in Engineering

Unethical behaviour in engineering involves actions that compromise safety, fairness, and honesty. Such behaviour can lead to harm, mistrust, and legal consequences. Key aspects include:

1. **Plagiarism**: It involves the unauthorised use or imitation of someone else's work, ideas, or intellectual property without proper acknowledgment or permission. This can occur in various contexts, including academic research, professional practice, and industrial design. Plagiarism undermines the integrity of the engineering profession, damages reputations, and can lead to legal consequences. Using others' work or ideas without proper attribution or citation of source.
2. **Bribery and Corruption**: They involve unethical practices where individuals or organisations offer, give, receive, or solicit something of value to influence decisions, gain unfair advantages, or secure contracts and projects. Engaging in or condoning corrupt practices to gain business advantages. These practices undermine the integrity of the engineering profession, distort market competition, and can lead to substandard work and unsafe conditions.

3. **Cutting Corners:** It refers to the practice of intentionally reducing quality, safety, or thoroughness to save time, money, or effort. Sacrificing safety, quality, or compliance with regulations to save time or money or gain undue advantage over competitors. This can involve using substandard materials, skipping essential steps in processes, or ignoring regulatory requirements. While cutting corners might provide short-term gains, it often leads to significant long-term consequences, including safety hazards, legal issues, and reputational damage.
4. **Discrimination**: It refers to unfair or prejudicial treatment of individuals or groups based on characteristics such as race, gender, age, religion, sexual orientation, disability, or other protected attributes. This discrimination can manifest in various forms, including hiring practices, workplace culture, opportunities for advancement, and access to resources. Addressing discrimination is crucial for fostering a diverse, inclusive, and innovative engineering environment. Allowing bias to influence professional decisions and actions such as recruitment, rewards and promotion.
5. **Environmental Negligence**: It occurs when engineers or engineering firms fail to incorporate or adhere to necessary environmental protection measures in their projects, resulting in harm to ecosystems, human health, or property. This negligence can stem from various factors, including inadequate planning, disregard for regulations, or prioritisation of cost savings over environmental safety. Ignoring or not adequately addressing potential risks and safety issues.
6. **Conflict of Interest**: It occurs when an engineer's personal interests, relationships, or activities could potentially influence or appear to influence their professional judgment, decisions, or actions. This can compromise the integrity of the engineering work, lead to unethical decisions, and damage public trust. Failing to disclose personal interests that may affect professional decisions or influence judgements.
7. **Misrepresentation:** Providing false information or data in engineering reports or presentations. Misrepresentation can lead to misinformed decisions.
8. **Inadequate Testing:** Failing to conduct thorough testing and safety checks on engineering projects. This can lead to avoidable accidents and harm to people and the environment.
9. **Infringing on Intellectual Property:** Using patented technology or copyrighted materials without proper authorisation. This can lead to legal consequences.
10. **Dishonesty:** It refers to unethical behaviours and practices that violate the principles of integrity, transparency, and accountability in engineering. This type of dishonesty can manifest in various ways and has significant repercussions for public safety, trust, and the integrity of the profession. It includes falsifying data, reports, or qualifications.

Examples of Unethical Behaviour in Engineering

a. Cutting corners in design or construction to save costs, compromising safety.
b. Falsifying test results to meet regulatory requirements.
c. Accepting gifts or favours in exchange for awarding contracts.
d. Copying another engineer's design without giving proper credit.
e. Overlooking or hiding defects or failures in a project to avoid liability.
f. Discriminating against employees or clients based on race, gender, or other characteristics.

Promoting Ethical Behaviour in Engineering

To foster ethical behaviour, engineering organisations and professionals can implement several measures:

1. **Code of Ethics**: Adopting a formal code of ethics that outlines the professional standards and ethical expectations for engineers.
2. **Ethics Training**: Providing regular training and resources to educate engineers about ethical principles and how to apply them in practice.
3. **Ethical Leadership**: Encouraging leaders to model ethical behaviour and create a culture of integrity within the organisation.
4. **Whistleblower Policies**: Establishing mechanisms for reporting unethical behaviour without fear of retaliation.
5. **Regular Audits and Reviews**: Conducting regular audits and reviews to ensure compliance with ethical standards and identify areas for improvement.

By understanding and adhering to ethical principles, engineers can ensure their work positively impacts society and upholds the profession's integrity.

