

Contents

Preface — V

1 Materials

C. Ayyanar, J. Paulo Davim, and Sumit Pramanik

Chapter 1.1

Introduction to biomaterials: advances in ceramic and polymer matrix composites — 3

Sudip Kumar Sinha

Chapter 1.2

Advanced hydrogels for biomedical applications — 23

T. Senthamil Selvan and Sumit Pramanik

Chapter 1.3

Recent developments of nanocomposites and fabrications for biosensor applications — 73

Ranjan Kumar, Kamlendra Vikram, Sudeepan J., and Sujeet Kumar Mishra

Chapter 1.4

Evolution of metallic dental implants: historical perspective, needs, and application — 89

Kamlendra Vikram, Ranjan Kumar, Avishek Mishra, and Sumit Pramanik

Chapter 1.5

Tribological behavior of specific implant materials for dental applications — 107

2 Design

Mohadese Rajaeirad, Mohammadjavad (Matin) Einafshar, Morad Karimpour, and Nima Jamshidi

Chapter 2.1

Patient-specific implant (PSI) design — 127

Hossein Sahbafar

Chapter 2.2

Modeling techniques of bone tissue scaffolds — 167

Jayanta Kumar Biswas and Masud Rana

Chapter 2.3

**Fundamentals of computational modeling of biomechanics
in the musculoskeletal system — 195**

Pechimuthu Susai Manickam, S. Balamurugan, and Sandipan Roy

Chapter 2.4

Computational modeling of bone, muscles, soft tissues, and ligaments — 205

Alireza Feizkhah

Chapter 2.5

Computational modeling of articular cartilage and cell mechanics — 213

Raja Dhasan, Sandipan Roy, and Shubhabrata Datta

Chapter 2.6

**Experimental and computational analysis for osteoporotic fracture implant
failure — 233**

Raja Dhasan, Vamsi Krishna Dommeti, and Sandipan Roy

Chapter 2.7

Computational modeling of fracture implants — 239

3 Manufacturing

Mohammadjavad (Matin) Einafshar, Mohadese Rajaeirad,
and Michael Skipper Andersen

Chapter 3.1

Patient-specific implant (PSI) by additive manufacturing — 249

Sharayu Jadhav, Vaibhav Girase, and Pankaj Dhatrak

Chapter 3.2

Development of artificial skin using composites — 273

Hossein Sahbafar, Fatemeh Ahmadvand, and Narmin Zarrinabadi

Chapter 3.3

Development of nerve tissue replacement using composites — 297

R. C. Kishor and Sumit Pramanik

Chapter 3.4

Manufacturing of advanced prosthetic limbs using composites — 343

Index — 357