



# Curriculum

**Field of study:** Digital Production for Sustainable Manufacturing

## Table of contents

3  
6  
8  
9  
11  
12  
16  
19  
23  
24

## General characteristics of the field of study

### Basic information

Faculty name:	Faculty of Management
Field of study:	Digital Production for Sustainable Manufacturing
Level:	Second-cycle (engineer) programme
Profile:	General academic
Form:	Full-time studies
ISCED classification:	0413
Number of ECTS credits necessary to complete studies at a given level:	90
Professional title awarded to graduates:	magister inżynier
Cycle start date:	2024/2025, summer semester
Duration of studies (number of semesters):	3

### Field of science to which the field of study is assigned:

Field of the social sciences

Field engineering and technical sciences

### Discipline of science to which the field of study is assigned:

Discipline	Percentage	ECTS
Management science and quality	80%	72
Mechanical engineering	20%	18

### Relationship between the field of study and the AGH University development strategy and the AGH University mission

The MSc programme 'Digital Production for Sustainable Manufacturing' focuses on the sustainable design and development of digital production systems, using advanced 'clean' technologies to deliver so-called 'green' products. Students gain the skills to design new and transform existing production systems, using digitisation and automation of processes and reducing resource and energy consumption, focusing on the principles of a circular economy.

The studies respond to the new challenges of the artificial intelligence and circular economy, respecting environmental principles. Their aim is to understand:

- the interrelationship between sustainable production factors and the effects of their impact on the economy,
- the environmental impact of the use of new and clean production techniques,
- the importance of digitisation and automation of processes in the context of reducing production costs,
- the relationship of local management activities to global supply chains,
- the relationship of technologies used to eco-efficiency and eco-efficient production.

The studies are focused on preparing students:

- to work in an international business environment,

- to develop key managerial competences,
- to develop their own knowledge in the area of advanced solutions in the context of production management,
- for the implementation of green and innovative projects/ undertakings,
- to design green products,
- to implement the objectives of clean production,
- to use digital technologies for monitoring, analysis, simulation and improvement of production processes and systems.

The Faculty's strong connection with the latest technologies and an active research and industrial environment will ensure an appropriate education. In specialised laboratories, the student will be introduced to the latest technologies, such as 3D printing, VR (virtual reality), IIoT (internet of things), AI (artificial intelligence), for example, while making use of a range of advanced simulation and optimisation software and specialised laboratories.

The study programme covers the engineering and management aspects of manufacturing and shows how they are interrelated. The engineering part is related to, among other things, clean production technologies, automation and product development tools and methods. The management part covers operational strategy, resource management for a sustainable production environment and elements of management in a global economy. Structured in this way, the programme provides up-to-date knowledge in:

- green production strategies,
- building reconfigurable and agile production systems,
- digital and automated production solutions,
- production engineering,
- describing and modelling production processes,
- defining requirements for digital solutions and their integration with information systems.

The course of study therefore aligns with the strategic objective: Modern education attractive to students and the environment at home and abroad, in particular it is in line with the operational objectives: tailoring the curriculum offer of studies to current needs and expectations, increasing the attractiveness of second-cycle studies, strengthening the position of AGH in the international educational area.

#### **Information on taking into account the socio-economic demand while creating the curriculum and indication of the assumed learning outcomes matching the identified demand**

The Faculty of Management has identified and incorporated socio-economic needs into the study program. Additionally, the faculty has relied on available studies and analyses of future professions and competencies, such as the 'Future 2024 Report,' 'Skills 2030,' 'Forbes - The Professions of the Future [Forbes - zawody przyszłości - in Polish],' 'Deloitte - The Future of Work Is Here,' and the 'Empirical Research Report on Competencies and Professions of the Future [Raport z badań empirycznych w zakresie kompetencji i zawodów przyszłości - in Polish].' These sources highlight that digital solutions, artificial intelligence, cybersecurity, process automation, and sustainable environments are areas where educated human resources will be needed in the near future.

The major 'Digital Production for Sustainable Manufacturing' benefits from ongoing consultation with employers and the socio-economic environment to ensure alignment of learning outcomes with current and future industry needs. The Faculty maintains an efficient alumni association, 'Klub Absolwenta', which facilitates the development of connections between alumni, employers, and students. As a platform for business-science integration, 'Klub Absolwenta' brings together individuals from academia, businesses, business-related institutions, and local government. This collaborative environment allows for identifying relevant learning directions and outcomes that meet current and future expectations of the labor market.

**Education paths - scope in Polish and in English**

Not applicable.

**Graduation paths - scope in Polish and in English**

Not applicable.

**The names of the majors in Polish and in English**

**Name [pl]**

**Name [en]**

---

## **General information about the curriculum**

Field of study: Digital Production for Sustainable Manufacturing

### **General information related to the curriculum (general learning objectives and employment opportunities, typical jobs and opportunities for graduate continuing education)**

The major 'Digital Production for Sustainable Manufacturing,' spans three semesters and leads to a master's degree in engineering. It aims to impart in-depth knowledge and advanced skills tailored for application in dynamic environments.

Graduates of the new major will be proficient in designing, planning, and organizing both primary and ancillary production processes. Their expertise will encompass the digital design of products, processes, and production systems, extending to such tasks as billing, control, and process improvement. Additionally, they will be equipped to design and develop the next generation of production facilities tailored for global manufacturing companies.