THE RELEVANCE OF ETHICS IN ENGINEERING PRACTICE

Ethics play a crucial role in engineering practice, ensuring that the engineers' work contributes positively to society and the environment. Here is an explanation of the relevance of ethics in engineering practice through various principles:

1. **Safety and Welfare of Society**
   a. **Relevance**: Engineers must prioritise the safety and well-being of the public in their designs and decisions.
   b. **Explanation**: Ensuring public safety prevents harm and builds trust in engineering solutions. For example, civil engineers design buildings to withstand natural disasters, protecting lives.

3. **Environmental Sustainability**
   a. **Relevance**: Engineers must consider the long-term impacts of their work on the environment.
   b. **Explanation**: Sustainable engineering practices minimise environmental damage and promote the conservation of resources, such as designing energy-efficient systems or using renewable materials.

4. **Equity and Social Justice**
   a. **Relevance**: Engineering solutions should be accessible and beneficial to all segments of society.
   b. **Explanation**: Ethical engineers design inclusive systems that do not discriminate based on race, gender, or economic status, ensuring fair access to technology and resources.

5. **Informed Consent**
   a. **Relevance**: Engineers must obtain consent from stakeholders who are affected by their projects.
   b. **Explanation**: This principle ensures that stakeholders are aware of potential risks and benefits, fostering transparency and trust. For example, consulting with communities before starting a construction project.

6. **Transparency and Accountability**
   a. **Relevance**: Engineers should be open about their processes and accountable for their work.
   b. **Explanation**: Transparency in reporting methods and results builds trust, while accountability ensures engineers take responsibility for their actions, preventing misconduct.

7. **Avoiding Conflicts of Interest**
   a. **Relevance**: Engineers must avoid situations where personal interests could compromise their professional judgment.
   b. **Explanation**: Conflicts of interest can lead to biased decisions that may not be in the best interest of the public or the client. Ethical engineers disclose and manage any potential conflicts.

8. **Continuing Education and Professional Development**
   a. **Relevance**: Engineers should engage in lifelong learning to stay current with advancements in their field.
   b. **Explanation**: Continuous education ensures that engineers maintain competence and can apply the latest technologies and methods safely and effectively.

9. **International Collaboration**
   a. **Relevance**: Engineers often work on global projects and must respect cultural differences and international standards.

b. Explanation: Ethical international collaboration promotes shared knowledge and solutions that are culturally and contextually appropriate, enhancing global welfare.

10. **Public Trust and Reputation**
    a. Relevance: Engineers must maintain the public's trust to ensure the profession's integrity.
    b. Explanation: Upholding ethical standards enhances the profession's reputation, encouraging public confidence in engineering solutions and decisions.

11. **Adherence to Codes of Ethics**
    a. Relevance: Engineers should follow established codes of ethics provided by professional bodies.
    b. Explanation: Adherence to these codes ensures consistency in ethical behaviour across the profession, providing a benchmark for evaluating conduct and decision-making.

The Process of Ethical Decision-Making

Ethical decision-making is a structured approach that individuals and organisations use to evaluate and resolve ethical dilemmas. The process typically involves several key steps to ensure that decisions are made in a morally and ethically responsible manner. Here is a common framework for ethical decision-making:

Identify the Ethical Issue

a. **Recognise the Dilemma:** Clearly define the ethical issue or conflict.
b. **Determine Stakeholders:** Identify all parties affected by the decision.

Gather Information

a. **Facts and Context:** Collect all relevant facts and contextual information.
b. **Legal and Professional Guidelines:** Understand applicable laws, regulations, and professional codes of ethics.

Evaluate the Alternatives

a. **Consider Options:** List actions or alternatives.
b. **Assess Consequences:** Evaluate the potential outcomes of each alternative for all stakeholders.

Analyse the Ethical Dimensions

a. **Ethical Theories:** Apply ethical theories (e.g., utilitarianism, deontology, virtue ethics) to analyse the alternatives.
b. **Principles and Values:** Consider core ethical principles (e.g., honesty, fairness, justice, respect) and personal or organisational values.

Make the Decision

a. **Weigh the Options:** Balance the ethical principles and outcomes to choose the best course of action.

b. **Justify the Decision:** Ensure the decision can be ethically justified and clearly articulate the reasoning behind it.

Implement the Decision

a. **Action Plan:** Develop and execute a plan to implement the chosen decision.
b. **Communicate:** Inform stakeholders of the decision and rationale.

Reflect and Evaluate

a. **Review Outcome:** Assess the impact of the decision on all stakeholders and the ethical implications.
b. **Learn and Adjust:** Reflect on the process and outcomes to improve future ethical decision-making.

