SYLLABUS

Name: **Industry 4.0 and artificial intelligence technologies**
Name in Polish: **Przemysł 4.0 i technologie sztucznej inteligencji**
Name in English: **Industry 4.0 and artificial intelligence technologies**

Information on course:

Course offered by department: Faculty of Organisation and Management
Course for department: Silesian University of Technology
Study level and form: Master's degree, Full-time
Term: summer semester 2025/2026
Coordinator of course edition: dr hab. inż. Jarosław Brodny, prof. PŚ

Default type of course examination report:

Pass

Language:

English

Course homepage:

https://platforma.polsl.pl/roz/

ECTS

6

Short description:

The aim of the course is to acquire knowledge by students regarding the essence, assumptions, and key elements of the idea of Industry 4.0, as well as skills and competences in the selection and use of methods and tools used in this field. The pillars of Industry 4.0 will be presented along with related new technologies, with particular emphasis on artificial intelligence technologies. In this matter, selected algorithms and methods will be presented along with examples of their application. An important element of this process will also be determining the role and importance of the human factor in these activities.

Description:

Detailed program content includes: Lecture: Introduction. Industrial revolutions. Definition of Industry 4.0. The main pillars of Industry 4.0. Internet of Things, cybersecurity, artificial intelligence. Smart factory management. Digital transformation of the economy. The impact of the fourth industrial revolution and artificial intelligence technology on consumption and the labor market. Social aspects of the development and implementation of artificial intelligence and other new technologies.

Laboratory
Getting to know the basic technologies related to Industry 4.0. Artificial intelligence, 3D technologies, virtual and augmented reality, integration of IT systems, cybersecurity. Analysis of basic issues in artificial intelligence, including the theory of fuzzy sets, neural networks and their learning algorithms, evolutionary algorithms, and data grouping methods. Practical examples of the use of the neural-fuzzy system.

Number of hours of classes with direct participation of academic teachers or other people conducting classes and students:
- Lecture: 30h
- Laboratory 30h

Student's own work
- Preparation for the lectures and its passing: 60 h
- Preparation for and passing laboratory classes: 60 hours.

Total number of hours: 180
Number of ECTS credits: 6
including
Number of ECTS credits obtained in classes conducted with the direct participation of academic teachers or other persons conducting classes and students: 2.0

Bibliography:

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2. Sobieraj J., Rewolucja przemysłowa 4.0. Wydawnictwo ITE, Radom, 2018
3. Schwab K. Czwarta rewolucja przemysłowa. Wydawnictwo Studio EMKA, 2018
4. Michna A., Kaźmierczak J.: Przemysł 4.0 w organizacjach. Wyzwania i szanse. Wydawnictwo CeDeWu, 2020 r.
5. Śledziewska K., Włoch R.: Gospodarka Cyfrowa. Wydawnictwo UW, 2020 r.
6. Knosala R., Inżynieria Produkcji – kompendium wiedzy. Polskie Wydawnictwo Ekonomiczne, Warszawa 2017.
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8. Kost G., Łebkowski P., Węsierski Ł.: Automatyzacji i robotyzacja procesów produkcyjnych, PWE, Warszawa 2013.
9. Siuta-Tokarska B., Przemysł 4.0 i sztuczna inteligencja: szansa czy zagrożenie dla realizacji koncepcji zrównoważonego i trwałego rozwoju? Nierówności Społeczne a Wzrost Gospodarczy, nr 65, 1/2021 r. str. 7-26.

10. Lennox John C. 2084. Sztuczna inteligencja i przyszłość ludzkości. Wydawnictwo Fundacja Prodoteo, 2023 r. str. 230.
11. Rutkowski L., Metody i techniki sztucznej inteligencji. Wydawnictwo Naukowe PWN 2023, str. 450.
12. Brodny J., Felka D., Tutak M., The use of the neuro-fuzzy model to predict the methane hazard during the underground coal mining production process, Journal of Cleaner Production, Elsevier BV, vol. 368, 2022, pp. 1-10, DOI:10.1016/j.jclepro.2022.133258.
13. Wawrzyński P., Podstawy sztucznej inteligencji. Oficyna Wydawnicza Politechniki Warszawskiej, 2019, str. 162.
14. Górka, K., Łuszczyk, M., Thier, A., Wdrażane oraz przewidywane skutki IV rewolucji przemysłowej. Marketing i Rynek, 9, 2018 r. str. 262–278.

Learning outcomes:

Student knows and understands: Advanced issues in the field of mathematics, physics, statistics, and areas of engineering and technical sciences useful for formulating and solving typical engineering tasks (K1A _W1).

Basic engineering processes and technologies in the life cycle of technical equipment, objects and systems and ways of solving typical engineering tasks, particularly in relation to the organization of production processes and production management (K1A _W3).

Fundamental problems of contemporary civilization relevant to the production engineering (K1A _W7).

Student is able to: Identify, formulate and solve complex and unusual engineering problems related to the field of management and production engineering by applying the principles of engineering, science and mathematics, as well as perform tasks under conditions that are not fully predictable (K1A _U1).

Select and use appropriate techniques, skills, and modern engineering tools (K1A _U9).

Independently plan and implement their own lifelong learning (K1A _U11).

Student is ready to: Critical evaluation of knowledge and received content, recognition of the importance of knowledge in solving cognitive and practical problems, and consulting experts in the event of difficulties in solving problems on their own (K1A _K1).

All learning outcomes relate to the subject Industry 4.0 and artificial intelligence technologies.

Assessment methods and assessment criteria:

Lecture:
Passing the lecture is based on a positive grade obtained in the written test.
The condition for a positive assessment is to receive at least 2.5 points out of 5. possible to obtain.
Correction of the written test is possible twice and takes place in writing.

Laboratory:
During laboratory classes, tasks can be performed individually or in sections. To pass, you must submit a properly prepared report on the use of a selected technology or artificial intelligence algorithm.
Class reports are assessed in formal and substantive terms.
Reports prepared incorrectly may be corrected twice.

The final grade is the arithmetic mean of the grades obtained from the lecture and laboratory classes.

Practical placement:

Not applicable