**Model of the DESCRIPTION of Curricula/Module**

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| **Short Name of the University/Country code Date (Month / Year)** | **CUT/P04 May 2018** |
| **TITLE OF THE MODULE** | **Code** |
| **Additive methods in bioengineering** |  |

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| **Teacher(s)** | **Department** |
| **Coordinating:** Marek Nykiel, PhD  **Others:** Szymon Gądek, MSc | Department of Materials Engineering and Physics |

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

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| **Form of delivery** | **Duration** | **Langage(s)** |
| lectures, laboratory, seminary | 15 weeks | English |

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| **Prerequisites** | |
| **Prerequisites:**  Knowledge: polymer materials, methods of physic-mechanical properties determination, material sciences  Skills: analysis, calculations,  Competences: team work in laboratory. | **Co-requisites (if necessary):**  - |

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| **ECTS  (Credits of the module)** | **Total student workload hours** | | **Contact hours** | | **Individual work hours** |
| 5 | 120 | | 30 | | 90 |
| **Aim of the module (course unit): competences foreseen by the study programmes** | | | | | |
| To enable the students to have knowledge about 3D prints in medical and biological.  Choose the appropriate additive technology to application in medicine and biotechnology.  Compare the advantages and disadvantages various 3D printing techniques for applications in medicine and biotechnology. | | | | | |
| **Learning outcomes of module (course unit)** | | **Teaching/learning methods** | | **Assessment methods** | |
| Knowledge:   * Knowledge about the design of parameters for additive manufacturing processes. * Knowledge about basic additive technologies of metal products * Knowledge about basic additive technologies of polymer products.. | | Lectures | | Knowledge test | |
| Skills:   * The ability to select methods and tools for testing metallic and polymeric materials. * Ability to design and select the technology of producing metal and polymer materials. * Ability to solve problems with analytical and simulation methods. | | Workshops | | Reports | |
| Competences:   * Demonstrate innovation ideas in the field of additive technology in medicine. * Collecting and transferring information about the achievements of technology in a comprehensible way. | | Seminary | | Project, presentation | |

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| **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. Basic concept and definitions of additive techniques. | 2 |  |  |  |  |  | **2** | **6** | Study of theoretical material, case studies |
| 2. Overview of additive methods. | 4 |  |  |  |  |  | **2** | **10** | Study of theoretical material, case studies |
| 3. Construction of devices for additive methods. | 4 |  |  |  | 2 |  | **6** | **10** | Study of theoretical material, case studies |
| 4. Materials used in additive methods | 2 |  |  |  |  |  | **2** | **8** | Study of theoretical material, case studies |
| 5. Combining methods of 3D scaning and 3D printing | 2 |  | 2 |  | 2 |  | **2** | **10** | Study of theoretical material, case studies |
| 6. Combining resonance methods and 3D printing | 2 |  | 2 |  |  |  | **6** | **6** | Study of theoretical material, workshop |
| 7. Application of additive methods in pharmacy, medicine and tissue engineering. | 2 |  | 1 |  |  |  | **2** | **20** | Study of theoretical material, preparing the project and its presentation |
| 8. Application of additive methods in tissue engineering. | 2 |  | 1 |  |  |  | **8** | **20** | Study of theoretical material, preparing the project and its presentation |
| **Total** | **20** |  | **6** |  | **4** |  | **30** | **90** |  |

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| **Assessment strategy** | **Weight in %** | **Deadlines** | **Assessment criteria** |
| Knowledge verifying | 30 | 15th week | Knowledge test |
| Assessment of work during laboratory exercise | 30 | 15th week | Reports on each laboratory exercise, activity. |
| Final Project- presentation | 40 | 15th week | Attendance, activity, oral presentation |

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| **Author** | **Year of issue** | **Title** | **No of periodical or volume** | **Place of printing. Printing house or internet link** |
| **Compulsory literature** | | | | |
| Deepak M Kalaskar. | 2017 | 3D Printing In Medicine |  | Woodhead Publishing |
| * Ian Gibson * David W. Rosen * Brent Stucker | 2017 | Additive Manufacturing Technologies |  | Springer |
| **Additional literature** | | | | |
| Samuel N. Bernier  Bertier Luyt,  Tatiana Reinhard | 2015 | Design for 3D Printing: Scanning, Creating, Editing, Remixing, and Making in Three Dimensions |  | Published by Maker Media, Inc |
| Oliver Bothmann | 2015 | 3D Printers: A Beginner's Guide |  | Published by Fox Chapel Pub Co Inc |
| James Min Bobak Mosadegh  Simon Dunham | 2018 | 3D Printing Applications in Cardiovascular Medicine |  | Academic Press |