Example: Ethical Decision-Making in Engineering

Scenario:

An engineer discovers that a new product design has a minor flaw that could lead to a failure under rare conditions. Fixing the flaw will delay the project and increase costs.

Steps Applied:

a. **Identify the Ethical Issue:** The ethical dilemma is whether to release the product as is, with a known flaw, or delay the release to fix it.
b. **Gather Information:** Collect data on the likelihood and consequences of the product failure and review relevant safety regulations and industry standards.
c. **Evaluate the Alternatives:**
    i. Release the product as is.
    ii. Delay the release to fix the flaw.
    iii. Provide a warning with the product about the potential issue.
d. **Analyse the Ethical Dimensions:**
    i. **Utilitarian Approach:** Consider the greatest good for the greatest number (e.g., consumer safety vs. cost implications).
    ii. **Deontological Approach:** Focus on duty and adherence to safety standards.
    iii. **Virtue Ethics:** Reflect on professional integrity and responsibility.
e. **Make the Decision:** Decide to delay the release and fix the flaw, prioritising safety, and adherence to ethical standards.
f. **Implement the Decision:** Communicate the decision to stakeholders, adjust the project timeline, and allocate resources for the fix.
g. **Reflect and Evaluate:** After the fix, assess the impact on the product's performance and stakeholder trust. Use the experience to refine the decision-making process.

Activity 3.1

Understanding ethical and unethical behaviours in everyday life and sharing personal experiences of them in a group discussion.

Materials Needed: A piece of paper and a pencil/pen

Instruction

a. Form a small group with your classmates ensuring diversity (i.e. gender balance and mixture of ethnic backgrounds)

b. Let the team select one member as the team's moderator.

c. Each member should list four (4) ethical behaviours in everyday life and indicate their experiences of ethical behaviours.

S/N	Ethical Behaviour	Personal Experience
1.		
2.		
3.		
4.		

d. Each member should list four (4) unethical behaviours in everyday life and indicate their experiences of unethical behaviours.

S/N	Unethical Behaviour	Personal Experience
1.		
2.		
3.		
4.		

e. Each group member should read out what they wrote, and the moderator allows for two (2) comments and constructive criticisms from other group members.

f. Use the comments and criticism from your colleagues to improve upon your submissions.

g. Collect all the contributions from your group and submit them to your facilitator for review and additional comments.

Activity 3.2

Identification of ethical and unethical behaviours faced by engineers in decision-making involving small projects within the community.

Learners should decide whether the behaviour is ethical or unethical faced by engineers and tick appropriately.

Worksheet: Ethical and Unethical behaviours

S/N	Behaviours	Ethical	Unethical
1	Cutting corners		
2	Transparency		
3	Teamwork		
4	Discrimination		
5	Whistle blowing		
6	Sustainability		
7	Environmental negligence		
8	Dishonesty		
9	Bribery and corruption		
10	Confidentiality		

Activity 3.3

Case Study Scenario: An engineer working on the construction of a new bridge discovers a critical design flaw that could potentially lead to structural failure. The bridge is intended to connect two major cities and is expected to support heavy traffic. The project is already facing significant delays and budget overruns. Reporting the flaw would likely lead to additional costs and further delays, and the engineer fears it might also damage their professional reputation and that of their firm. However, if the flaw is not addressed, there is a serious risk to public safety. The engineer must decide whether to report the flaw to their superiors or stay silent.

Objective: To help you understand the ethical implications of engineering decisions and the impact of those decisions on society.

Instructions:

a. Form a small group with your classmates, ensuring diversity.
b. You and your group should pick up a copy of the case study scenario, analyse it and prepare a presentation of your deductions.
c. The presentation should include:
    i. Description of the ethical dilemma.
    ii. Identification of stakeholders, that is, Engineer (who finds the flaw), Manager (concerned about the project deadline), Safety Inspector (focused on public safety), Government Official (concerned about political implications).
    iii. Possible actions the engineer could take.
    iv. Analysis of the potential consequences of each action.
    v. The group's recommended course of action and rationale.
d. Present your findings to your class in a 10 minute presentation.
e. Allow for questions and discussions after your presentations.

Lead questions for student analysis and discussion

a. What are the primary ethical issues in this case?
b. What professional responsibilities does the engineer have in this situation?
c. Who are the stakeholders affected by the engineer's decision?
d. How might each stakeholder be impacted by the decision to report or not report the flaw?
e. What are the possible actions the engineer could take?
f. What are the pros and cons of each action?
g. What are the potential short-term and long-term consequences of reporting the flaw?
h. What are the potential short-term and long-term consequences of staying silent?
i. Based on your analysis, what action would your group recommend the engineer take?
j. How does this recommended action align with ethical principles and professional standards?
k. How does this case study illustrate the importance of ethics in engineering?
l. What lessons can be learned from this case to apply to future engineering projects?

