- Preface (p. xi)
- **Done Is Good** (p. xiv)
- Structure and Pedagogy (p. xvi)
- Notes and Commentary (p. xix)
- Acknowledgments (p. xxi)
- Bioethics Questions Posed in Text (p. xxiii)
- Prologue: Bioethics Discovery through Design
- A Different Approach to Bioethics (p. 3)
- Arguments for and Against Case Analysis (p. 4)
- Driver's Education Analogy (p. 5)
- Example Case: Priming the Pump (p. 6)
- Case Analysis (p. 7)
- Notes and Commentary (p. 8)
- Chapter 1 Bioethics: A Creative Approach
- Thought Experiments (p. 10)
- Teachable Moment: Trust (p. 12)
- The Principle of Double Effect (p. 12)
- Teachable Moment: The Engineer as Agent versus Judge (p. 12)
- Amy the Engineer (p. 15)
- Teachable Moment: Who Was Van Rensselaer Potter? (p. 18)
- Credat Emptor (p. 18)
- Teachable Moment: Capital Punishment, Abortion, and the Definition of Human Life (p. 20)
- The Good Engineer (p. 21)
- Feedback and Enhancement of Design (p. 22)
- Teachable Moment: The Good Engineer (p. 24)
- The Profession of Engineering (p. 25)
- Engineering Bioethics and Morality (p. 26)
- Discussion Box: Ethics and the Butterfly Effect (p. 27)
- "Small" Error and Devastating Outcomes (p. 28)
- Technology, Engineering, and Economics (p. 28)
- Teachable Moment: The Dismal Scientist versus the Technological Optimist (p. 31)
- **Engineering Competence** (p. 39)
- Engineering: Both Integrated and specialized (p. 39)
- Who Is a Professional? (p. 40)
- What Is Technical? (p. 41)
- Systematics: Incorporating Ethics into the Design Process (p. 42)
- Notes and Commentary (p. 43)
- Chapter 2 Bioethics and the Engineer
- Major Bioethical Areas (p. 51)
- Cloning and Stem Cell Research (p. 52)
- **Teachable Moment: Nanog** (p. 56)
- **Human Enhancement** (p. 57)
- Patenting Life (p. 57)
- Teachable Moment: Patenting Germplasm (p. 58)
- Neuroethics (p. 59)

- Organ Transplantation (p. 60)
- Responsible Conduct of Human Research (p. 60)
- **Animal Testing** (p. 61)
- Is the Research Worth It? (p. 63)
- Systematic Reality Check (p. 66)
- Genetically Modified Organisms (p. 67)
- Transgenic Species (p. 68)
- **Food** (p. 68)
- Environmental Health: The Ethics of Scale and the Scale of Ethics (p. 70)
- Temporal Aspects of Bioethical Decisions: Environmental Case Studies (p. 70)
- **Agent Orange** (p. 71)
- **Japanese Metal Industries** (p. 74)
- Minamata Mercury Case (p. 74)
- Cadmium and Itai Itai Disease (p. 75)
- Scale Is More than Size (p. 77)
- **Love Canal** (p. 78)
- **Times Beach** (p. 79)
- Teachable Moment: The Whole Is Greater than the Sum of Its Parts (p. 80)
- Active Engineering (p. 81)
- Ethical Theories: A Primer (p. 83)
- **Truth** (p. 84)
- Psychological Aspects of Ethics (p. 86)
- Teachable Moment: The Physiome Project: The Macroethics of Engineering toward Health (p. 89)
- **Fairness** (p. 94)
- Value as a Bioethical and Engineering Concept (p. 95)
- Technical Optimism versus Dismal Science (p. 96)
- Notes and Commentary (p. 98)
- Chapter 3 An Engineered Future: Human Enhancement
- Professional Zeitgeist: How Engineers Think (p. 106)
- Improvement versus Enhancement (p. 109)
- Engineering Intuition (p. 111)
- Engineers versus Economists (p. 112)
- **Intuiting Value** (p. 113)
- Deductive and Inductive Reasoning: Precursors to Intuition (p. 114)
- **Creativity** (p. 116)
- Moral Coherence (p. 120)
- Creativity and Bioethics (p. 122)
- The Ethical Quandary of Enhancement (p. 124)
- Scientific Dissent (p. 126)
- Notes and Commentary (p. 134)
- Chapter 4 The Bioethical Engineer
- **Professional Trust** (p. 139)
- Codes of Ethics: Words to Live By (p. 142)
- **Discussion Box: The Code of Hammurabi** (p. 143)
- Limitations of Codes of Ethics (p. 147)

