COURSE DESCRIPTION CARD - SYLLABUS

Course name
Digital Twins [S1DSwB1>CB]

Course

Field of study
Data Science in Business

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
0

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student should have basic knowledge in management fundamentals, technical basics, and information technology. The student understands the mechanisms of business management and is able to view a company as a functioning whole.

Course objective

The objective of this course is to introduce students to the tools and techniques used in the creation of digital twins and to develop the skills and competencies needed to build an example digital twin. Knowledge will be provided to enable the construction of a digital twin using, among other things, simulation software. Students will also develop skills related to the structuring of processes and data, which serve as input elements for the digital twin.

Course-related learning outcomes

Knowledge:
Defines the concept of a digital twin and describes the tools and technologies supporting its implementation [DSB1_W01].
Characterizes modeling and simulation methods used in the construction of digital twins, considering

the structuring of processes and data [DSB1_W03].

Skills:
Selects appropriate simulation tools for building a digital twin based on the specifics of the process and available data [DSB1_U02].
Prepares input data for the digital twin model by structuring information about processes, resources, and human factors [DSB1_U04].
Creates digital twin models, considering the physical flow of resources and interactions between system layers [DSB1_U08].
Analyzes and optimizes business and decision-making processes using simulation-based digital twins [DSB1_U09].
Integrates digital twins with data management and analysis systems to support decision-making processes [DSB1_U10].

Social competences:
Collaborates in interdisciplinary teams on the design and implementation of digital twins, integrating technical and business knowledge [DSB1_K02].
Identifies ethical and technological challenges related to digital twins, considering the impact of their implementation on business and social processes [DSB1_K05].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment: Evaluation of skills based on the construction of individual models (tasks) along with a report.
Summative assessment: Evaluation based on the points earned from the component tasks.

Programme content

The concept of a digital twin.
Supporting tools and technologies.
Simulation technology as the environment for building a digital twin.
Process approach.

Course topics

Familiarization with the principles of using simulation software as an environment for building digital twins.
Process and data structuring - preparing input data.
Building the physical flow layer in the digital twin.
Modeling the human aspect.
Modeling the decision-making/management area in the digital twin.

Teaching methods

Laboratory: Thematic tasks ending with the preparation of a report along with independent conclusions for these tasks.

Bibliography

Basic:
1. Pawlewski P., 2025, Cyfrowy bliźniak w zarządzaniu danymi, PWE, ISBN: 978-83-208-2630-2.
2. Pawlewski P., Kosacka-Olejnik M., Werner-Lewandowska K., Digital Twin Lean Intralogistics: Research Implications, Appl. Sci. 11/2021, s. 1495.
3. Beaverstock M., Greenwood A., Lavery E., Nordgren W. Applied Simulation, Flexsim Software Products, 2011.

Additional:
1. Hoffa-Dąbrowska P., 2024, The Popularity of Digital Twins at Intralogistics, published at 44th IBIMA Conference: 27-28 November 2024, Granada, Spain. Conference proceedings (ISSN: 2767-9640), p.774-779.

2. Kosacka-Olejnik M., Kostrzewski M., Marczewska, M., Mrówczyńska B., Pawlewski P., How Digital Twin Concept Supports Internal Transport Systems?-Literature Review, Energies, 14(16), 2021, s. 4919.
3. Pacholski, L., Cempel, W., Pawlewski P., Reengineering, Reformowanie procesów biznesowych w przedsiębiorstwie, WPP, Poznań, 2009.
4. Cempel Cz., Teoria i inżynieria systemów, Instytut Technologii Eksploatacji - PIB/2008.

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