GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Development trends in smart industry, PG_00062764		
Field of study	Technologies for Industry 5.0		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2029/2030
Education level	first-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	4	Language of instruction	Polish
Semester of study	7	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Electrochemistry and Surface Physical Chemistry -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Marta Prześniak-Welenc	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	15.0	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	5.0	40.0	75

Subject objectives

The aim of the course is to familiarize students with key trends and technologies of Industry 5.0, including smart factories, robotics, digital twins, data integration, real-time monitoring systems, sensors, failure prediction, safety, reliability, and the integration of mobile systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_W06] demonstrates knowledge related to data analysis and engineering, machine learning, knows the principles of integrating data with management systems to analyze complex engineering and technological problems	The student knows how to apply the principles of data analysis and engineering, as well as machine learning, to integrate data with management systems in order to analyze complex engineering and technological problems.	[SW1] Assessment of factual knowledge
[K6_U06] performs analysis, exploration and cleaning of data sets, can use statistical models and machine learning models, integrate various analytical, management and data storage tools	The student is able to perform data analysis, exploration, and cleaning, utilize statistical and machine learning models, as well as integrate various data analytics, management, and storage tools.	[SU1] Assessment of task fulfilment

Subject contents	Course content – lecture **Lecture 1 (1h): Introduction to Industry 5.0** Basic Concepts: • Definition and goals of Industry 5.0 • Differences between Industry 4.0 and 5.0 • Key technologies and trends **Factory Tweeting:** • Concept and applications • How machines communicate in real-time **Lecture 2 (1h): Digital Twins** Definition and Concept: • What is a digital twin? • Applications of digital twins in industry Creation and Management: • Methods for creating digital twins • Examples of implementations and benefits **Lecture 3 (1h): Smart Factories** Concept of a Smart Factory: • Key features and technologies • Examples of implementations Benefits and Challenges: • How smart factories improve production efficiency • Potential challenges and barriers **Lecture 4 (1h): Use of Robotics in Manufacturing** Types of Robots: • Types of industrial robots and their applications Process Automation: • How robotics contributes to process automation • Case study on the use of robotics **Lecture 5 (1h): Data Integration and Real-Time Monitoring Systems** Data Integration Technologies: • Tools and methods of integration Monitoring Systems: • How monitoring systems support real-time production management • Examples of implementations **Lecture 6 (1h): Sensor Implementation** Types of Sensors: • Types of sensors used in industry Applications: • How sensors are used for monitoring and automation • Integration of sensors with production systems

Lecture 7 (1h): Failure Prediction

Prediction Methods:

- Techniques for failure prediction

Data Analysis:

- Using historical data for prediction
- Examples of systems supporting predictive maintenance

Lecture 8 (1h): Safety and Reliability Issues

Basic Concepts:

- Industrial safety and its importance

Technologies and Methods:

- How to enhance the reliability of industrial systems
- Examples of security systems

Lecture 9 (1h): Integration of Mobile Systems

Role of Mobile Systems:

- How mobile technologies impact industry

Integration with Production Systems:

- Examples of integration and benefits

Lecture 10 (1h): ERP and BI Systems in the Context of Industry 5.0

Introduction to ERP and BI Systems:

- How ERP and BI systems support management in Industry 5.0

Integration with New Technologies:

- How they integrate with Industry 5.0 technologies

Lecture 11 (1h): Case Study: Smart Factory in Practice

Case Analysis:

- Example of smart factory implementation

Benefits and Challenges:

- Analysis of outcomes and conclusions

Lecture 12 (1h): Case Study: Sensor Implementation and Real-Time Monitoring

Case Analysis:

- Implementation of monitoring systems and sensors

Results and Conclusions:

- Examples of applications and effects

Lecture 13 (1h): Case Study: Failure Prediction and Safety

Case Analysis:

- Implementation of failure prediction systems

Safety Issues:

<table>
<tr><td></td><td>• Methods used in security systems

Lecture 14 (1h): Trends and the Future of Industry 5.0</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Seminar</td><td>50.0%</td><td>30.0%</td></tr>
<tr><td>Lecture</td><td>50.0%</td><td>70.0%</td></tr>
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</td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>Podstawy teoretyczne i praktyczne rewolucji przemysłowej 4.0 i 5.0
FNCE, KNAST PAWEŁ, MACIEJEWSKI RYSZARD</td></tr>
<tr><td>Supplementary literature</td><td>https://przemyslprzyszlosci.gov.pl/tag/przemysl-5-0/</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Sample Topics:

• Key technologies and features of smart factories
• Benefits and challenges of implementing a smart factory
• Automation of production processes through robotics

Sample Questions:

• What are the key technologies used in smart factories?
• What is a digital twin, and what are its applications in the industry?
• What are the benefits of implementing real-time monitoring systems?
• What are the main types of industrial robots and their applications?

Sample Seminar Tasks:

• Develop a case analysis of smart factory implementation, considering the benefits and challenges.
• Prepare a case study on the use of robotics in a selected production process.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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