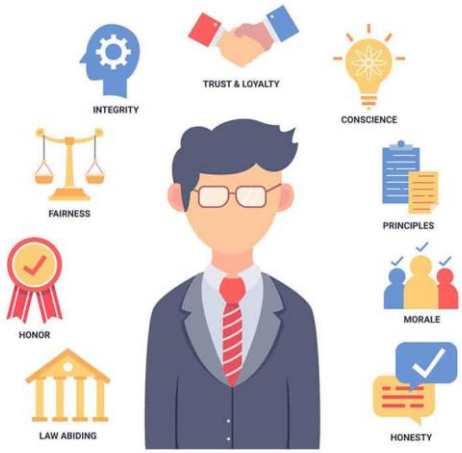
Reactor Design II-Ethics in Engineering



Week 12
Moral Reasoning

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Introduction

- Definition: Moral reasoning is the process of determining right from wrong based on ethical principles.
- Significance: Essential for addressing ethical challenges in professional and societal contexts.
- Scope:
- - Understanding ethical theories
- - Applying frameworks in engineering

Topics to be Addressed

- Overview:
- 1. Importance of Moral Reasoning
- 2. Ethical Theories and Frameworks
- 3. Case Studies
- 4. Tools for Decision-Making
- 5. Emerging Ethical Challenges

Objectives

- Purpose of this Presentation:
- - Explore the role of moral reasoning in engineering ethics
- - Highlight practical applications in Chemical Engineering
- - Analyze case studies for lessons learned
- - Discuss tools and frameworks for ethical decision-making

Introduction to Moral Reasoning

- Definition: The process of determining right from wrong through logical reasoning.
- Purpose: To guide ethical decision-making in personal and professional contexts.
- Key Components:
- - Moral principles
- - Ethical theories
- - Contextual analysis

Importance of Moral Reasoning in Engineering

- Why it Matters:
- - Protects public safety
- - Ensures sustainability
- - Upholds professional integrity
- Applications:
- - Decision-making in design
- - Handling conflicts of interest
- - Balancing economic and ethical concerns

Ethical Theories in Moral Reasoning

- Key Theories:
- - Utilitarianism: Maximizing benefits, minimizing harm
- - Deontology: Duty-based ethics
- - Virtue Ethics: Focusing on character
- Example: A chemical engineer deciding on safety protocols: balancing cost vs. safety (Utilitarianism) vs. adhering to codes (Deontology).

Framework for Moral Reasoning

- Steps:
- 1. Identify the ethical issue
- 2. Gather relevant facts
- 3. Evaluate alternative actions
- 4. Make a decision
- 5. Reflect on the outcome
- Example Application: Choosing environmentally friendly materials for a process.

Ethical Decision-Making in

Chemical Engineering

- Typical Scenarios:
- - Process safety and risk management
- - Environmental sustainability
- - Resource allocation and cost-efficiency
- Example: Deciding on the disposal method for hazardous waste.

Case Study 1 - Bhopal Gas Tragedy

- Background: Leak of methyl isocyanate gas in Bhopal, India, in 1984.
- Ethical Failures:
- - Negligence in safety measures
- - Inadequate disaster preparedness
- - Cost-cutting compromises
- Lessons Learned:
- - Prioritize human safety over cost
- - Implement stringent safety standards

Role of Professional Codes of Ethics

- Codes in Practice:
- - AIChE Code of Ethics
- - NSPE Code of Ethics
- Core Principles:
- - Public welfare
- - Honesty and integrity
- - Responsibility and accountability
- Example: Reporting potential risks in a chemical plant.

- Key Focus Areas:
- - Reducing environmental impact
- - Sustainable development
- - Climate change mitigation
- Example: Designing a process with minimal greenhouse gas emissions.

Case Study 2 - Flint Water Crisis

- Background: Contamination of drinking water with lead in Flint, Michigan.
- Ethical Issues:
- - Neglecting public health concerns
- - Failure to address complaints promptly
- - Lack of accountability
- Resolution: Importance of transparency and prioritizing community health.

Moral Dilemmas in Engineering

- Types:
- - Conflicts between profit and safety
- - Balancing innovation with ethical constraints
- - Dealing with whistleblowing
- Example: Deciding whether to report a defect in a chemical product.

Ethical Risk Assessment

- Steps:
- 1. Identify potential risks
- 2. Evaluate the impact on stakeholders
- 3. Develop mitigation strategies
- Application: Risk assessment for introducing new chemical products.

Case Study 3 - DuPont and PFOA Contamination

- Background: Release of perfluorooctanoic acid (PFOA) into water sources.
- Ethical Failures:
- - Concealing health risks
- - Delayed response to contamination
- Outcome: Legal and reputational consequences.

Tools for Ethical Decision-Making

- Common Tools:
- - Decision matrices
- - Cost-benefit analysis
- - Ethical checklists
- Example: Assessing the feasibility of a green chemistry approach.

Moral Reasoning in Team Dynamics

- Focus Areas:
- - Collaboration and communication
- - Respecting diverse perspectives
- - Resolving ethical conflicts
- Example: Handling disagreements over process safety standards.

Promoting Ethical Culture in Organizations

- Strategies:
- - Leadership by example
- - Ethical training programs
- - Encouraging whistleblowing
- Case Example: Implementation of an ethics hotline in a chemical firm.

Emerging Ethical Challenges

- Challenges in Chemical Engineering:
- - Biotechnology and genetic engineering
- - Nanotechnology safety
- - Artificial intelligence in process control
- Example: Ethical considerations in using AI for hazardous material handling.

Case Study 4 - Green Chemistry Innovations

- Success Story: Adoption of green solvents to reduce toxic waste.
- Moral Reasoning: Balancing cost, efficiency, and environmental benefits.
- Outcome: Enhanced sustainability and compliance.

Are you ready?

Summary

- Key Takeaways:
- - Moral reasoning is integral to ethical engineering practices.
- - Ethical theories and frameworks aid decision-making.
- - Case studies highlight the importance of prioritizing ethics.
- Call to Action: Foster ethical practices in engineering education and industry.