After graduation, alumni will be equipped to pursue employment opportunities in manufacturing companies, where they can assume managerial and engineering positions focused on advanced intelligent manufacturing systems. They will possess the knowledge and skills necessary for tasks involving system design and development, digital production planning and control, as well as the design of eco-friendly products aimed at reducing the environmental impact of production processes.

### **Information on including the conclusions from the students and graduates careers monitoring in the curriculum**

The education programme of the field of study in Digital Production for Sustainable Manufacturing will undergo continuous monitoring and it will take into account the needs of the labour market by using the opinions of students and employers. Graduates from the Faculty of Management at AGH are included in the "Vocational Staff Monitoring Programme of AGH (AGH Career Centre)", which has been continuously tracking the professional careers of the Faculty's graduates since 2008. The results of this monitoring will be analysed and used to modify the existing learning outcomes of the Digital Production for Sustainable Manufacturing. Within the mentioned monitoring graduates complete detailed questionnaires answering a multitude of questions, including evaluation of their studies and their current employment prospects. These surveys are used during the annual Faculty self-evaluation of educational quality, and play an important role in the development of study programmes.

### **Information on including the requirements and recommendations of the accreditation committees, in particular the Polish Accreditation Committee and industry accreditation committees in the curriculum**

The field of study in Digital Production for Sustainable Manufacturing has not yet been evaluated by PKA. However, the experience of evaluations conducted by PKA and other institutions at the Faculty of Management have been used in the development of this field of study. The Faculty implements the comments and recommendations made by PKA and the other auditing entities. The study programme will be systematically audited by the University Audit Team. This will lead to introduction of changes to the study program, if recommended.

The view and opinion of the Council for your field of study will be sought within this kind of internal audit. As part of it, individual will be appointed to collaborate with students in proposing changes to teaching methods and other relevant identified recommendations. In order to monitor and improve the quality of education in the proposed study field on an ongoing basis, the results of Staff evaluation surveys will be used.

### **Information on including examples of good practice in the curriculum**

The Faculty of Management cooperates with other foreign universities by implementing the Foreign Professor program, thus

exchanging and sharing knowledge on educational programs. This cooperation allows for the implementation of the best teaching practices. This cooperation provides an opportunity to gain knowledge and experience on educational needs and programs between universities in Europe, e.g. Italy, Spain, and in beyond, e.g. Turkey or India. The Faculty of Management cooperates with international production companies, e.g. Danieli SPA, Maspex, to study the needs of employers and use the findings in the training of future employees. In this way, the good practices developed thanks to the cooperation help to prepare graduates of the Faculty for working internationally.

### **Information on cooperation in the preparation of the curriculum with external stakeholders, in particular associations, professional and social organizations**

Strategic decisions for this field of study and the Faculty are made by taking into account two groups of stakeholders:

1. Internal: a group of faculty employees and students.
2. External: a group of international institutions, the international industry and trade sector, including cooperation with institutions, universities and enterprises (domestic and international) as well as civil society. The opinions of clients are identified and analyzed at regular meetings of, among others, Faculty Committees established for this purpose.

### **Duration, rules and form of the practical placement**

Not applicable.

## **Admission criteria, rules and policies**

Field of study: Digital Production for Sustainable Manufacturing

### **Description of competences expected from the candidate applying for admission to studies**

A candidate applying for admission to the second-cycle studies in the Digital Production for Sustainable Manufacturing programme at the Faculty of Management of AGH University of Krakow should have knowledge and skills that are adequate to the learning outcomes of the first-cycle studies in Management and Production Engineering. The student should have the ability to perform tasks and solve problems appropriate for the continuous learning process, related to the field of study. The candidate should know English at the B2 level and demonstrate the ability to think independently and creatively use the skills.

### **Recruitment conditions, including the winners and finalists of the central level high school scientific Olympics, as well as winners of international and national contests**

In accordance with the recruitment conditions specified for a given academic year by the Resolution of the AGH Senate, the basis for qualification is the recruitment index calculated on the basis of the number of points obtained in the entrance examination confirming the achievement of selected educational outcomes achieved in the first cycle studies of a given field of study and the average grade from first-cycle studies or master's studies. For AGH University of Krakow graduates, if they continue their studies, it is possible to recognize their result from the general examination finalising the first-cycle studies as the result of the entrance examination.

Recruitment Rules:

Recruitment is conducted in accordance with the principles set out in the Resolution of the AGH University of Krakow Senate in force for a given academic year regarding the conditions, procedure and date of starting and ending recruitment for the first year of first-cycle and second-cycle studies.

(details - <https://kandydaci.agh.edu.pl>)

### **The expected limit of admissions to studies along with an indication of the minimum number of admitted candidates required to successfully launch a study cycle**

Minimum number of students: 12

Maximum number of students: 48

## Learning outcomes

Field of study : Digital Production for Sustainable Manufacturing

### Knowledge

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
DPSM2A_W01	Knows and understands deeply the principles of ongoing and sustainable organisational development.	P7S_WK_A
DPSM2A_W02	Knows and understands deeply the issues related to the digital design, planning and manufacturing of products in a sustainable and ecological manner to respond to market demand.	P7S_WG_A_Inz, P7S_WG_A
DPSM2A_W03	Knows and understands deeply the needs and requirements for the design and operation of digital, sustainable and energy-efficient manufacturing processes and systems.	P7S_WG_A
DPSM2A_W04	Knows and understands deeply the methods, tools and theories concerning the digital reality design, planning and organisation phenomena and processes.	P7S_WK_A
DPSM2A_W05	Knows and understands deeply the trends, concepts and decision-making dilemmas in management with sustainability aspects.	P7S_WK_A_Inz, P7S_WK_A
DPSM2A_W06	Demonstrates in-depth knowledge and understanding of concepts, principles and methods for managing production processes and systems, including their design, modelling and optimisation.	P7S_WG_A
DPSM2A_W07	Knows and deeply understands the functioning of modern management systems of intelligent and eco-efficient solutions supporting production management	P7S_WG_A
DPSM2A_W08	Knows and understands deeply the methods, techniques, technologies and tools used to solve complex engineering problems.	P7S_WG_A