Activity 3.4

You will engage in a detailed exploration of how engineers' ethical and unethical behaviours affect society. This will be done through group discussions.

Objectives

a. Understand the societal impact of engineers' decisions.
b. Identify the consequences of ethical and unethical behaviours in engineering.
c. Develop skills in critical thinking, ethical reasoning, and public speaking.

Instructions

a. Form a small group with your classmates to ensure diversity.
b. Explain the activity objectives and the importance of ethics in engineering.

Questions to Consider:

a. Why are ethics important in engineering?
b. How do engineers' decisions affect the broader society?

1. Learners watch the video below on everyday life

https://www.youtube.com/watch?v=-p1P4fdhaF8

Discuss the good and bad behaviours exhibited in the video above.

2. Learners watch a video on engineering ethics

https://www.youtube.com/watch?v=ldQABp2MuQ4

After watching the above video, learners discuss using the following questions:

a. What engineering ethical behaviours can you identify in the video?
b. What unethical behaviours did you identify from the video?
c. How costly is unethical behaviours to engineers

DISTINGUISH BETWEEN ETHICAL AND UNETHICAL BEHAVIOURS IN ENGINEERING PRACTICE

Distinguishing between ethical and unethical behaviours in engineering practice involves evaluating actions and decisions based on various key principles. Here is an overview of how behaviours can be categorised as ethical or unethical under each principle:

1. **Professional Responsibility**

   Ethical Behaviours:
   - Adhering to professional standards and codes of conduct.
   - Prioritising public safety, health, and welfare.
   - Reporting unethical practices and taking responsibility for one's actions.
   - Providing services only in areas of competence.

   Unethical Behaviours:
   - Neglecting safety standards or regulations.
   - Ignoring or covering up mistakes that could harm others.
   - Taking on projects beyond one's competence without proper supervision.
   - Failing to report unethical practices.

2. **Honesty and Integrity**

   Ethical Behaviours:
   - Being truthful and transparent in all professional communications.
   - Accurately representing one's qualifications and experiences.
   - Providing honest assessments and avoiding false claims.
   - Admitting and correcting mistakes promptly.

   Unethical Behaviours:
   - Misrepresenting qualifications, experiences, or work results.
   - Providing misleading or false information.
   - Engaging in deceitful practices for personal gain.
   - Failing to correct known errors.

3. **Conflicts of Interest**

   Ethical Behaviours:
   - Disclosing any potential conflicts of interest.
   - Recusing oneself from decisions where impartiality is compromised.
   - Prioritising the client's or public's interest over personal gains.

Unethical Behaviours:

- Hiding conflicts of interest.
- Making decisions that benefit oneself at the expense of clients or the public.
- Accepting gifts or favours that could influence professional judgment.

4. **Environmental and Social Impact**

Ethical Behaviours:

- Considering the environmental and social impact of engineering projects.
- Implementing sustainable practices and minimising harm.
- Engaging in projects that promote social good and environmental stewardship.

Unethical Behaviours:

- Ignoring the environmental and social consequences of projects.
- Pursuing profits or efficiency at the cost of environmental degradation.
- Engaging in projects that harm communities or ecosystems without mitigation measures.

5. **Respect for Intellectual Property**

Ethical Behaviours:

- Acknowledging and respecting the intellectual property rights of others.
- Using patented or copyrighted materials only with permission or proper licensing.
- Giving proper credit to original creators and contributors.

Unethical Behaviours:

- Plagiarising or copying others' work without permission.
- Failing to attribute or give credit to original sources.
- Using proprietary information for unauthorised purposes.

6. **Professional Competence**

Ethical Behaviours:

- Continuously updating skills and knowledge to maintain competence.
- Seeking additional training or education when necessary.
- Providing services only within the scope of one's expertise.

Unethical Behaviours:

- Offering services outside one's area of competence without adequate training.
- Neglecting continuing education and professional development.
- Relying on outdated or insufficient knowledge in practice.

Unethical Behaviours in Engineering Practice

1. **Negligence**
   - *Ethical:* Diligently performing duties with due care and attention to detail.
   - *Unethical:* Ignoring critical safety checks or failing to address known issues.

   Example: Overlooking known design flaws that could lead to catastrophic failures.

