GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Material technologies processing, PG_00057889		
Field of study	Mechanical and Medical Engineering		
Date of commencement of studies	February 2026	Academic year of realisation of subject	2026/2027
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Faculty of Mechanical Engineering and Ship Technology -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Stefan Dzionk	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	15.0	0.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	0.0	0.0	30

Subject objectives

To introduce students to modern methods of making components used in medical engineering, and methods of data acquisition for design and manufacturing.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_K81] is able to cooperate in international team at her/his own university, during work placement and during study abroad	The student cooperates within an international team to improve their work and obtain information from professional literature necessary for the preparation of simple tools used in the manufacturing of components for medical engineering applications.	[SK3] Assessment of ability to organize work [SK2] Assessment of progress of work
[K7_U81] is able to communicate with ease in foreign language at B2+ level of the Common European Framework of Reference for Languages (CEFR) in everyday life, in academic and professional environments	The student communicates in a foreign language during consultations with specialists in order to develop their own design concepts for components used in medical engineering.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools
[K7_W12] identifies and interprets the main developmental trends and significant new achievements in the field of engineering and technical sciences and disciplines relevant to the course of study	The student has knowledge of basic manufacturing technologies used to produce components and assemblies for medical engineering applications. The student is able to define quality requirements for manufactured components, taking into account the requirements applicable to components intended for use in mechanical and medical engineering.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
[K7_U02] formulates hypotheses to test research problems in the field of medical engineering	The student is able to identify basic problems related to the manufacturing of components used in medical engineering and propose solutions to these problems using information obtained from professional literature. The student is also able to present selected technologies used in mechanical and medical engineering.	[SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task

Subject contents	Course content – lecture Additive and subtractive manufacturing technologies, including incremental sheet metal forming, waterjet cutting, electrical discharge machining, chemical and electrochemical machining, unconventional abrasive machining, laser machining and electron beam machining. Polymer processing technologies, including extrusion, injection moulding, casting and the manufacturing of polymer composites. Geometric accuracy of prototypes, model distortion and the causes of manufacturing process errors. Reverse engineering, object digitisation methods, point cloud processing and registration, and measurement verification. 3D model representation, the STL file format, CAD data conversion and geometric errors. Course content – project Development of a manufacturing process and preparation of a concept for simple tooling enabling the production of a specific component for medical engineering applications.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	60.0%	50.0%
Midterm colloquium	60.0%	50.0%

Recommended reading

Basic literature

1. Gibson I., Rosen D., Stucker B., Khorasani M.: Additive Manufacturing Technologies. 3rd ed., Springer, Cham, 2021. DOI: 10.1007/978-3-030-56127-7.

2. Chlebus E.: Techniki komputerowe CAx w inżynierii produkcji. Wydawnictwa Naukowo-Techniczne, Warszawa, 2000.

3. Chlebus E. (red.): Innowacyjne technologie Rapid Prototyping – Rapid Tooling w rozwoju produktu. Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2003.

4. Strong A. B.: Plastics: Materials and Processing. 3rd ed., Pearson Prentice Hall, Upper Saddle River, New Jersey, 2006.

Supplementary literature

1. 1. Saechtling H., Machowska Z., Wielgosz Z. A.: Tworzywa sztuczne. Poradnik. Wyd. 5 zmienione, Wydawnictwa Naukowo-Techniczne, Warszawa, 2000.
2. Wilczyński K. (red.): Przetwórstwo tworzyw polimerowych. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa, 2018.
3. Wilczyński K.: Rheology in Polymer Processing: Modeling and Simulation. Carl Hanser Verlag, Munich, 2021.
4. Feld M.: Podstawy projektowania procesów technologicznych typowych części maszyn. Wyd. 2 zmienione, Wydawnictwa Naukowo-Techniczne, Warszawa, 2003
5. Feld M.: Uchwyty obróbkowe. Wydawnictwa Naukowo-Techniczne, Warszawa, 2002.
6. Chua C. K., Leong K. F., Lim C. S.: Rapid Prototyping: Principles and Applications. 3rd ed., World Scientific, Singapore, 2010.

eResources addresses

Example issues/ example questions/ tasks being completed	1. Incremental Sheet Forming (ISF) – methods, technological capabilities and applications. 2. Waterjet and abrasive waterjet cutting – operating principles, capabilities and limitations. 3. Electrical Discharge Machining (EDM) – basic methods, operating principles and technological capabilities. 4. Chemical and electrochemical machining – types of processes, operating principles and applications. 5. Unconventional abrasive machining methods – characteristics and applications. 6. Laser beam and electron beam machining – process fundamentals, capabilities and applications. 7. Basic polymer processing methods and their applications. 8. Polymer extrusion – process types, operating principles and applications. 9. Polymer injection moulding – process variants, technological parameters and product requirements. 10. Polymer casting, including rotational and centrifugal casting – operating principles and applications. 11. Manufacturing technologies for fibre-reinforced polymer composites – methods and applications. 12. Geometric accuracy of models produced using RP technologies. Model distortion, its causes and methods of minimisation. 13. Object digitisation methods – contact and non-contact methods and their operating principles. 14. Point cloud registration and alignment, surface reconstruction, and methods for measurement verification and accuracy assessment. 15. 3D model representation and data storage in the STL format. Conversion of CAD models into STL format, typical triangulation and mesh errors, mesh integrity assessment, including the application of Euler's formula.
Practical activites within the subject	Not applicable

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