### Skills

KEU symbol	Learning outcomes prescribed to a field of study	CEU symbol
DPSM2A_U01	Is able to evaluate the environmental, economic and social consequences of own decisions in corporate and global contexts, including advanced analysis of complex problems.	P7S_UW_A
DPSM2A_U02	Is able to characterise, compare and discuss sustainable practices and innovation initiatives in production management, including design and assessment of their environmental impact.	P7S_UW_A_Inz_0 2, P7S_UW_A
DPSM2A_U03	Is able to implement modern concepts, methods (including digital methods), techniques and tools in engineering practice to solve complex problems including non-technical aspects.	P7S_UW_A_Inz_0 2, P7S_UW_A
DPSM2A_U04	Is able to plan and conduct experiments, to identify, collect and interpret required data as well as personal judgement and creativity to work with complex and emerging tasks.	P7S_UW_A_Inz_0 1, P7S_UW_A
DPSM2A_U05	Is able to identify directions for further scientific development and consciously undertake a process of self-education	P7S_UU_A
DPSM2A_U06	Is able to work as an individual as well as in a team, can manage an interdisciplinary team	P7S_UO_A
DPSM2A_U07	Is able to perform tasks under not fully predictable conditions, selecting and applying appropriate methods and tools, including advanced digital techniques.	P7S_UW_A

<b>KEU symbol</b>	<b>Learning outcomes prescribed to a field of study</b>	<b>CEU symbol</b>
<b>DPSM2A_U08</b>	Is able to communicate fluently in an international and interdisciplinary team at the B2+ level, using specialised terminology.	P7S_UK_A

## **Social competence**

<b>KEU symbol</b>	<b>Learning outcomes prescribed to a field of study</b>	<b>CEU symbol</b>
<b>DPSM2A_K01</b>	Ready to critically evaluate own knowledge and perceived content, complement and improve acquired knowledge and skills, independently seek solutions to theoretical and practical tasks while determining priorities for the completion of assigned activities.	P7S_KK_A
<b>DPSM2A_K02</b>	Ready to fulfill social obligations, think and act in an entrepreneurial, innovative and socially responsible manner, initiate and participate in the preparation of social projects, evaluate the consequences of their activities, including their impact on the environment.	P7S_KO_A
<b>DPSM2A_K03</b>	Ready to perform professional roles responsibly, taking into account the changing social needs, including: developing professional achievements, upholding the ethos of the profession, observing and developing the principles of professional ethics, and acting to uphold these principles.	P7S_KR_A

# Compliance table of engineering competence (Inz) with directional learning outcomes (KEU)

Major : Digital Production for Sustainable Manufacturing

## Knowledge

CEU symbol	Learning outcomes for qualifications including engineering competence	KEU references
<b>P7S_WG_A_Inz</b>	knowledge of basic processes taking place in the life cycle of technical devices, facilities and systems	DPSM2A_W02
<b>P7S_WK_A_Inz</b>	knowledge of basic principles of creating and developing various forms of individual entrepreneurship	DPSM2A_W05

## Skills

CEU symbol	Learning outcomes for qualifications including engineering competence	KEU references
<b>P7S_UW_A_Inz_01</b>	ability to plan and carry out experiments, including measurements and computer simulations as well as to interpret the obtained results and draw conclusions out of them. When identifying and formulating the specification of engineering problems and solving them, being able to: - use analytical, simulation and experimental methods; - recognize their systemic and non-technical aspects, including ethical connotations; - conduct a preliminary economic assessment of the proposed solutions and planned engineering activities; - perform a critical analysis of the functioning of existing technical solutions to further evaluate them;	DPSM2A_U04
<b>P7S_UW_A_Inz_02</b>	ability to design solutions in compliance with the given specification as well as being able to: create simple devices, facilities and systems typical for the study major or implement processes using skillfully chosen methods, techniques, tools and materials	DPSM2A_U02, DPSM2A_U03

## Field of study-prescribed outcomes coverage matrix

Field of study: Digital Production for Sustainable Manufacturing

2024/2025/S/III/Z/DPSM/all

Course	Code	Semestr	DPSM2A_W01	DPSM2A_W02	DPSM2A_W03	DPSM2A_W04	DPSM2A_W05	DPSM2A_W06	DPSM2A_W07	DPSM2A_W08	DPSM2A_U01	DPSM2A_U02	DPSM2A_U03	DPSM2A_U04	DPSM2A_U05	DPSM2A_U06	DPSM2A_U07	DPSM2A_U08	DPSM2A_K01	DPSM2A_K02	DPSM2A_K03	
Sustainable Manufacturing in Circular Economy	ZRDPSMS.IIi1K.661e374a7e952.24	1s	x			x	x				x	x			x				x	x		
Competitive Sustainable Business	ZRDPSMS.IIi75.4c7769b33a50a129c26d7e8277962e98.24	1s lub 2s lub 3s	x				x				x										x	
Contemporary trends, challenges and concepts in digital technologies	ZRDPSMS.IIi75.661e374b1460a.24	1s lub 2s lub 3s		x	x	x							x	x							x	
Digitalisation in Smart and Cleaner Production	ZRDPSMS.IIi1K.661e374a8b303.24	1s					x	x		x		x	x								x	
Project management	ZRDPSMS.IIi1K.8a38ca14dfd6a4112fda620666db2f11.24	1s					x						x			x					x	
Contemporary trends, challenges and concepts in economy and management	ZRDPSMS.IIi75.65631eefb0dac.24	1s lub 2s lub 3s	x				x				x		x	x							x	x

