GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Hybrid Manufacturing Processes, PG_00057859		
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 inż. Dawid Zieliński	
	Teachers	dr inż. Dawid Zieliński	

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

eNauczanie source address: https://enauczanie.pg.edu.pl/2025/course/view.php?id=8987

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

Introduction to hybrid and additive manufacturing methods, including reverse engineering, as applied in the production of machine components and in the medical industry, as well as trends in the development of modern manufacturing.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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	Communication and data analysis skills used to present a proposed manufacturing technology for mechanical components used in mechanical engineering, utilizing hybrid and additive manufacturing methods.	[SW2] Assessment of knowledge contained in presentation
[K7_K81] is able to cooperate in international team at her/his own university, during work placement and during study abroad	Communication and data analysis skills used to collaborate in international teams, as well as to present the results of one's own work aimed at solving engineering and technical problems related to hybrid and additive manufacturing.	[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice
[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 demonstrates the ability to communicate fluently in a foreign language, which is used to work in an international team and to identify and solve engineering and technical problems.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
[K7_U02] formulates hypotheses to test research problems in the field of medical engineering	The student has advanced knowledge of unconventional and hybrid manufacturing methods, particularly additive technologies and specialty materials. In addition, the student demonstrates knowledge and skills in working in a computer-based environment related to hybrid and additive manufacturing methods.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents

Course content – lecture

Lectures: basics of additive manufacturing and hybrid manufacturing; principles and characteristics of the 3D printing process for machine components; characteristics of additive methods, including powder-based technologies, resin-based technologies, and material extrusion methods; characteristics of 3D printing and hybrid manufacturing systems; application of hybrid and additive manufacturing methods in the construction of machine parts.

Course content – project

Project classes: basics and characteristics of CAD/CAM software used in hybrid and additive manufacturing; development of a process for fabrication of selected mechanical engineering parts using subtractive technology with CAM software; development of a process for rapid prototyping of selected mechanical engineering parts using 3D printing technology with dedicated slicers; multi-criteria comparative evaluation of processes for fabrication of selected mechanical engineering parts using CNC cutting technology and 3D printing, considering technological and economic aspects.

Prerequisites and co-requisites

Knowledge of technical drawing, the fundamentals of mechanical engineering and machining, as well as computer-aided design and manufacturing (CAD/CAM) systems.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquium at the end of the semester	60.0%	60.0%
Project	60.0%	40.0%

Recommended reading

Basic literature

1.Redwood, B., Schffer, F., & Garret, B. (2017). The 3D printing handbook: technologies, design and applications. 3D Hubs.

2.Gebhardt, A. (2012). Understanding additive manufacturing. Munich: Carl Hanser Verlag.

3.Siemiński, P., & Budzik, G. (2015). Techniki przyrostowe: druk drukarki 3D. Warsaw, Poland: Oficyna Wydawnicza Politechniki Warszawskiej.

4. Katapian S. Manufacturing Engineering and Technology Pearson Education Inc. Upper Saddle River, New Jersey 2006.

5. Przemysław Kochan. EdgeCAM. Wieloosiowe frezowanie CNC. Wydawnictwo Helion. Gliwice 2014.

6. Adam, Z., Grzesik, W., Deja, M., Jarosz, K., & Ruszaj, A. (2024). Obrabiarki CNC. Podstawy funkcjonowania i programowania. Procesy ubytkowe, przyrostowe i hybrydowe.

Supplementary literature

1. Deja, M., Dobrzyński, M., Flaszyński, P., Haras, J., & Zieliński, D. (2018). Application of Rapid Prototyping technology in the manufacturing of turbine blade with small diameter holes. Polish Maritime Research, 25(s1), 119-123.

2. Deja, M., & Zieliński, D. (2020). Application of 3D printing metal powder technology in the manufacture of components with complex geometries. Mechanik, 22-25.

3. Zieliński, D. (2020). Podstawy technologii selektywnego spiekania laserowego proszków polimerowychSLS. Tworzywa Sztuczne w Przemyśle, 81-83.

4. Zieliński, D. (2021). Drukowanie trwałych elementów z tworzyw termoplastycznych w technologii FDM/FFF. Tworzywa Sztuczne w Przemyśle, 103-106.

	eResources addresses	
Example issues/ example questions/ tasks being completed	1. Basics of 3d printing technology (definition, division into main areas of application, etc.) 2. Division of 3d printing technology (characteristics, examples of methods, etc.) 3. Comparison of subtractive (machining) processes and additive (incremental) technology 4. Advantages and disadvantages (limitations) of 3d printing technology. 5. Characteristics of 3d printing technology: DMLS/SLM (working principle, schematic, materials, application area) 6. Characteristics of 3d printing technology: SLS (working principle, schematic, materials, application area) 7. Characteristics of 3d printing technology: FFF/FDM (principle of operation, schematic, materials, area of application) 8. Characteristics of 3d printing technology: UV LCD/mSLA (principle of operation, schematic, materials, area of application) 9. Characteristics of the different stages of the rapid prototyping process of selected mechanical parts. 10. Indication of the main parameters in 3D printing software (slicers). 11. Characterization of selected post-processing procedures and methods for parts printed with various technologies: DMLS/SLM, SLS, FFF/FDM. 12. Importance of support structures in incremental technologies. 13. Characteristics of typical defects/defects found in selected 3D printing technologies. 14. Areas of application of 3d printing technologies - selected examples. 15. Construction of an exemplary 3d printer working in SLS technology (indication of selected and main elements of construction). 16. Construction of an example 3d printer working in FFF/FDM technology (indication of selected and main elements of construction). 17. Directions of development of 3D printing technology. 18. Characteristics of hybrid manufacturing. 19. Methods of hybrid machining using different 3D printing technologies. 20. Examples of hybrid machining and the purpose of its application.	
Practical activites within the subject	Not applicable	

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