COURSE DESCRIPTION CARD - SYLLABUS

Course name
System engineering [N1IBiJ1>IS]

Course

Field of study
Safety and Quality Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
0

Laboratory classes
18

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

A student starting this course should have a basic knowledge of the basics of management and information technology in security engineering. He/she should also have the ability to acquire information from indicated sources and have the readiness to cooperate within a team.

Course objective

The aim of the course is to provide knowledge of systems theory and engineering in the context of safety and quality engineering problems. As a result of the course realization, the student will acquire knowledge and skills in description, principles of operation, design, modeling, analysis, evaluation and improvement of sociotechnical systems.

Course-related learning outcomes

Knowledge:
1. The student has advanced knowledge of quality and technical safety systems, including occupational health and safety rules, and understands how these systems prevent threats and minimize their effects [K1_W02].
2. The student knows at an advanced level mathematical and statistical methods used in the analysis of

system data, both quantitative and qualitative [K1_W04].
3. The student knows at an advanced level the methods, techniques, tools and materials used in preparing to conduct scientific research and solving simple engineering tasks using information technologies, information protection and computer support [K1_W11].

Skills:
1. The student is able to properly select sources about systems and information derived from them and to evaluate, critically analyze and synthesize this information [K1_U01].
2. The student is able to recognize systemic and non-technical, as well as socio-technical, organizational and economic aspects in engineering tasks [K1_U03].
3. The student is able to use analytical, simulation and experimental methods to formulate and solve systems engineering tasks, also using information and communication methods and tools [K1_U04].

Social competences:
1. The student is able to notice cause-and-effect relationships in the implementation of set goals and use ranks in relation to the importance of alternative or competing tasks [K1_K01].
2. The student is aware of understanding non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions made [K1_K03].
3. The student is able to demonstrate professionalism and follow the principles of professional ethics, promoting respect for diversity and building a culture of safety and quality [K1_K06].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1) Passing test colloquium: 50% of the points
2) Semester paper: 50% of the points
Threshold for passing: at least 50% of the points from the test and the term paper.

Programme content

General systems theory and its application in science and practical activities. Overview of the principles of the systems approach. System traps and opportunities. Fundamentals of systems modeling and principles of systems analysis and description using selected notations.

Course topics

1. GENERAL SYSTEMS THEORY AND ITS APPLICATION IN SCIENCE AND PRACTICAL ACTIVITIES
Introduction to systems theory
o Definition and basic concepts
o History and development of systems theory
Application of systems theory in science
o Examples of applications in different scientific fields (biology, economics, sociology)
o Interdisciplinary approach to research problems
Application of systems theory in practical activities
o Examples of applications in management, engineering, computer science
o Solving complex practical problems
2. OVERVIEW OF THE PRINCIPLES OF THE SYSTEMS APPROACH
Basic principles of the systems approach
o Holism: the whole is greater than the sum of its parts
o Interaction and interconnectedness of system components
o Hierarchy of systems: systems, subsystems, supersystems
Key concepts in the systems approach
o Homeostasis and dynamic equilibrium
o Feedback: positive and negative
o Adaptation and evolution of systems
3. SYSTEM TRAPS AND OPPORTUNITIES
Identification of system traps
o Examples of typical traps
o Consequences of not being aware of system traps
Analysis of system opportunities

o Use of the systems approach to identify new opportunities
o Examples of successes resulting from the application of systems theory
Methods of avoiding traps and exploiting opportunities
o Systems analysis tools and techniques
o Case studies and practical examples
4. BASICS OF SYSTEMS MODELLING AND PRINCIPLES OF SYSTEMS ANALYSIS AND DESCRIPTION USING SELECTED NOTATIONS
Introduction to systems modelling
o Purpose and benefits of systems modelling
o Types of system models (e.g. mathematical, simulation, graphical models)
Principles of systems analysis and description
o Identification of system elements and their relationships
o Creating system diagrams
Selected notations for describing systems
o UML
o BPMN
Practical exercises in system modelling and analysis
o Examples and case studies
o Creation and interpretation of system models
5. SUMMARY AND CONCLUSION
o Discussion of key points and concepts discussed in class
o Reflection on the knowledge acquired
o Answers to questions

Teaching methods

Multimedia presentation illustrated with examples given on the blackboard and performing the tasks given by the instructor - practical exercises.

Bibliography

Basic:
Meadows D.H., Myślenie systemowe. Wprowadzenie, Wydawnictwo Helion 2020
Piotrowski M., Procesy biznesowe w praktyce, Wydawnictwo Helion 2016

Additional:
Dennis A., Wixom B.H., Roth M.R., Systems analysis and design, Wiley 2019
Cempel C., Teoria i inżynieria systemów - zasady i zastosowania myślenia systemowego, Wydawnictwo Naukowe Instytutu Technologii Eksploatacji, Radom 2008.
Piekarczyk, A., & Zimniewicz, K., Myślenie sieciowe w teorii i praktyce. Polskie Wydawnictwo Ekonomiczne 2010
Mierzwiak R., Nowak M., Modele decyzyjne w teorii systemów szarcyh. Wydawnictwo PTE Poznań 2020

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,00
Classes requiring direct contact with the teacher	18	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	32	1,50