2. **Bribery and Corruption**
   - *Ethical:* Maintaining integrity and fairness in all professional dealings.
   - *Unethical:* Engaging in bribery or corrupt practices to secure contracts or approvals.

   Example: Offering gifts or payments to officials in exchange for favourable treatment.

3. **Exploitation**
   - *Ethical:* Ensuring fair compensation and working conditions for all employees and contractors.
   - *Unethical:* Exploiting workers by underpaying them or subjecting them to unsafe working conditions.

   Example: Using cheap labour in unsafe conditions to maximise profits.

4. **Dishonesty in Professional Qualifications**
   - *Ethical:* Accurately representing one's qualifications and experience.
   - *Unethical:* Misrepresenting or exaggerating credentials to obtain projects or positions.

   Example: Claiming expertise in an area where one has little to no experience.

5. **Failure to Report Unethical Behaviour**
   - *Ethical:* Reporting observed unethical behaviour to appropriate authorities.
   - *Unethical:* Ignoring or covering up unethical actions by oneself or others.

   Example: Not reporting a colleague's falsification of safety data.

6. **Conflict of Interest**
   - *Ethical:* Disclosing any potential conflicts of interest and taking steps to mitigate them.
   - *Unethical:* Concealing conflicts of interest that could influence professional judgment.

   Example: Secretly benefiting from contracts awarded to a family member's company.

DEMONSTRATE ETHICAL BEHAVIOUR IN CASE STUDY SCENARIOS

These are some case study scenarios to illustrate ethical behaviour in engineering practice:

Case Study 1: Environmental Responsibility

Scenario: An engineer is designing a manufacturing plant and identifies an opportunity to implement a more expensive yet, a significantly more environmentally friendly waste management system.

- **Ethical Behaviour:** The engineer advocates for the implementation of the environmentally friendly system, presenting a case to management that includes long-term benefits and compliance with environmental regulations.
- **Explanation:** By promoting sustainable practices, the engineer demonstrates a commitment to environmental responsibility and long-term thinking. This decision aligns with the ethical principles of protecting the environment and public health.

Case Study 2: Safety and Compliance

Scenario: An engineer is working on the design of a new bridge. During the design process, they identified a potential structural weakness that could pose a risk to public safety.

- **Ethical Behaviour:** The engineer reports the weakness to their supervisor and recommends additional analysis and modifications to the design, even though this might delay the project and increase costs.
- **Explanation:** Prioritising public safety over project deadlines and costs demonstrates ethical behaviour. The engineer's transparency and commitment to safety ensures that the bridge will be safe for public use.

Case Study 3: Conflict of Interest

Scenario: An engineer is tasked with selecting a contractor for a large infrastructure project. One of the potential contractors is owned by a close family member.

- **Ethical Behaviour:** The engineer discloses conflict of interest to their employer and recuses themselves from the decision-making process to ensure impartiality and fairness.
- **Explanation:** Disclosing conflicts of interest and stepping aside from the selection process maintains fairness and avoids any perception of bias or favouritism. This action upholds the integrity of the selection process.

Case Study 4: Reporting Unethical Behaviour

Scenario: An engineer discovers that a colleague has been falsifying safety inspection reports to expedite project approvals.

- **Ethical Behaviour:** The engineer reports unethical behaviour to the appropriate authorities within their organisation, following established procedures for whistleblowing.
- **Explanation:** Reporting unethical behaviour demonstrates a commitment to integrity and public safety. It ensures that the issue is addressed, maintaining the credibility of the engineering profession, and protecting the public from potential harm.

Case Study 5: Honesty in Reporting

Scenario: An engineer is conducting tests on a new type of material intended for use in construction. The initial test results are not favourable, showing that the material does not meet the required safety standards.

- **Ethical Behaviour:** The engineer accurately reports the test results to their client and management, suggesting further research and development to improve the material's properties.
- **Explanation:** By reporting the actual test results without falsification, the engineer maintains integrity and honesty. This ensures that only safe and reliable materials are used in construction, protecting future users and clients.

Case Study 6: Professional Competence

Scenario: An engineer is offered a project that involves advanced robotics, a field in which they have limited experience.

- **Ethical Behaviour:** The engineer declines the project, explaining their lack of expertise, and suggests either obtaining additional training or collaborating with a colleague who has the necessary skills.
- **Explanation:** By acknowledging their limitations and seeking to ensure the project is handled by a qualified professional, the engineer upholds the ethical principle of competence. This ensures the project is completed to a high standard and reduces the risk of failure.