Course	Code	Semestr	DPSM2A_W01	DPSM2A_W02	DPSM2A_W03	DPSM2A_W04	DPSM2A_W05	DPSM2A_W06	DPSM2A_W07	DPSM2A_W08	DPSM2A_U01	DPSM2A_U02	DPSM2A_U03	DPSM2A_U04	DPSM2A_U05	DPSM2A_U06	DPSM2A_U07	DPSM2A_U08	DPSM2A_K01	DPSM2A_K02	DPSM2A_K03
Eco-Innovation in Industry	ZRDPSMS.Ili7S.726bbcf8375ed4b0e4f52911391624f0.24	1s lub 2s lub 3s	x				x				x				x					x	x
Crossborder Management	ZRDPSMS.Ili1K.661e374aa4164.24	1s	x								x										x
Cybersecurity & Ai System Protection	ZRDPSMS.Ili1K.661e374aafab2.24	1s			x	x		x					x			x	x				x
International Transportation and Logistics Management	ZRDPSMS.Ili7S.65c13beb51b6b5a2454ee124dfa4b578.24	1s lub 2s lub 3s		x			x				x		x						x	x	x
Green & Clean Technologies in Manufacturing	ZRDPSMS.Ili1K.661e374abaff7.24	1s	x	x	x		x				x	x	x						x	x	
Sustainable Development in EU	ZRDPSMS.Ili7S.df27d183e31f0ceb478725f74bba5110.24	1s lub 2s lub 3s	x								x							x			x
Robotics and Mechatronic Systems	ZRDPSMS.Ili3S.661e374b399f9.24	1s lub 2s		x	x								x	x							x
Decision-Making in Circular Supply Chain	ZRDPSMS.Ili3S.6242cf60be444.24	1s lub 2s					x	x						x		x		x	x		

Course	Code	Semestr	DPSM2A_W01	DPSM2A_W02	DPSM2A_W03	DPSM2A_W04	DPSM2A_W05	DPSM2A_W06	DPSM2A_W07	DPSM2A_W08	DPSM2A_U01	DPSM2A_U02	DPSM2A_U03	DPSM2A_U04	DPSM2A_U05	DPSM2A_U06	DPSM2A_U07	DPSM2A_U08	DPSM2A_K01	DPSM2A_K02	DPSM2A_K03
Combinatorial Optimization and Scheduling in Manufacturing and Services	ZRDPSMS.IIi3S.a5daa280fe78b2a8e42b7254ef1f113f.24	1s lub 2s						x		x							x			x	
Modeling and Optimization in Transport Planning	ZRDPSMS.IIi3S.da99b40398910cb421ed4db1a6b0df6d.24	1s lub 2s						x						x		x		x	x		
Sustainable Energy Systems	ZRDPSMS.IIi3S.661e374b79d9d.24	1s lub 2s	x	x	x			x	x	x		x	x			x			x	x	
Additive methods in rapid prototyping	ZRDPSMS.IIi3S.662650499928a.24	1s lub 2s		x	x	x	x	x	x	x		x	x	x			x		x	x	x
English B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b95918269.24	1s																	x		
French B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b95923fe1.24	1s																	x		
Spanish B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b9592fa42.24	1s																	x		
German B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b9593b5e9.24	1s																	x		



## Characteristics matrix of learning outcomes in relation to modules

Major: Digital Production for Sustainable Manufacturing

2024/2025/S/III/Z/DPSM/all

Course	Code	Semestr	P75_WK_A	P75_WG_A_Inz	P75_WG_A	P75_WK_A_Inz	P75_UW_A	P75_UW_A_Inz_02	P75_UW_A_Inz_01	P75_UU_A	P75_UO_A	P75_UK_A	P75_KK_A	P75_KO_A	P75_KR_A
Sustainable Manufacturing in Circular Economy	ZRDPSMS.IIi1K.661e374a7e952.24	1s	x			x	x	x		x			x	x	
Competitive Sustainable Business	ZRDPSMS.IIi7S.4c7769b33a50a129c26d7e8277962e98.24	1s lub 2s lub 3s	x			x	x							x	
Contemporary trends, challenges and concepts in digital technologies	ZRDPSMS.IIi7S.661e374b1460a.24	1s lub 2s lub 3s	x	x	x		x	x	x					x	
Digitalisation in Smart and Cleaner Production	ZRDPSMS.IIi1K.661e374a8b303.24	1s	x		x	x	x	x	x					x	
Project management	ZRDPSMS.IIi1K.8a38ca14dfd6a4112fda620666db2f11.24	1s	x			x	x	x			x			x	
Contemporary trends, challenges and concepts in economy and management	ZRDPSMS.IIi7S.65631eefb0dac.24	1s lub 2s lub 3s	x			x	x	x	x					x	x
Eco-Innovation in Industry	ZRDPSMS.IIi7S.726bbcf8375ed4b0e4f52911391624f0.24	1s lub 2s lub 3s	x			x	x			x				x	x
Crossborder Management	ZRDPSMS.IIi1K.661e374aa4164.24	1s	x				x								x
Cybersecurity & Ai System Protection	ZRDPSMS.IIi1K.661e374aafab2.24	1s	x		x		x	x			x				x
International Transportation and Logistics Management	ZRDPSMS.IIi7S.65c13beb51b6b5a2454ee124dfa4b578.24	1s lub 2s lub 3s	x	x	x	x	x	x					x	x	x
Green & Clean Technologies in Manufacturing	ZRDPSMS.IIi1K.661e374abaff7.24	1s	x	x	x	x	x	x					x	x	