- Risk Shifting: Organochlorine Pesticides (p. 147)
- Right of Professional Conscience (p. 152)
- Groupthink and the Right of Conscience (p. 156)
- Animals and Engineers (p. 158)
- Teachable Moment: Confined Animal Feeding Operations and the Moral Standing of Animals (p. 159)
- Making Ethical Decisions in Engineering (p. 160)
- Discussion Box: Four Persons Who Changed the Way We Think about Nature (p. 162)
- Gaylord Nelson (p. 164)
- **John Muir** (p. 162)
- Rachel Carson (p. 162)
- **Christopher Stone** (p. 163)
- Notes and Commentary (p. 164)
- Chapter 5 Bioethical Research and Technological Development
- **Beyond Regulation** (p. 169)
- **Integrity** (p. 169)
- Teachable Moment: The Therapeutic Misconception (p. 173)
- The Experiment (p. 173)
- The Hypothetico-Deductive Method (p. 174)
- Research Conflict of Interest (p. 175)
- Teachable Moment: Truth and Turtles (p. 176)
- **Professionalism** (p. 178)
- Technology: Friend and Foe (p. 178)
- Teachable Moment: Medical Device Risk (p. 179)
- Risk Homeostasis and the Theory of Offsetting Behavior (p. 180)
- **Artifacts** (p. 182)
- Automation and Mechanization of Medicine (p. 183)
- Professional Consideration: Do Engineers Have Patients? (p. 184)
- Technological Reliability (p. 185)
- Low Tech Engineering (p. 189)
- **Information Technology** (p. 190)
- The Ethics of Nanotechnology (p. 193)
- Notes and Commentary (p. 195)
- Chapter 6 Bioethical Success and Failure
- Teachable Moment: Engineering Measurement (p. 201)
- Measurements of Success and Failure (p. 203)
- Technological Success and Failure (p. 203)
- Risk as a Bioethical Concept (p. 205)
- Safety, Risk, and Reliability in Design (p. 206)
- Probability: The Mathematics of Risk and Reliability (p. 206)
- **Discussion Box: Choose Your Risk** (p. 210)
- Reliability: An Ethics Metric (p. 214)
- **Reducing Risks** (p. 217)
- Risk as an Ethical Concept (p. 220)
- Risk-Based Ethics: The Syllogism Revisited (p. 223)

- **Causation** (p. 225)
- Biographical Box: Sir Bradford Hill (p. 226)
- Notes and Commentary (p. 228)
- Chapter 7 Analyzing Bioethical Success and Failure
- Medical Device Failure: Human Factors Engineering (p. 232)
- Teachable Moment: How to Analyse a Medical Device (p. 233)
- Utility as a Measure of Success (p. 234)
- Failure Type 1 Mistakes and Miscalculations (p. 236)
- Failure Type 2 Extraordinary Natural Circumstances (p. 236)
- Failure Type 3 Critical Path (p. 237)
- Failure Type 4 Negligence (p. 243)
- Failure Type 5 Lack of Imagination (p. 244)
- Bioterrorism: The Engineer's Response (p. 244)
- **Dual Use and Primacy of Science** (p. 246)
- Social Response of Engineering to Terrorism (p. 248)
- Success Paradigms (p. 248)
- Characterizing Success and Failure (p. 249)
- Accountability (p. 249)
- Value (p. 250)
- Case Analysis (p. 250)
- Notes and Commentary (p. 258)
- Chapter 8 Justice and Fairness as Biomedical and Biosystem Engineering Concepts
- Fairness and Distributive Justice (p. 263)
- Discussion Box: Harm and the Hippocratic Oath (p. 271)
- Teachable Moment: Disposal of a Slightly Hazardous Waste (p. 272)
- Solution and Discussion (p. 272)
- Though Experiment: Who Is More Ethical? (p. 274)
- Professional Virtue and Empathy (p. 277)
- Teachable Moment: Albert Schweitzer and the Reverence for Life (p. 277)
- **Reason** (p. 279)
- Teachable Moment: Abortion, Fairness, and Justice (p. 280)
- **Utility** (p. 281)
- Teachable Moment: Utility and Futility (p. 283)
- Precaution as a Bioethical Concept (p. 285)
- Discussion Box: The Tragedy of the Commons (p. 286)
- Notes and Commentary (p. 287)
- Chapter 9 Sustainable Bioethics
- **Green Is Good** (p. 291)
- Sustainability (p. 292)
- Teachable Moment: Rational Ethics and Thermodynamics (p. 293)
- Life Cycles and Concurrent Engineering (p. 300)
- Case Study Box: SIDS, A Concurrent Engineering Failure (p. 301)
- **Discussion Box: The Coffee Cup Debate** (p. 305)
- The Bioethics of Combustion (p. 307)
- **Systematic Bioethics** (p. 317)
- Seveso Plant Disaster (p. 318)

- **Poverty and Pollution** (p. 320)
- Interdependence (p. 322)
- Notes and Commentary (p. 323)
- Chapter 10 Engineering Wisdom
- Ethics and Chaos (p. 329)
- Macroethics and Microethics (p. 330)
- Future Directions (p. 331)
- The Humble Engineer (p. 338)
- Notes and Commentary (p. 340)
- Epilogue: Practical Bioethics
- Shutting Down the Pump (p. 343)
- Objectivity and Finding Truth (p. 344)
- Moral Courage (p. 346)
- Bioethics Resources for the Engineer (p. 347)
- Suggested Readings (p. 348)
- Ethics of Emerging Technologies (p. 348)
- Ethical Analysis, Reasoning, and Decision Making (p. 349)
- Macroethics and Societal Risk (p. 349)
- Teaching Engineering Macroethics (p. 351)
- Teaching Engineering Microethics (p. 353)
- Useful Websites (p. 354)
- Notes and Commentary (p. 356)
- **Appendix 1** (p. 357)
- **Appendix 2** (p. 363)
- Glossary of Terms Likely to Be Encountered in Bioethical Decision Making (p. 365)
- **Name Index** (p. 395)
- **Subject Index** (p. 397)