- Preface (p. iii)
- Chapter 1 Mechatronic Systems (p. 1)
- **1.1 Synergy of Systems** (p. 1)
- **1.2 Definition of Mechatronics** (p. 3)
- 1.3 Applications of Mechatronics (p. 5)
- 1.4 Objectives, Advantages, and Disadvantages of mechatronics (p. 9)
- Illustrative Examples (p. 10)
- Exercises (p. 11)
- Chapter 2 Mechatronics in Manufacturing (p. 12)
- **2.1 Production Unit** (p. 12)
- 2.2 Input/Output and Challenges in Mechatronic Production Units (p. 13)
- 2.3 Knowledge Required for Mechatronics in Manufacturing (p. 16)
- 2.4 Main Features of Mechatronics in Manufacturing (p. 17)
- 2.5 Computer Integrated Manufacturing (p. 21)
- 2.6 Just-in-Time Production Systems (p. 22)
- 2.7 Mechatronics and Allied Subjects (p. 23)
- Illustrative Examples (p. 23)
- **Exercises** (p. 26)
- Chapter 3 Mechanical Engineering and Machines in Mechatronics (p. 27)
- 3.1 Force, Friction, and Lubrication (p. 27)
- 3.2 Behaviour of Materials Under Load (p. 32)
- **3.3 Materials** (p. 38)
- **3.4 Heat Treatment** (p. 38)
- **3.5 Electroplating** (p. 39)
- **3.6 Fits and Tolerance** (p. 39)
- 3.7 Surface Texture and Scraping (p. 40)
- **3.8 Machine Structure** (p. 41)
- **3.9 Guideways** (p. 42)
- 3.10 Assembly Techniques (p. 44)
- 3.11 Mechanisms used in Mechatronics (p. 44)
- Illustrative Examples (p. 52)
- **Exercises** (p. 56)
- Chapter 4 Electronics in Mechatronics (p. 57)
- 4.1 Conductors, Insulators, and Semiconductors (p. 57)
- 4.2 Passive Electrical Components (p. 58)
- **4.3 Active Elements** (p. 65)
- 4.4 Digital Electronic Components (p. 72)
- **5.1 Analog Computer** (p. 83)
- Illustrative Examples (p. 78)
- Exercises (p. 81)
- Chapter 5 Computing Elements in Mechatronics (p. 82)
- **5.2 Timer 555** (p. 85)
- 5.3 Analog to Digital Conversion (p. 86)
- 5.4 Digital to Analog Conversion (p. 88)
- 5.5 Digital Computer (p. 89)
- 5.6 Architecture of a Microprocessor (p. 91)

- **5.7 Microcontroller** (p. 94)
- **5.8 Programmable Logic Controller** (p. 95)
- **5.9 Computer Peripherals** (p. 97)
- Illustrative Examples (p. 105)
- **Exercises** (p. 109)
- Chapter 6 Systems Modelling and Analysis (p. 110)
- **6.1 Control System Concept** (p. 112)
- **6.2 Standard Test Signals** (p. 118)
- 6.3 Time Response of A System (p. 120)
- **6.4 Block Diagram Manipulation** (p. 130)
- **6.5 Automatic Controllers** (p. 132)
- **6.6 Frequency Domain Analysis** (p. 134)
- **6.7 Modern Control Theory** (p. 135)
- **6.8 Sequential Control System** (p. 141)
- **6.9 Digital Control System** (p. 141)
- Illustrative Examples (p. 147)
- **Exercises** (p. 149)
- Chapter 7 Motion Control Devices (p. 151)
- **7.3 DC Servomotor** (p. 166)
- **7.5 AC Servomotor** (p. 170)
- 7.1 Hydraulic and Pneumatic Actuators (p. 152)
- **7.2 Electrical Actuators** (p. 160)
- 7.4 Brushless Permanent Magnet DC Motor (p. 169)
- **7.6 Stepper Motor** (p. 171)
- **7.7 Microctuators** (p. 172)
- 7.8 Drive Selection and Applications (p. 176)
- Illustrative Examples (p. 179)
- **Exercises** (p. 183)
- Chapter 8 Sensors and Transducers (p. 185)
- **8.1 Static Performance Characteristics** (p. 186)
- 8.2 Dynamic Performance Characteristics (p. 187)
- **8.3 Internal Sensors** (p. 189)
- **8.4 External Sensors** (p. 195)
- **8.5 Microsensors** (p. 207)
- Illustrative Examples (p. 213)
- **Exercises** (p. 215)
- Chapter 9 CNC Machines (p. 216)
- 9.1 Adaptive Control Machine System (p. 220)
- 9.2 CNC Machine Operations (p. 221)
- Exercises (p. 246)
- Chapter 10 Intelligent Systems and Their Applications (p. 248)
- **10.1 Artificial Neural Network** (p. 249)
- **10.2 Genetic Algorithm** (p. 257)
- 10.3 Fuzzy Logic Control (p. 260)
- **10.4 Nonverbal Teaching** (p. 263)
- 10.5 Design of Mechatronic Systems (p. 264)

- **10.6 Integrated Systems** (p. 268)
- Case Study 10.1 Slip Casting Process (p. 277)
- Case Study 10.2 Pick-and-Place Robot (p. 282)
- **Exercises** (p. 285)
- Chapter 11 Autotronics, Bionics, and Avionics (p. 286)
- **11.1 Autotronics** (p. 286)
- **11.2 Bionics** (p. 300)
- **11.3 Avionics** (p. 309)
- **Exercises** (p. 316)
- Appendix A Laplace Transform (p. 317)
- Appendix B Laplace and Z Transforms (p. 319)
- **Bibliography** (p. 320)
- **Index** (p. 327)