Course	Code	Semestr	P7S_WK_A	P7S_WG_A_Inz	P7S_WG_A	P7S_WK_A_Inz	P7S_UW_A	P7S_UW_A_Inz_02	P7S_UW_A_Inz_01	P7S_UU_A	P7S_UO_A	P7S_UK_A	P7S_KK_A	P7S_KO_A	P7S_KR_A
Sustainable Development in EU	ZRDPSMS.IIi7S.df27d183e31f0ceb478725f74bba5110.24	1s lub 2s lub 3s	x				x					x		x	
Robotics and Mechatronic Systems	ZRDPSMS.IIi3S.661e374b399f9.24	1s lub 2s		x	x		x	x	x					x	
Decision-Making in Circular Supply Chain	ZRDPSMS.IIi3S.6242cf60be444.24	1s lub 2s	x		x	x	x		x		x	x	x		
Combinatorial Optimization and Scheduling in Manufacturing and Services	ZRDPSMS.IIi3S.a5daa280fe78b2a8e42b7254ef1f113f.24	1s lub 2s			x		x							x	
Modeling and Optimization in Transport Planning	ZRDPSMS.IIi3S.da99b40398910cb421ed4db1a6b0df6d.24	1s lub 2s			x		x		x		x	x	x		
Sustainable Energy Systems	ZRDPSMS.IIi3S.661e374b79d9d.24	1s lub 2s	x	x	x		x	x			x		x	x	
Additive methods in rapid prototyping	ZRDPSMS.IIi3S.662650499928a.24	1s lub 2s	x	x	x	x	x	x					x	x	x
English B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b95918269.24	1s										x			
French B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b95923fe1.24	1s										x			
Spanish B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b9592fa42.24	1s										x			
German B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b9593b5e9.24	1s										x			
Russian B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	ZRDPSMS.IIi1JO.6565b959473e1.24	1s										x			
Bussiness Simulation	ZRDPSMS.IIi2K.661e374c19a31.24	2s	x		x	x	x								
Digital Plant and Buildings Simulation	ZRDPSMS.IIi2K.661e374bea1a3.24	2s	x	x	x		x	x	x			x		x	

Course	Code	Semestr	P7S_WK_A	P7S_WG_A_Inz	P7S_WG_A	P7S_WK_A_Inz	P7S_UW_A	P7S_UW_A_Inz_02	P7S_UW_A_Inz_01	P7S_UU_A	P7S_UO_A	P7S_UK_A	P7S_KK_A	P7S_KO_A	P7S_KR_A
Green Product Design	ZRDPSMS.IIi2K.661e374bd362e.24	2s	x	x	x	x	x	x	x					x	
Industrial Eco-Efficiency	ZRDPSMS.IIi2K.661e374c0e69a.24	2s	x	x	x		x	x						x	
Modelling and Process Optimization	ZRDPSMS.IIi2K.661e374bdebe0.24	2s	x			x	x		x			x	x		
Research Methods in Management	ZRDPSMS.IIi2P.b8dadd94be64c8b6713c09aa120fbbd8.24	2s			x		x	x	x				x	x	
Diploma Thesis	ZRDPSMS.IIi4K.e53bc1ffec52171870fc55d1cec2fa6a.24	3s	x			x	x			x			x		
Diploma Seminar	ZRDPSMS.IIi4K.113e607328fe3b1feac36d5c37a13bcd.24	3s			x		x	x			x		x		
Sum (obligatory):			12	4	9	8	14	10	5	2	3	2	6	8	2
Sum (elective):			9	5	8	6	12	6	6	1	3	8	5	10	4
Sum:			21	9	17	14	26	16	11	3	6	10	11	18	6