Case Study 7: Respect for Intellectual Property

Scenario: An engineer is preparing a presentation and finds a detailed analysis that perfectly supports their argument. The analysis was conducted by another engineer.

- **Ethical Behaviour:** The engineer cites the original author and acknowledges their work in the presentation.
- **Explanation:** Giving proper credit to the original author demonstrates respect for intellectual property and maintains academic and professional integrity. It encourages a culture of respect and collaboration within the engineering community.

Case Study 8: Responsible Data Management in Artificial Intelligence (AI) Applications:

Scenario: Engineers are developing AI systems that process and analyse substantial amounts of user data.

- **Ethical Behaviour:** The engineers prioritise data privacy and security, ensuring that user data is anonymised, encrypted, and used only for legitimate purposes. They adhere to data protection regulations and inform users about how their data will be used to obtain informed consent.

Activity 3.5

A company discovers a significant safety issue in their latest product just before its launch. The marketing team wants to proceed with the launch while working to fix this significant safety issue, but the engineering team believes the product should not be released until the issue is resolved.

Objective: To help you understand the ethical implications of business decisions, especially when they involve safety concerns, and to analyse the impact of those decisions on various stakeholders.

Instructions:

a. Form a small group with your classmates (4-5 students per group).
b. Pick up a printed copy of the case study scenario.
c. In your group, prepare a presentation summarising your analysis.
d. Include the following in the presentation:
    i. Description of the ethical dilemma.
    ii. Identification of stakeholders (Engineers, manager, safety officer, marketing team, customers).
    iii. Possible actions the company could take.
    iv. Analysis of the potential consequences of each action.
    v. The group's recommended course of action and rationale.
f. Your group presents your findings to the class in 5 minutes.
g. After each presentation, there will be time for questions and discussion.

Guideline questions

a. What are the primary ethical issues in this case?
b. What professional responsibilities do the marketing and engineering teams have in this situation?
c. Who are the stakeholders affected by the company's decision?
d. How might each stakeholder be impacted by the decision to delay the launch or proceed as planned?

e. What are the possible actions the company could take?
f. What are the pros and cons of each action?
g. What are the potential short-term and long-term consequences of delaying the launch?
h. What are the potential short-term and long-term consequences of proceeding with the launch?
i. Based on your analysis, what action would your group recommend the company take?
j. How does this recommended action align with ethical principles and professional standards?
k. How does this case study illustrate the importance of ethics in business and engineering?
l. What lessons can be learned from this case to apply to future business and engineering projects?

Activity 3.6

You are part of a team working on a large infrastructure project. One of your colleagues suggests cutting corners on materials to save costs.

Objective: To help you understand the ethical implications of cost-cutting decisions in engineering projects. This activity will also develop your skills in ethical reasoning, teamwork, and decision-making.

Instructions

a. Form a small group with your classmates (4-5 students per group).
b. Pick up a printed copy of the case study scenario.
c. In your group, prepare a presentation summarising your analysis.
d. Include the following in the presentation:
    i. Description of the ethical dilemma.
    ii. Identification of stakeholders (Engineers, manager, safety officer, customers).
    iii. Possible actions the company could take.
    iv. Analysis of the potential consequences of each action.
    v. The group's recommended course of action and rationale.
f. Your group presents your findings to the class in 10 minutes.
g. After each presentation, there will be time for questions and discussion.

Guideline questions

a. What are the primary ethical issues in this case?
b. What professional responsibilities does each team member have in this situation?
c. Who are the stakeholders affected by the team's decision?
d. How might each stakeholder be impacted by the decision to cut corners or not?
e. What are the possible actions the team could take?
f. What are the pros and cons of each action?
g. What are the potential short-term and long-term consequences of cutting corners on materials?
h. What are the potential short-term and long-term consequences of finding alternative solutions?
i. Based on your analysis, what action would your group recommend the team take?
j. How does this recommended action align with ethical principles and professional standards?
k. How does this case study illustrate the importance of ethics in engineering projects?
l. What lessons can be learned from this case to apply to future engineering projects?

Activity 3.7

You are a junior engineer at a water treatment engineering firm working on a large-scale industrial project. You have noticed some discrepancies in the environmental impact reports (such as falsifying data or improperly disposing of hazardous materials) prepared by a senior engineer, who is known to have significant influence within the company. These actions could lead to severe environmental harm, affecting local communities and ecosystems.

Objective: To help you understand the ethical dilemmas involved in whistleblowing, especially when it concerns environmental harm, and to analyse the impact of your decisions on your career, the environment, and society.

