



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Artificial intelligence in production processes [S1ZiIP2>MSIwPP]

### Course

Field of study	Year/Semester
Management and Production Engineering	3/6
Area of study (specialization)	Profile of study
–	general academic
Level of study	Course offered in
first-cycle	Polish
Form of study	Requirements
full-time	elective

### Number of hours

Lecture	Laboratory classes	Other
15	15	0
Tutorials	Projects/seminars	
0	0	

### Number of credit points

2,00

### Coordinators

dr hab. inż. Tomasz Bartkowiak prof. PP  
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### Lecturers

### Prerequisites

The student has basic knowledge of production management. Has basic skills related to information technologies. Knows the basics of descriptive statistics and probabilistics. Knows what probability density and distribution function are. Is able to use literature (obtaining knowledge from indicated sources) and the Internet.

### Course objective

Acquiring knowledge regarding modern data processing and analysis techniques in the context of issues related to production management. Learning the basics of programming in Python and basic data science tools.

### Course-related learning outcomes

Knowledge:

The student knows the basic tools used in data mining and analysis.

The student has knowledge of data classification methods and ways of determining the quality of the obtained results

The student knows the basic prediction algorithms and ways of determining the quality of the obtained

results

The student is familiar with the basic artificial intelligence algorithms used in classification and production models

Skills:

The student has the ability to self-educate, including: in order to "improve" professional competences. The student can visualize data using tools available in Python or other languages.

The student is able to prepare a classification model for prepared input data regarding issues related to production management and determine its quality.

The student is able to prepare a predictive model for prepared input data regarding issues related to production management and determine its quality

Social competences:

The student is aware of the social role of a technical university graduate, and especially understands the need to formulate and convey to society, in particular through the mass media, information and opinions regarding technological achievements and other aspects of engineering activities; makes every effort to convey such information and opinions in a generally understandable manner.

Is aware of the role of "data science" in modern industry and its importance for society and the environment, and is able to define priorities for implementing a specific task in the field of production management.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written assessment of theory from lectures in the form of a test in electronic and conventional form consisting of 10-15 questions. Assignment of grades to percentage ranges of results: <90-100> very good; <80-90) good plus; <70-80) good; <60-70) satisfactory plus; <50-60) satisfactory; <0-50) unsatisfactory. Ongoing monitoring of preparation for laboratories, optional final laboratory test in written form. Assignment of grades to percentage ranges of results: <90-100> very good; <80-90) good plus; <70-80) good; <60-70) satisfactory plus; <50-60) satisfactory; <0-50) unsatisfactory.

### Programme content

The main theme of the classes include the new methods of data processing based on artificial intelligence. The main emphasis is placed on problems that appear every day in the manufacturing practice. This primarily concerns the exploration of data from various production systems: PLC, SCADA, MES, ERP. The issue of different types of data, their transformation and anomaly detection will be discussed. Then, methods with supervised and unsupervised learning and reinforcement learning will be discussed. An example area will be classification and regression problems. The classes will be carried out on sample data reflecting production reality.

### Course topics

Lecture:

1. Introduction to data analysis in production processes. Opportunities and threats of artificial intelligence.
2. Types of production data, their visualization and detection of outliers or erroneous observations.
3. Descriptive statistics, parametric and non-parametric testing, stationary and non-stationary processes.
4. Unsupervised learning. Classification problems.
5. Supervised learning. Trend analysis, anomaly and regression problem.
6. Neural networks and their applications to production processes.
7. Large language models in the production data analysis.

Laboratory:

1. Introduction to the Jupyter Notebook environment.
2. Basics of programming in Python, data import and display.
3. Data mining and visualization.
4. Trend analysis, detecting anomalies and change point in data.
5. Construction of classification models and assessment of the quality of the obtained models.
6. Construction of predictive models and assessment of the quality of the obtained models.

## 7. Large language models in production data analysis.

### Teaching methods

Lectures and presentations, application examples, case studies

### Bibliography

Basic:

1. Hill R., Berry S., Guide to industrial analytics : solving data science problems for manufacturing and the internet of things, Springer, 2021.
2. Larose D. T., Metody i modele eksploracji danych, Wydawnictwo Naukowe PWN, Warszawa 2022.
3. Morzy T., Eksploracja danych: Metody i algorytmy, Wydawnictwo Naukowe PWN, Warszawa 2023.

Additional:

1. Kroese D.P. , Botev Z.I. , Taimre T. , Vaisman R., Data Science and Machine Learning: Mathematical and Statistical Methods, Chapman and Hall/CRC, Boca Raton, 2019.

### Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	20	1,00