## Matrix of learning outcomes prescribed to a field of study with related forms of classes and the method of testing

Major: Digital Production for Sustainable Manufacturing

2024/2025/S/III/Z/DPSM/all

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Sustainable Manufacturing in Circular Economy	Lectures, Project classes	Participation in a discussion, Examination, Activity during classes, Project, Presentation	DPSM2A_W01, DPSM2A_W05, DPSM2A_W04, DPSM2A_U01, DPSM2A_U02, DPSM2A_U05, DPSM2A_K01, DPSM2A_K02
Competitive Sustainable Business	Lectures, Auditorium classes	Test, Test, Project, Case study, Presentation	DPSM2A_W05, DPSM2A_W01, DPSM2A_U01, DPSM2A_K02
Contemporary trends, challenges and concepts in digital technologies	Lectures, Auditorium classes	Test, Project	DPSM2A_W02, DPSM2A_W04, DPSM2A_W03, DPSM2A_U03, DPSM2A_U04, DPSM2A_K02
Digitalisation in Smart and Cleaner Production	Lectures, Project classes, Laboratory classes	Examination, Test, Project	DPSM2A_W05, DPSM2A_W07, DPSM2A_U03, DPSM2A_U01, DPSM2A_U04, DPSM2A_K02
Project management	Lectures, Project classes	Test, Project	DPSM2A_W05, DPSM2A_U06, DPSM2A_U03, DPSM2A_K02
Contemporary trends, challenges and concepts in economy and management	Lectures, Auditorium classes	Test, Project	DPSM2A_W05, DPSM2A_W01, DPSM2A_U01, DPSM2A_U03, DPSM2A_U04, DPSM2A_K03, DPSM2A_K02
Eco-Innovation in Industry	Lectures, Auditorium classes	Activity during classes, Case study, Test results, Activity during classes, Execution of a project, Case study, Presentation	DPSM2A_W01, DPSM2A_W05, DPSM2A_U01, DPSM2A_U05, DPSM2A_K02, DPSM2A_K03
Crossborder Management	Lectures, Auditorium classes	Activity during classes, Test, Examination, Case study, Involvement in teamwork, Presentation, Activity during classes, Case study, Test results, Presentation, Oral answer	DPSM2A_W01, DPSM2A_U01, DPSM2A_K03

<b>Name of the module</b>	<b>Activity</b>	<b>Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module</b>	<b>KEU references</b>
Cybersecurity & Ai System Protection	Lectures, Project classes, Laboratory classes	Test, Project, Completion of laboratory classes	DPSM2A_W03, DPSM2A_W04, DPSM2A_W07, DPSM2A_U03, DPSM2A_U06, DPSM2A_U07, DPSM2A_K03
International Transportation and Logistics Management	Lectures, Auditorium classes	Test results, Execution of exercises, Presentation	DPSM2A_W02, DPSM2A_W05, DPSM2A_U01, DPSM2A_U03, DPSM2A_K01, DPSM2A_K02, DPSM2A_K03
Green & Clean Technologies in Manufacturing	Lectures, Project classes	Test, Project, Presentation	DPSM2A_W01, DPSM2A_W03, DPSM2A_W05, DPSM2A_W02, DPSM2A_U01, DPSM2A_U02, DPSM2A_U03, DPSM2A_K01, DPSM2A_K02
Sustainable Development in EU	Lectures, Auditorium classes	Activity during classes, Participation in a discussion, Essay, Essays written during classes, Activity during classes, Participation in a discussion, Essay, Presentation	DPSM2A_W01, DPSM2A_U01, DPSM2A_U08, DPSM2A_K02
Robotics and Mechatronic Systems	Lectures, Project classes	Test results, Report	DPSM2A_W02, DPSM2A_W03, DPSM2A_U03, DPSM2A_U04, DPSM2A_K02
Decision-Making in Circular Supply Chain	Lectures, Project classes	Test, Participation in a discussion, Execution of exercises, Execution of a project, Case study, Involvement in teamwork, Presentation	DPSM2A_W05, DPSM2A_W06, DPSM2A_U04, DPSM2A_U06, DPSM2A_U08, DPSM2A_K01
Combinatorial Optimization and Scheduling in Manufacturing and Services	Lectures, Project classes	Test, Activity during classes, Execution of exercises, Project, Case study, Presentation	DPSM2A_W06, DPSM2A_W08, DPSM2A_U07, DPSM2A_K02
Modeling and Optimization in Transport Planning	Lectures, Project classes	Test, Participation in a discussion, Execution of exercises, Execution of a project, Case study, Involvement in teamwork, Presentation	DPSM2A_W06, DPSM2A_U04, DPSM2A_U06, DPSM2A_U08, DPSM2A_K01
Sustainable Energy Systems	Lectures, Project classes	Test, Project, Presentation	DPSM2A_W01, DPSM2A_W03, DPSM2A_W06, DPSM2A_W08, DPSM2A_W02, DPSM2A_W07, DPSM2A_U03, DPSM2A_U02, DPSM2A_U06, DPSM2A_K01, DPSM2A_K02

Name of the module	Activity	Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module	KEU references
Additive methods in rapid prototyping	Lectures, Laboratory classes	Test, Activity during classes, Project, Report, Completion of laboratory classes	DPSM2A_W02, DPSM2A_W03, DPSM2A_W04, DPSM2A_W08, DPSM2A_W05, DPSM2A_W06, DPSM2A_W07, DPSM2A_U02, DPSM2A_U03, DPSM2A_U04, DPSM2A_U07, DPSM2A_K01, DPSM2A_K02, DPSM2A_K03
English B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Report, Scientific paper, Test results, Essays written during classes, Presentation	DPSM2A_U08
French B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Report, Scientific paper, Test results, Essays written during classes, Presentation	DPSM2A_U08
Spanish B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Report, Scientific paper, Test results, Essays written during classes, Presentation	DPSM2A_U08
German B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Report, Scientific paper, Test results, Essays written during classes, Presentation	DPSM2A_U08
Russian B2+ course - compulsory course for students of SECOND-CYCLE STUDIES	Foreign language classes	Activity during classes, Participation in a discussion, Execution of exercises, Test, Examination, Report, Scientific paper, Test results, Essays written during classes, Presentation	DPSM2A_U08
Bussiness Simulation	Laboratory classes	Report	DPSM2A_W05, DPSM2A_W07, DPSM2A_U01
Digital Plant and Buildings Simulation	Lectures, Project classes, Laboratory classes	Test, Presentation, Project	DPSM2A_W01, DPSM2A_W02, DPSM2A_W03, DPSM2A_W07, DPSM2A_W08, DPSM2A_U02, DPSM2A_U03, DPSM2A_U04, DPSM2A_U07, DPSM2A_U08, DPSM2A_K02