Instructions

a. Form a small group with your classmates (4-5 students per group).
b. Pick up a printed copy of the case study scenario.
c. In your group prepare a presentation summarising your analysis.
d. Include the following in the presentation:
    i. Description of the ethical dilemma.

ii. Identification of stakeholders (Engineers, manager, safety officer, environment).
iii. Possible actions the company could take.
iv. Analysis of the potential consequences of each action.
v. The group's recommended course of action and rationale.

f. Your group presents your findings to the class in 10 minutes.
g. After each presentation, there will be time for questions and discussion.

Guideline questions

a. What are the primary ethical issues in this case?
b. What professional responsibilities does the junior engineer have in this situation?
c. Who are the stakeholders affected by the junior engineer's decision?
d. How might each stakeholder be impacted by the decision to report or not report the unethical practices?
e. What are the possible actions the junior engineer could take?
f. What are the pros and cons of each action?
g. What are the potential short-term and long-term consequences of reporting the senior engineer to the stakeholders?
h. What are the potential short-term and long-term consequences of staying silent?
i. Based on your analysis, what action would your group recommend the junior engineer take?
j. How does this recommended action align with ethical principles and professional standards?
k. How does this case study illustrate the importance of ethics in engineering and environmental protection?
l. What lessons can be learned from this case to apply to future engineering projects and professional conduct?

Review Questions

1. How do you understand ethical behaviour in the context of engineering?
2. Provide an example of an ethical decision an engineer might make.
3. State five (5) common unethical behaviours in engineering?
4. Why is it important for engineers to adhere to ethical standards?
5. Describe a real-world example of unethical behaviour in engineering and its consequences.
6. How can engineers ensure they are making ethical decisions?
7. State three (3) roles professional engineering organisations play in promoting ethical behaviour?
8. How do you understand conflict of interest, and how can it be managed ethically in engineering?
9. Why is it unethical to ignore safety standards to cut costs in engineering projects?
10. State four (4) steps taken by engineering firms to promote a culture of ethical behaviour?
11. Why is it important for engineers to adhere to a code of ethics in their professional practice?
12. How does ethical behaviour in engineering contribute to public safety?
13. Give an example of a situation where an engineer must choose between an ethical and an unethical action. What should the engineer do and why?
14. Give two (2) potential consequences of unethical behaviour in engineering for the engineer, the public, and the profession.
15. How does honesty in reporting and documentation benefit an engineering project?
16. Describe how an engineer can handle a situation where they are pressured to compromise on quality to meet a deadline.
17. Outline environmental responsibilities of engineers that will help to promote engineering ethics.
18. How can engineering firms create a culture that promotes ethical behaviour?
19. Explain the concept of a conflict of interest in engineering and how it can be managed ethically.
20. Why is it important for engineers to engage in continuous professional development related to ethics?

Answers to Review Questions

1. Ethical behaviour in engineering refers to actions and decisions consistent with the principles of honesty, integrity, fairness, and respect for the public's safety and welfare. It involves adhering to professional codes of ethics, following legal standards, and considering the impact of engineering work on society and the environment.
2. An example of an ethical decision is an engineer choosing to report a design flaw in a product, even though it may lead to project delays or additional costs. By doing so, the engineer ensures the safety and well-being of users, which aligns with ethical principles.
3. Common unethical behaviours in engineering include falsifying data or reports, ignoring safety standards to cut costs, plagiarising designs, or ideas, accepting bribes or kickbacks, and failing to disclose conflicts of interest.
4. Adhering to ethical standards is crucial for engineers because it helps maintain public trust, ensures the safety and well-being of the community, upholds the integrity of the profession, and prevents legal and financial repercussions. Ethical behaviour also fosters a positive work environment and promotes long-term success.
5. A real-world example of unethical behaviour is the Volkswagen emissions scandal, where the company installed software in diesel engines to cheat on emissions tests. The consequences included significant financial penalties, damage to the company's reputation, loss of consumer trust, and legal action against executives. This scandal highlighted the importance of honesty and transparency in engineering practices.
6. Engineers can ensure they are making ethical decisions by adhering to professional codes of ethics, seeking guidance from mentors or ethics committees, conducting thorough risk assessments, considering the broader impact of their work, and maintaining transparency and honesty in all their professional activities.
7. Professional engineering organisations promote ethical behaviour by establishing and enforcing codes of ethics, providing ethics training and resources, offering guidance and support for ethical dilemmas, and recognising and rewarding ethical conduct. They also create a community where ethical standards are upheld and shared.
8. A conflict of interest occurs when an engineer's personal interests or relationships could potentially influence their professional judgment or actions. It can be managed ethically by fully disclosing the conflict to relevant parties, recusing oneself from decision-making where the conflict exists, and ensuring that decisions are made based on objective criteria and the best interest of the project or public.

