# COURSE DESCRIPTION CARD

<table>
<tr><td colspan="10">Bialystok University of Technology<br>Faculty of Mechanical Engineering</td></tr>
<tr><td>Field of study</td><td colspan="6">Biomedical Engineering</td><td>Degree level and programme type</td><td>2nd degree full-time studies</td></tr>
<tr><td>Specialisation/ diploma path</td><td colspan="6">Common course</td><td>Study profile</td><td>General academic</td></tr>
<tr><td rowspan="2">Course name</td><td colspan="6" rowspan="2">Advanced manufacturing techniques in biomedical engineering</td><td>Course code</td><td>MYIB2S0105</td></tr>
<tr><td>Course type</td><td>Compulsory</td></tr>
<tr><td rowspan="2">Forms and number of hours of educational activities</td><td>L</td><td>C</td><td>LC</td><td>P</td><td>SW</td><td>T</td><td>S</td><td>Semester</td><td>1</td></tr>
<tr><td>30</td><td>0</td><td>15</td><td>30</td><td>0</td><td>0</td><td>0</td><td>No. of ECTS credits</td><td>6</td></tr>
<tr><td>Entry requirements</td><td colspan="9">-</td></tr>
<tr><td>Course objectives</td><td colspan="9">Introducing students to contemporary methods of manufacturing of medical products and materials. Learning to perform technological processes and to develop technological documentation of products used in medicine.</td></tr>
<tr><td>Course content</td><td colspan="9">Lectures: Innovative technologies in materials engineering. Modern design-assist techniques: rapid prototyping, reverse engineering. Electrochemical, electro-discharge, laser, and loose abrasive machining. High-speed machining and hard materials machining. Modern methods of cutting materials. Modern melting and casting techniques. Technologies for manufacturing endoprosthetic components. Modern methods of manufacturing spherical surfaces. Methods of producing medical materials by powder metallurgy; consolidation of powders by induction, microwave, laser, SPS (spark plasma sintering) and HIP (hot isostatic pressing) methods. Nanotechnologies.<br><br>Laboratory classes: Preparing CNC machine tools for operation. Laser machining – profile cutting from polymers. Rapid prototyping techniques in designing and manufacturing machine parts (3D printing). Surface digitalisation of complex-shaped objects (3D scanning). Electrical discharge machining, wire cutting. Technologies for obtaining bone fusion components – waterjet cutting. Powder metallurgy processing.<br><br>Project: Development of a technological process for a specified medical component, e.g. an endoprosthesis, an endosteal anastomosis, or a bone fracture stabiliser (including selecting of the process parameters and machinery as well as preparing the technological documentation – manufacturing drawings and technological process sheets).</td></tr>
<tr><td>Teaching methods</td><td colspan="9">Informative lecture on a given topic, discussion, solving practical problems in groups, a project for individual students or 2-person groups.</td></tr>
<tr><td>Assessment method</td><td colspan="9">Lecture - a written examination, laboratory classes – evaluation of reports, tests of preparation for exercises (entry tests), project – development and defence of the project.</td></tr>
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| Symbol of learning outcome | Learning outcomes | Reference to the learning outcomes for the field of study |
|---|---|---|
| | **Knowledge: the graduate knows and understands** | |
| **LO1** | in depth biomedical engineering issues necessary for manufacturing components of biomedical devices and for analysing phenomena in biomedical processes and devices. | IB2_W02 |
| **LO2** | in depth processes and systems for manufacturing medical materials and devices as well as the influence of the parameters of the processes on the structural and performance properties of these materials and devices. | IB2_W07 |
| | **Skills: the graduate is able to** | |
| **LO3** | obtain information from literature and databases, apply knowledge from different fields of science to formulate and solve complex, non-standard problems, and innovatively perform biomedical engineering tasks | IB2_U04 |
| **LO4** | prepare documentation of design or research tasks, of the experiment results, and prepare a concise review of these results | IB2_U09 |

| Symbol of learning outcome | Methods of assessing the learning outcomes | Type of tuition during which the outcome is assessed |
|---|---|---|
| **LO1** | A written examination. | **L** |
| **LO2** | A written examination, laboratory classes reports, credit for written assignments. | **L, LC** |
| **LO3** | Development and defence of the project, laboratory classes reports, credit for written assignments. | **P, LC** |
| **LO4** | Development and defence of the project. | **P** |

| Student workload (in hours) | | No. of hours |
|---|---|---|
| **Calculation** | Participation in lectures | **30** |
| | Participation in project classes | **30** |
| | Participation in laboratory classes | **15** |
| | Preparation for laboratory classes | **20** |
| | Developing reports for laboratory classes | **13** |
| | Preparation for the examination | **20** |
| | Participation in the examination | **2** |
| | Developing the project | **15** |
| | Participation in student-teacher sessions | **5** |
| | **TOTAL:** | **125** |

| Quantitative indicators | HOURS | No. of ECTS credits |
|---|---|---|
| **Student workload – activities that require direct teacher participation** | **82** | **3.3** |
| **Student workload – practical activities** | **98** | **3.9** |

**Basic references**


1. Kapil Gupta. Advanced Manufacturing Technologies, Springer 2017, Switzreland.
2. Salvatore Brischetto, Paolo Maggiore and Carlo Giovanni Ferro, Additive Manufacturing Technologies and Applications, MDPI, Basel, Switzerland 2017.
3. Ahmed, Waqar; Ahmed, Waqar; Jackson, M. J.; Jackson, Mark J., Emerfing Nanotechnologies for Manufacturing, Copyright © 2009 by Academic Press. Inc

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|---|---|---|
| **Supplementary references** | **1.** Hahn H., Sidorenko A., Tiginyanu I., Nanoscale phenomena, Springer-Verlag, Berlin, 2009. | |
| **Organisational unit conducting the course** | Institute of Biomedical Engineering | **Date of issuing the programme** |
| **Author of the programme** | Associate Prof. Zbigniew Oksiuta, DSc, PhD, Eng. | 10.03.2023 |

**L – lecture, C – classes, LC – laboratory classes, P – project, SW – specialization workshop, T – tutorial, S – seminar**