<b>Name of the module</b>	<b>Activity</b>	<b>Method of verification and assessment of learning outcomes achieved by the student in individual forms of classes and activities for the entire module</b>	<b>KEU references</b>
Green Product Design	Lectures, Project classes, Laboratory classes	Test, Examination, Presentation, Project	DPSM2A_W02, DPSM2A_W04, DPSM2A_W05, DPSM2A_W06, DPSM2A_W08, DPSM2A_U01, DPSM2A_U03, DPSM2A_U04, DPSM2A_K02
Industrial Eco-Efficiency	Lectures, Auditorium classes	Test, Participation in a discussion, Presentation	DPSM2A_W01, DPSM2A_W02, DPSM2A_U01, DPSM2A_U02, DPSM2A_K02
Modelling and Process Optimization	Lectures, Project classes, Laboratory classes	Examination, Activity during classes, Project, Case study, Presentation, Activity during classes, Execution of laboratory classes, Involvement in teamwork	DPSM2A_W01, DPSM2A_W05, DPSM2A_U01, DPSM2A_U08, DPSM2A_U04, DPSM2A_K01
Research Methods in Management	Lectures, Project classes	Project, Test, Project	DPSM2A_W06, DPSM2A_W07, DPSM2A_W08, DPSM2A_U03, DPSM2A_U04, DPSM2A_K01, DPSM2A_K02
Diploma Thesis	Diploma Thesis	Activity during classes, Participation in a discussion, Diploma thesis	DPSM2A_W05, DPSM2A_W04, DPSM2A_U05, DPSM2A_U07, DPSM2A_K01
Diploma Seminar	Seminars	Activity during classes, Presentation	DPSM2A_W08, DPSM2A_U03, DPSM2A_U01, DPSM2A_U06, DPSM2A_K01

## ECTS credits calculations

Field of study: Digital Production for Sustainable Manufacturing

### The total number of ECTS credits the student needs to obtain in the form of:

classes conducted with the direct participation of academic teachers or other persons conducting classes	46
core science classes relevant to a given major	4
practical classes, developing practical skills, including laboratory, design, practical and workshop classes	36
classes subject to choice by the student (in the amount of not less than 30% of the number of ECTS credits necessary to obtain qualifications corresponding to the level of education)	51
classes in the field of humanities or social sciences - in the case of fields of study assigned to disciplines within fields other than humanities or social sciences, respectively	5
foreign language classes	2
practical placements	0
classes related to the academic activity conducted at the University in the discipline or disciplines to which the field of study is assigned, in the amount greater than 50% of the number of ECTS credits required to complete studies at a given level, taking into account the participation of students in classes preparing to conduct scientific activity or participate in this activity (applies only to studies with a general academic profile)	60
classes shaping practical skills in the amount greater than 50% of the number of ECTS credits required to complete studies at a given level (applies only to studies with a practical profile)	0

## **Detailed rules of the implementation of the curriculum established by the Dean of the Faculty (the so-called Study Rules)**

Field of study: Digital Production for Sustainable Manufacturing

### **Enrollment rules for the next semester**

The rules for registering for the next semester are regulated by the Study Regulations applicable in a given academic year.

To obtain entry it is necessary:

- to pass all modules of classes specified in the study program applicable to a given field of study, level and profile, provided for in the plan of this semester of studies,
- to obtain 27-33 ECTS points, depending on the semester planned for implementation under a given study plan.

The condition for passing the last semester of studies is to pass all course modules specified in the study program applicable to a given field of study and provided for in the plan of this semester of study, with the exception of the diploma thesis.

### **Enrollment rules for the next semester as a part of the so-called ECTS credits debt ceiling**

If the standard conditions for registration for the next semester are not met, it is possible to apply for registration for the next semester of studies with the so-called permissible total deficit of points. The permissible total deficit of points is 15 ECTS.

### **ECTS credits debt ceiling**

15

### **Organization of classes within the so-called blocks of classes (i.e. such organization of subjects or individual forms of classes that creates exceptions to the cyclical nature of classes in particular weeks of a given semester of studies)**

Not applicable.

### **Monitoring semesters**

Non-existent.

### **Study rules in case of the individual organization of studies approved for a specific student**

Individual organization of studies may be granted to students:

1. particularly gifted and outstanding in science,
2. with disabilities,
3. in a difficult life situation,
4. taking part in sports competitions at national or international level,
5. wishing to complete part of their studies at another university,
6. students in more than one field of study,
7. elected to the collegial body of the University,
8. foreigners taking a Polish language course,
9. pregnant full-time students,
10. female and full-time students who are parents.

11. wishing to carry out a research project or a scientific project as part of a research educational path under the "Research University Excellence Initiative (IDUB)" project.

Individual organization of the study program may consist in particular in:

- individual selection of lesson modules, methods and forms of education,
- modification of the form of tests and examinations,
- modification of the number of ECTS points required to complete a semester of studies,
- modifying the weekly schedule of classes, if possible by selecting a class group and/or class hours, in a way that enables the implementation of the applicable study program while adapting to the student's time possibilities,
- changes in the dates of exams and tests, in consultation with the teacher of the subject or class.

