

# POSMAT I Programa de Pós-graduação em Engenharia de Materiais



**Course:** Biomaterials and Tissue Engineering

**Code:** MEM.009

**Credits:** 03

**Module:** Specific formation

**Research area:** Biomaterials

## Contents:

Introduction to Biomaterials - history, definition and classification of materials: metallic, bioceramics, polymeric materials, homologous or heterologous materials and composites as biomaterials. Basic concepts: biocompatibility - healing processes, inflammatory process, cellular response to implants, systemic and local effects; blood biocompatibility (non-thrombogenic surfaces), and biofunctionality (clinical behavior of implants). Correlations between structure and function in tissues: bone, conjunctive, vessels and other applications in tissue engineering or biomaterials. Technical standards for development and uses of biomaterials: protocols, synthesis and design of new biomaterials. - Metallic biomaterials: structures, properties and processing. Ceramic biomaterials: structures, properties and processing (bioceramics). Polymeric biomaterials: structures, properties and processing. (synthetic polymers and biopolymers). Improvements in nanostructured biomaterials and / or applications of bionanotechnology in the fields of rehabilitation engineering and engineering of artificial tissues / organs. Surface treatments - Covering and surface modification techniques. Artificial organs. Tissue engineering. New trends in biomaterials: biological design; application areas. Sterilization, Regulation and Ethics (national and international standardization of bioethics). Characterization of biomaterials: physical-chemical, mechanical and chemical tribe (mechanical, surface properties and deteriorating characteristics indicate the chemical reactivity of biomaterials for tissue engineering or drug delivery system). In vitro and in vitro evaluation of synthetic / biomimetic and / or modified natural biomaterials (biological properties of these biomaterials). Culture and manipulation of cells for 3D cultivation. Gene therapy. Bioreactors for tissue engineering. Recent advances in tissue engineering and artificial organs.

## References:

1. RATNER, B.; HOFFMAN, A.; SCHOEN, F.; LEMONS, J. **Biomaterials Science. An Introduction to Materials in Medicine**. 3<sup>th</sup> Edition, Amsterdam: Elsevier, 2012.
2. PARK, J.B.and LAKES, R.S. **Biomaterials. An Introduction**. 3<sup>th</sup> Edition, New York: Plenum Press, 2007.

3. HENCH L.L. **An Introduction to Bioceramics**. 1<sup>th</sup> Edition, London: Imperial College Press, 2013.
4. BRANDON, D. and KAPLAN, W. D. **Microstructural characterization of materials**. 1<sup>th</sup> Edition, John Wiley & Sons, 2004.
5. CALLISTER, W. D. Jr. **Ciência e engenharia de materiais: uma introdução**. 8<sup>a</sup> Edição. Rio de Janeiro: LTC, 2008.
6. RAMAKRISHNA, S.; RAMALINGAM, M.; SAMPATH KUMAR, T.S.; SOBOYEJO, W.O. **Biomaterials: A Nano Approach**. 1<sup>th</sup> Edition, London: CRC Press, 2010.
7. ENDERLE, J. D.; BLANCHARD, S.; BRONZINO, J. D. **Introduction to biomedical engineering**. 1<sup>th</sup> Edition, San Diego: Academic Press, 1999. 1062p.
8. JONES, J. R. **Biomaterials, artificial organs and tissue engineering**. 1<sup>th</sup> Edition, Cambridge: Woodhead Publishing Limited, 2005.
9. MA, P. X.; ELISSEEF, J. **Scaffolding in tissue engineering**. 1<sup>th</sup> Edition, New York: Taylor & Francis, 2005.
10. PARK, J. B.; BRONZINO, J. D. **Biomaterials: principles and applications**. 1<sup>th</sup> Edition, New York: Taylor & Francis, 2003.
11. HIN, T. S. **Engineering materials for biomedical applications**. 1<sup>th</sup> Edition, Singapore: WSP Co. Ltd., 2004.
12. WATCHTMAN, J. B. and HABER, R. A. **Ceramic films and coatings**. 1<sup>th</sup> Edition, New Jersey: Noyes Publications, 1992.
13. OREFICE, R.L.; PEREIRA, M.M.; MANSUR, H.S., **Biomateriais: Fundamentos e Aplicações**. 1<sup>th</sup> Edition, Belo Horizonte: Cultura Médica, 2005.
14. HOLLINGER. J.O. **An Introduction to Biomaterials**. 2<sup>th</sup> Edition, London: CRC Press, 2011.
15. WONG, J.Y. and BRONZINO, J.D. **Biomaterials**. 1<sup>th</sup> Edition, London: John Willey, 2007.
16. BLACK, J. **Biological Performance of Materials: Fundamentals of Biocompatibility**. 4<sup>th</sup> Edition, London: CRC Press, 2005.
17. SILVER, F.H. and CHRISTIANSEN, D.L., **Biomaterials Science and Biocompatibility**. 1<sup>th</sup> Edition, Springer Verlag, 1999.
18. KING, P.H., FRIES, R.C.; JOHNSON, A.T. **Design of Biomedical Devices and Systems**. 3<sup>th</sup> Edition, Boca Raton: CRC Press, 2014.

**POSMAT I Programa de Pós-graduação  
em Engenharia de Materiais**



19. HENCH L.L. and JONES, J.R., **Biomaterials, Artificial Organs and Tissue Engineering**. 1<sup>th</sup> Edition, Boca Raton: CRC Press, 2005.
20. HELSEN, J.A., **Metals as Biomaterials**. 1<sup>th</sup> Edition, New York: John Wiley and Sons, 1998.
21. DUMITRIU, S. and POPA, V. **Polymeric Biomaterials – Vol. 1: Structure and Function**. 3<sup>th</sup> Edition, Boca Raton: CRC Press, 2013.
22. ASKELAND, D.R.; FULAY, P.P.; WRIGHT, W.J. **The Science and Engineering of Materials**. 6<sup>th</sup>. Edition, Stanford: Cengage Learning, 2011.
23. SHACKELFORD, J.F. **Introduction to Materials Science for Engineers**. 7<sup>th</sup> Edition, New York: Prentice Hall, 2009.