9. Ignoring safety standards to cut costs is unethical because it compromises the safety and well-being of the public, can lead to accidents and fatalities, and undermines the integrity of the engineering profession. It prioritises financial gain over human life and ethical responsibilities.

10. Engineering firms can promote a culture of ethical behaviour by:

- Implementing comprehensive ethics training programs.
- Establish clear policies and procedures for ethical conduct.
- Encouraging open communication and reporting of unethical behaviour without fear of retaliation.
- Recognising and rewarding employees who demonstrate ethical behaviour.
- Leading by example, with management consistently modeling ethical behaviour.
- Providing resources and support for employees facing ethical dilemmas.

11. Adhering to a code of ethics is important for engineers because it:

- Ensures the safety, health, and welfare of the public.
- Maintains the integrity and reputation of the engineering profession.
- Provides a framework for making consistent and fair decisions.
- It helps build public trust and confidence in engineering solutions.
- Prevents legal issues and professional misconduct.

12. Ethical behaviour in engineering ensures that engineers prioritise public safety over other considerations such as cost or convenience. This includes following safety standards, conducting thorough risk assessments, and being honest about potential risks and limitations of engineering solutions. By doing so, engineers help prevent accidents, injuries, and fatalities.

13. Example Situation: An engineer discovers a critical flaw in a bridge design that could lead to structural failure. Fixing the flaw would delay the project and increase costs.

What Should the Engineer Do? The engineer should report the flaw immediately and recommend corrective actions to address the issue.

Why? Reporting the flaw is the ethical choice because its priorities public safety and upholds the integrity of the engineering profession. Ignoring the flaw could lead to catastrophic failure, endangering lives and damaging public trust.

14.

- **For the Engineer:** Unethical behaviour can lead to loss of professional license, legal action, fines, and damage to personal and professional reputation.
- **For the Public:** Unethical behaviour can result in unsafe products, structures, or systems, leading to accidents, injuries, and fatalities.
- **For the Profession:** It undermines public trust in engineers, harms the reputation of the engineering field, and can lead to stricter regulations and oversight.

15. Honesty in reporting and documentation ensures that all stakeholders have accurate information about the project's status, potential risks, and challenges. This transparency helps in making informed decisions, prevents misunderstandings, and builds trust among team members, clients, and the public. It also ensures compliance with legal and professional standards.

16. The engineer should:

- Communicate the potential risks and consequences of compromising on quality to the relevant stakeholders.
- Propose alternative solutions that could meet the deadline without sacrificing quality, such as reallocating resources or adjusting the project scope.
- Adhere to professional and ethical standards, refusing to take actions that could endanger public safety or violate ethical guidelines.
- Document the situation and their response to ensure transparency and accountability.

17. Environmental responsibility in engineering ethics involves designing and implementing projects that minimise harm to the environment, promote sustainability, and use resources efficiently. This includes considering the environmental impact of materials and processes, reducing waste, and ensuring compliance with environmental regulations. It reflects the ethical duty of engineers to protect the planet for current and future generations.

18. Engineering firms can promote a culture of ethical behaviour by:

- Establishing and enforcing a clear code of ethics.
- Providing regular ethics training and resources for employees.
- Encouraging open communication and reporting of unethical behaviour without fear of retaliation.
- Recognising and rewarding employees who demonstrate ethical behaviour.
- Leading by example, with management consistently modeling ethical behaviour.
- Implementing policies and procedures that support ethical decision-making.

19. A conflict of interest in engineering occurs when an engineer's personal interests or relationships might influence their professional judgment or actions. It can be managed ethically by:

- Fully disclosing the conflict to all relevant parties.
- Recusing oneself from decision-making processes where conflict exists.
- Ensuring that decisions are based on objective criteria and the best interests of the project or public.
- Seeking guidance from supervisors or ethics committees if unsure how to proceed.

20. Continuous professional development related to ethics is important because:

- It helps engineers stay informed about new ethical challenges and best practices.
- It reinforces the importance of ethical behaviour in a rapidly changing technological landscape.
- It ensures engineers are aware of updates to ethical standards and regulations.
- It promotes a culture of lifelong learning and commitment to professional integrity.
- It equips engineers with the tools and knowledge to make sound ethical decisions in complex situations.

Extended Reading

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Acknowledgements

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