Individual organization of studies may concern classes within one or several semesters or the entire course of studies and may not lead to a change in the field of study learning outcomes and compulsory modules specified in the study program for a given field of study, level and profile of education, or to an extension of the deadline for completing studies. IOS does not exempt the student from attending classes.

The student interested in the IOS study mode submits a correctly completed and documented application to the Dean of the Faculty immediately after the reason for granting the IOS occurs. The Dean of the Faculty makes a decision within 14 days, about which the student is informed by e-mail. If the application is approved, the student signs and accepts the conditions for individual organization of studies.

The scope of individualization of the study program, including semester study plans, is determined and approved by the Dean of the Faculty, taking into account:

- current course of studies,
- technical and economic possibilities of individualizing the organization of studies,
- superior provisions resulting from resolutions, orders and regulations regarding the education process.

The scientific and didactic supervisor, responsible for the entire student's education process according to the individual organization of studies, including the study plan, is appointed by the Dean of the Faculty. The scientific and didactic supervisor proposes an individual study program, including a study plan. After the Dean's approval, he/she exercises scientific and didactic supervision over the student, reports any deviations from the adopted program and study plan to the Dean of the Faculty, and creates adjustments to the individual study program.

If a student fails a module that was to be completed as part of an individual study organization, he or she is obliged to repeat the module resulting from the applicable study plan. The above rule also applies to students for whom equivalent modules have been designated as a result of international agreements.

### **Implementation of practical placements including monitoring system and completion rules**

Not applicable.

### **Rules of elective modules taking**

The elective module is selected by the student from among modules belonging to a specific larger set given in the study program. From among the proposed modules, the Dean each time selects those that may be launched in a given semester, depending on the capabilities of the Faculty and the availability of academic teachers. Students select on the e-learning platform or in the University's IT system a specific number of modules for a given semester, resulting from the ECTS points allocated in a given study plan. The qualification rules for a given elective module are made public before the selection

procedure begins.

### **Rules of education paths, graduation paths, major choice/eligibility**

Not applicable.

### **Rules related to the preparation of diploma projects and theses as well as the implementation of the degree granting**

The student works on the diploma thesis under the supervision of an authorized academic teacher (thesis supervisor). The student selects the topic of the thesis from among the topics proposed by the supervisors and placed in the USOS system or agrees it with the supervisor.

The student may be admitted to the diploma examination if:

- completed all course modules provided for in the study program;
- submitted a diploma thesis.

The diploma examination includes:

- presentation of the diploma thesis,
- discussion of work,
- checking the level of knowledge and skills in the field of study.

The issues for the diploma examination checking the level of knowledge and skills in the field of study are published on the Faculty's website. Each part of the diploma examination is assessed separately, and the grade for the diploma examination is the arithmetic mean of all parts. The diploma examination ends with the announcement of the final result of studies and, if a positive grade is obtained, with the awarding of an appropriate title by the chairman of the Committee. A scientific article may be recognized as a diploma thesis, when the article is published in a scientific journal related to the learning outcomes achieved in a given field, level and profile of studies, and it is a peer-reviewed journal included in the list of scientific journals and peer-reviewed materials from international conferences announced by the minister responsible for higher education and science of July 17, 2023 pursuant to Art. 267 section 3 of the Act of July 20, 2018, Law on higher education and science (Journal of Laws of 2023, items 742, 1088 and 1234) for a minimum of 70 points.

The diploma thesis in the form of an article is prepared independently or as co-authorship, of no more than 2 people, with the student's contribution being at least 50% and confirmed in the statement submitted by both co-authors. Declarations of co-authors are attached to the submission of a copy of the work.

The student is obliged to submit an application for the recognition of the prepared scientific article as a thesis diploma, in a topic of thier choice, no later than one semester before the planned date of graduation, indicating the co-author of the article in the application. Consent to recognition of the prepared scientific article for the diploma thesis in response to the student's application is issued by the Vice-Dean of the Faculty seeking the opinion of at least one of the following persons:

- student's scientific supervisor,
- co-author of the scientific article indicated in the application,
- the head of the Department or Laboratory where the student conducts research.

At the time of submission of the application, the article should be published or accepted for publication. This fact should be documented by a certificate issued by the Publishing House.

**Principles for determining the overall evaluation of graduation (the final grade)**

The final grade entered on the graduation diploma is determined in accordance with the Study Regulations. The final grade is calculated on the basis of:

- average grade from studies with a weight of 60%,
- evaluation of the work, agreed by the supervisor and reviewer, with a weight of 20%,
- grades for the diploma exam with a weight of 20%.

**Other requirements related to the implementation of the curriculum resulting from the AGH University Study Regulations or other regulations in force at the University**

Not applicable.

The programme of the master's degree 'Digital Production and Sustainable Production' refers to the modern approach in production management, manifested by digital integration of all production activities in the context of globalisation and minimisation of negative environmental impact.

The graduate of the programme will be fluent in issues related to the design, planning and organisation of the main as well as accompanying (auxiliary) processes of production, ranging from digital design of products, processes and production systems to billing, control and process improvement.

After graduation, the student will be employable in manufacturing companies in managerial and engineering positions focused on the use of advanced intelligent manufacturing systems and will be prepared to perform tasks related to the design and development of systems, planning and controlling digital production, designing green products and reducing the negative impact of production on the environment.