**DESCRIPTION of Curricula/Module**

|  |  |
| --- | --- |
| **Short Name of the University/Countrycode Date (Month / Year)** | **CUT JUNE 2018** |
| **TITLE OF THE MODULE** | **Code** |
| **Biomaterials I** |  |

|  |  |
| --- | --- |
| **Teacher(s)** | **Department** |
| **Coordinating:** Grzegorz Milewski, PhD, DSc  **Others:**- | Applied Mechanics |

|  |  |  |
| --- | --- | --- |
| **Study cycle** | **Level of the module** | **Type of the module** |
| Bachelor/Masters | 4th/5th semester | Basic/Elective |

|  |  |  |
| --- | --- | --- |
| **Form of delivery** | **Duration** | **Language(s)** |
| Lectures, Seminary | 15 weeks | English |

|  |  |
| --- | --- |
| **Prerequisites** | |
| **Prerequisites:**  Knowledge: Basic knowledge of physics, chemistry, mechanics, strength of materials and material engineering.  Skills: none  Competences: none | **Co-requisites (if necessary):**  none |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **ECTS  (Credits of the module)** | **Total student workload hours** | | **Contact hours** | | **Individual work hours** |
| 6 | 90 | | 30 | | 60 |
| **Aim of the module (course unit): competences foreseen by the study program** | | | | | |
| Students should be able to:   * Analyze and compare physical and mechanical properties of different types of biomaterials; * Formulate the terms of material biocompatibility and bio-functionality from the point of view of the safe use in the human body; * Differentiate various biomaterials with regards to their properties and possible applications in medicine; * Understand the appropriate factors influencing the physical and mechanical properties of biomaterials as well as the mutual interaction between implant and host tissues; | | | | | |
| **Learning outcomes of module (course unit)** | | **Teaching/learning methods** | | **Assessment methods** | |
| Knowledge:  Specialized knowledge on physical and mechanical properties of biomaterials, methods of biomaterials properties testing, knowledge on basic methods of biomaterials processing and overall look on chosen procedures of clinical implantation | | Work with the lecture notes on biomaterials as well as on the available fundamental subject literature | | Knowledge test | |
| Skills:  Ability to choice biomaterials for clinical practice with regards to the biocompatibility formulation. Ability to plan and conduct basic physical and mechanical tests for biomaterials as well as to analyze the obtained results. | | Lectures, project, consultation | | Active attendance on lectures, individual/group project and presentation | |
| Competences:  Ability to choose and adjust the biomaterial to match its properties to living tissues, study the subject literature, exchange knowledge, working in group | | Lectures, project, consultation | | Individual/group project and presentation | |

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Themes** | **Contact work hours** | | | | | | | **Time and tasks for individual work** | |
| Lectures | Consultations | Seminars | Practical work | Laboratory work | Placements | **Total contact work** | **Individual work** | **Tasks** |
| 1. General characteristics of biomaterials. Types and requirements for biomaterials. Biomaterials functionality. | 2 |  |  |  |  |  | **2** | **4** | Study of general characteristics of biomaterials and requirements for specific material applications in medicine |
| 2. The mechanisms of osseo-integration and cooperation of biological tissue with implants. | 2 |  |  |  |  |  | **2** | **4** | Understanding the mechanisms of osseo-integration and interactions processes between implant and living tissues |
| 3.Fundamentals of tissue engineering. Scaffolds processing, bio-printing, bioreactors. | 4 |  |  |  |  |  | **4** | **4** | Understanding the idea of tissue engineering and the role of scaffold, study properties of scaffold |
| 4. Natural polymers as biomaterials. | 2 |  |  |  |  |  | **2** | **4** | Study on applications of natural polymers as biomaterials |
| 5. Application of polymeric synthetic materials in medicine. | 2 |  |  |  |  |  | **2** | **4** | Study on characteristics applications of synthetic polymers as biomaterials |
| 6. Metallic materials in implantology. Alloy steels resistant to corrosion, cobalt alloys. Stainless steel alloys for medical instrumentation. | 4 |  |  |  |  |  | **4** | **4** | Study on characteristics and ways of application of metallic implants, |
| 7. Smart materials in technics and medicine. | 2 |  |  |  |  |  | **2** | **4** | Study on modern smart (intelligent) materials in technics and medicine |
| 8. Titanium and its alloys in medical applications. | 2 |  |  |  |  |  | **2** | **4** | Study on titanium and its alloys applications in medicine |
| 9. Carbon biomaterials. Carbon-carbon composites and carbon composites with polymer matrix. | 2 |  |  |  |  |  | **2** | **4** | Study on carbon composites applications in medicine |
| 10. Ceramic materials: corundum bioceramics, bioglass, hydroxyapatite. | 2 |  |  |  |  |  | **2** | **4** | Study on variety of ceramic materials applications in medicine |
| 11. Seminars on biomaterials properties, functionality and applications |  |  | 6 |  |  |  | **6** | **20** | Understanding the criteria of material choice for medical applications with special attention paid to the factors influencing their physical and mechanical properties as well as the interaction between material and living tissues |
| **Total** | **24** |  | **6** |  |  |  | **30** | **60** |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Assessment strategy** | **Weight in %** | **Deadlines** | **Assessment criteria** |
| Knowledge verifying with a multiple choice test | 60 | 15thweek | Test |
| Individual or group final project referred during seminars | 40 | 10th - 15th week | Project |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Author** | **Year of issue** | **Title** | **No of periodical or volume** | **Place of printing. Printing house or internet link** |
| **Compulsory literature** | | | | |
| Buddy D. Ratner, Allan S. Hoffman, Frederick J. Schoen, Jack E. Lemons | 2013 | Biomaterials Science, Third Edition: An Introduction to Materials in Medicine |  | Elsevier Inc.  ISBN: 978-0-12-374626-9 |
| Joon Park, R. S. Lakes | 2007 | Biomaterials: An Introduction |  | Springer  ISBN: 978-0387378794 |
| Joseph D. Bronzino, Donald R. Peterson (eds.) | 2015 | Biomedical Engineering Fundamentals |  | CRC Press  ISBN: 978-1-4398-2518-1 |
| Joseph D. Bronzino, Donald R. Peterson (eds.) | 2015 | Molecular. Cellular and Tissue Engineering |  | CRC Press  ISBN: 978-1-4398-2530-3 |
| Joon B. Park, Joseph D. Bronzino. | 2002 | Biomaterials: Principles and Applications |  | CRC Press  ISBN: 9780849314919 |
| Gary E. Wnek, Gary L. Bowlin (eds.) | 2008 | Encyclopedia of Biomaterials and Biomedical Engineering | Vol. 1, 2, 3, 4 | Informa Healthcare USA, Inc.  ISBN: 978-1-4200-7953-1 |
| Murphy W., Black J., Hastings G. (eds.) | 2016 | Handbook of Biomaterials Properties – 2nd ed. |  | Springer  ISBN: 978-1-4939-3303-7  ISBN: 978-1-4939-3305-1 (eBook) |
| **Additional literature** | | | | |
| Myer Kutz (ed.) | 2009 | Biomedical Engineering and design handbook, 2nd ed. | Vol. 1, 2 | McGraw Hill Companies  ISBN: 978-0-07-149838-8 |
| Lisa A. Pruitt, Ayyana M. Chakravartula | 2011 | Mechanics of Biomaterials |  | Cambridge University Press  ISBN: 978-0-521-76221-2 |