COURSE DESCRIPTION CARD - SYLLABUS

Course name
Ergonomics and Systems Engineering [S1DSwB1>EiIS]

Course

Field of study
Data Science in Business

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

Basic knowledge of work processes and production.

Course objective

The aim of this course is to understand the role of ergonomics in modern work systems, particularly in the context of future industries, with a focus on human interaction with intelligent systems. Students will learn methods for modeling and analyzing work systems, cognitive ergonomics in automation and artificial intelligence, and techniques for assessing psychophysical workload. The course covers ergonomic challenges of Industry 4.0, including the use of technologies such as augmented reality and process robotics. Macroergonomic methods will be presented and practiced as a key element in designing sustainable work systems.

Course-related learning outcomes

Knowledge:
Characterizes human-machine-environment interaction models and the principles of cognitive ergonomics in the context of automation and decision support systems [DSB1_W05].
Describes methods for analyzing and modeling work systems and human errors in high-risk

environments, considering their application in Industry 4.0 [DSB1_W06].

Skills:
Analyzes the impact of ergonomic factors on the safety and effectiveness of work systems and predicts the consequences of their misalignment [DSB1_U07].
Selects and applies methods for identifying and analyzing human errors, such as HAZOP, FMEA, SHERPA,
or CREAM, depending on the system's specifics [DSB1_U02].
Models and evaluates human-machine interaction systems, considering the impact of automation, artificial intelligence, and new technologies on human work [DSB1_U08].
Designs strategies for minimizing human errors and managing fatigue and stress in high-responsibility environments [DSB1_U10].
Analyzes the risk associated with users' cognitive limitations and their impact on decision-making under uncertainty [DSB1_U07].

Social competences:
Considers the ethical and social consequences of automation and the growing role of technology in human decision-making processes [DSB1_K05].
Collaborates in interdisciplinary teams, integrating knowledge of ergonomics, systems engineering, and human error analysis to optimize the work environment [DSB1_K02].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:
Exercises: Ongoing knowledge and skills checks during exercises.
Lectures: Discussions based on materials from previous lectures.
Laboratory: Completion of laboratory tasks and ongoing knowledge assessment.
Summative assessment:
Exercises: Based on the average grades from formative assessments.
Lectures: Knowledge test.
Laboratory: Reports on completed tasks with the ability to defend conclusions.

Programme content

The course covers the history and role of ergonomics in modern industry, its relationship with systems engineering, and its impact on technological development. It analyzes the evolution of work systems from manual production to intelligent support systems and discusses ergonomic standards and workplace design. Students will learn about work system modeling and analysis, considering human-machine-environment interactions, and cognitive ergonomics in automation, artificial intelligence, and user interfaces supporting decision-making processes. Methods for assessing mental and psychophysical workload, fatigue, and stress management strategies are discussed. The course also covers ergonomic challenges in Industry 4.0, including the integration of IoT, augmented reality, and robotics, as well as the future of macroergonomics in the context of digitalization, new technologies, and social changes.

Course topics

History and role of ergonomics in modern industry, its connection with systems engineering, and its impact on technology development.
Evolution of work systems from manual production to intelligent support systems.
Ergonomic standards and workplace design.
Modeling and analysis of work systems, considering human-machine-environment interactions.
Cognitive ergonomics in automation, artificial intelligence, and user interfaces supporting decision-making.
Methods for assessing human mental and psychophysical workload, fatigue, and stress management in systems engineering.
Ergonomic challenges in Industry 4.0, including IoT, augmented reality, and human-robot interaction.
Macroergonomics - the future of ergonomics and systems engineering in the context of new technologies, social changes, and digitalization.

Teaching methods

Lectures with multimedia presentations.
Problem-solving exercises related to lecture topics.
Experiment laboratories related to lecture topics..

Bibliography

Basic:
INCOSE Systems Engineering Handbook, San Diego, CA: INCOSE, 2010.
Butlewski M., Projektowanie ergonomiczne wobec dynamiki deficytu zasobów ludzkich, Politechnika Poznańska 2018, ISBN: 978-83-7775-506-8; 255 stron

Additional:
Altshuller, G. (2002). 40 principles: TRIZ keys to innovation (Vol. 1). Technical Innovation Center, Inc..
Blanchard, B. S. (2004). System engineering management. John Wiley & Sons.
Cempel, C. (2008). Teoria i inżynieria systemów. ITE Radom.
Handbook of human factors and ergonomics (Salvendy & Karwowski), 5th edition, Wiley, 2021, Hoboken, New Jersey, 1600 pp., ISBN 9781119636083 (hbk), 9781119636106 (epdf), 9781119636090 (epub) Hardcover 315, E-Book 252. International Journal of Occupational Safety and Ergonomics, 29(2), 911. https://doi.org/10.1080/10803548.2022.2156154.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	47	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	28	1,00