Contents

Chapter 1. Mechanics and Biomechanics 1

- Definitions 1
- Types of Motion 2
- Galileo's Study on the Motion of Objects 2
  Newton's Law of Motion 2
- Force and Moment of Force 4
  Balanced Forces 4
  Unbalanced Forces 4
  Moment of Force 4
  Balance and Force 6
- Center of Gravity 9
  Center of Gravity of the Human Body 9
  Stability of Equilibrium 12
  Intrinsic and Extrinsic Stability 15
- Velocity 17
  Average Velocity 18
- Acceleration 19
- Friction 19
  Types of Friction 20
  Laws of Friction 20
- Work 21
- Use of Statics 21
- Use of Kinematics 24
- Use of Kinetics 25
  Kinetics 26
  Definitions of Key Terms 26

Chapter 2. Biomechanics of Shoulder Joint 28

- Functional Anatomy 28
  Joint Structure 28
  Articulating Surfaces 29
- Functional Rom 29
  Stability 29
  Deltoid Muscle 32

Rotator Cuff Muscles 32
Supraspinatus 34
Long Head of Biceps 34
Kinematics 34
Degree of Freedom 35
Axis of Motion 35
- Arthrokinematics 36
Osteokinematics 36
Specifics of Kinematics 38
Scapulohumeral Rhythm 38
Kinetics 39

Chapter 3. Biomechanics of Elbow Joint 43

- Functional Anatomy 43
Joint Structure 43
Articulating Surfaces 44
- Functional Rom 45
Functional Range of Motion 45
Stability 46
- Muscular 47
- Kinematics 47
Degree of Freedom 47
Axis of Motion 47
Range of Motion 50
- Factors Affecting ROM 50
Arthrokinematics 52
Kinetics 52
- Radioulnar Joints 54
Axis of Motion 54
Kinetics 57
- Mobility and Stability 59
Relationship to Hand and Wrist 59
Effects of Age and Injury 60

Chapter 4. Biomechanics of Wrist and Hand Complex 61

- Wrist Complex 61
Joint Structure 61
Articulating Surfaces 63
Stability 63
- Functional ROM 65
Kinematics 66

- Hand Complex 70
  Structure of Fingers 71
  Specialized Function 72
  MCP Joints 73
  Kinematics 74
  Kinetics 75
- Thumb 85
  CMC Joint of Thumb 85
  MCP Joint 86
  Interphalangeal Joint 87
  Kinetics of Thumb 87
  Prehension 88

Chapter 5. Biomechanics of Hip Joint 94

- Functional Anatomy 94
  Joint Structure 94
  Articulating Surfaces 94
- Functional ROM 94
  Stability 95
- Kinematics 99
  Degree of Freedom 99
  Axis of Motion 99
- Osteokinematics 100
  Motion of Femur 100
  Kinetics 104

Chapter 6. Biomechanics of Knee Joint 112

- Functional Anatomy 112
  Joint Structure 112
  Articulating Surfaces 112
  Stability 112
  Ligaments 113
  Capsule of the Joint 115
  kinematics 115
  Axis of Motion 115
  Arthrokinematics 115
- Osteokinematics 118
  Range of Motion 118
  Coupled Motions 120
  Kinetics 121

Chapter 7. Biomechanics of Ankle and Foot Complex 135

- Functional Anatomy 135
  Kinematics 135
- Subtalar Joint 137
  Subtalar Joint Axis 138
  Transverse Tarsal Joint 141
- Interphalangeal Joint 144
  Plantar Aponeurosis 145
  Weight Distribution 146

Chapter 8. Biomechanics of Spinal Column as a Whole 148

- Functional Anatomy 148
  Mechanism of Listhesis 152
  Intervertebral Disk 152
  Ligaments and Joint Capsules 155
- Kinematics 157
- Kinetics 161
  Axial Compression 161
- Posterior Muscles 165
  Lateral Muscles 166
  Anterior Muscles 166
  Anterior Muscles 168
  Muscles of Pelvic Floor 168
  General Effects of Aging and Injury 170
- Cervical Region 170
  Kinematics 171
  Kinetics 173
- Thoracic Region 174
  Kinematics 174
  Kinetics 175
- Lumbar Region 175
  Kinematics 176
- Sacral Region 178
  Kinetics 179

Chapter 9. Biomechanics of Thoracic Spine 181

- Functional Anatomy 181
- Kinematics 181
- Effects of Scoliosis on RIB Cage 184
- Kinetics 184
- Measures of Lung Volume and Capacities 184

Chapter 10. Biomechanics of Temporomandibular Joint 192

- Applied Anatomy 192
  Mandibular motions 192
  Kinetics of TM joint 194
  Relationship with Cervical Spine 195
- Dysfunctions 196

Chapter 11. Posture 198

- Static and Dynamic Posture 199
  Postural Control 199
  Inertial and Gravitational Forces 201
- Foot and Toes 202
  Hammer Toes 203
  PES Planus (Flatfoot) 203
- Ankle 208
- Knee 208
  Flexed Knee Posture 209
  Hyperextended Knee Posture 210
- Hip and Pelvis 212
  Lumbosacral and Sacroiliac Joints 214
  Vertebral Column 215
- Head 219
  Forward Head Posture 220

Chapter 12. Kinetics and Kinematics of Functional Activities 222

- Rising from a Supine Position on the Bed 222
- Rising from Supine to Prone 226
- Standing up from a Sitting Position 227
- Squatting 229
- Climbing up the Steps 231
- Pushing and Punching 232
- Pulling 232
- Press up or Push up 232

Appendix 1. Functional Position of Joints 235
Appendix 2. Open and Closed Pack Positions 236
Bibliography 239
Index 241