COURSE DESCRIPTION CARD - SYLLABUS

Course name
Systems engineering in crisis management [N2IBiJ1-BiZK>ISwZK]

Course

Field of study
Safety and Quality Engineering

Year/Semester
2/3

Area of study (specialization)
Safety and Crisis Management

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
elective

Number of hours

Lecture
10

Laboratory classes
0

Other
0

Tutorials
10

Projects/seminars
10

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

General knowledge of design specifically related to the engineering of complex systems in emergency situations.

Course objective

To familiarize students with the principles of universal design in the context of safety and crisis management, and thus how to solve the problem of complexity in crisis situations.

Course-related learning outcomes

Knowledge:
1. Student has in-depth knowledge of mechanisms of functioning of complex socio-technical systems characteristic for mechanical engineering concerning systems engineering [K2_W02].
2. Student has a structured and theoretically grounded knowledge of computer-aided design and decision-making systems in the areas of safety engineering, quality engineering, ergonomics and occupational safety and emergency management pertaining to systems engineering [K2_W07].
3. Student has a structured and theoretically grounded knowledge of quality and environmental management, systems approach to management, systems integration and auditing of management

systems in organisations concerning systems engineering [K2_W08].

Skills:
1. Student is able to design, in a team, using appropriately selected means, methods and techniques, selected elements of safety, quality and environmental systems in organisations concerning systems engineering [K2_U05].
2. Student can fluently use a foreign language at a minimum B2+ level of the Common European Framework of Reference for Languages, using specialist terminology specific to safety management issues in organisations concerning systems engineering [K2_U12].

Social competences:
1. Student is critical of his/her knowledge, is ready to consult experts when solving cognitive and practical problems related to safety management in organisations using systems engineering principles [K2_K01].
2. Student correctly identifies and resolves dilemmas related to safety in a broad sense, understands the necessity of making the society aware of the need to shape safety in various areas of organisation functioning concerning systems engineering [K2_K02].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative evaluation:
a) in terms of exercises: ongoing testing of knowledge and skills during exercises;
b) in terms of lectures: on the basis of discussion of the material learned in previous lectures;
c) in terms of the project: ongoing evaluation of the degree of completion of individual project tasks;
Summative evaluation:
a) in terms of exercises: on the basis of the results of the average of the partial marks of the formative assessment;
b) in terms of lectures: knowledge test;
c) in terms of the project evaluation of the way of describing the way of solving the design problem posed and the degree of completion of individual steps.
Grading system (passing threshold: 51% points):
Points Grade:
0 - 50 Fail (2)
51 - 59 Satisfactory (3)
60 - 69 More than satisfactory but less than good (3+)
70 - 79 Good (4)
80 - 89 Very good (4+)
90 - 100 Excellent (5)

Programme content

Systems engineering theories. Systems life cycles in the context of crises. Systemic complexity of a crisis. Processes, strategies and methods for systems engineering. Systems engineering tools, and including requirements management, project structure matrix, TRIZ, ARZW for crisis situations. Value and limitations of modeling and simulation. Planning, data collection and use. Determinism and determinability of the outcome as an object of consideration in crisis situations.

Course topics

- Systems engineering theories
- Life cycles of systems in the context of crisis situations
- Systemic complexity of a crisis
- Processes, strategies and methods for systems engineering
- Systems engineering tools including requirements management, project structure matrix, TRIZ, ARZW for crisis situations
- Value and limitations of modelling and simulation
- Planning, collection and use of data
- Determinism and determinism of outcome as a consideration in crisis situations
- Integrated approach to crisis management

- Risk analysis and its importance in systems engineering
- Early warning and crisis response systems
- Change management in crisis situations
- Use of artificial intelligence in crisis management
- Design of resilience systems
- Roles and responsibilities in crisis management
- Cross-sectoral coordination and collaboration in crisis management
- Communication and information in crisis situations
- Evaluation and improvement of systems engineering processes in the context of crises
- Case studies: analyses of real crises and applied solutions

Teaching methods

Lectures with multimedia presentation; task exercises on topics related to lectures and project.
The lecture is conducted using distance learning techniques in a synchronous mode. Acceptable platforms: eMeeting, Zoom, Microsoft Teams.

Bibliography

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

Additional:
1. Altshuller, G. (2002). 40 principles: TRIZ keys to innovation (Vol. 1). Technical Innovation Center, Inc..
2. Blanchard, B. S. (2004). System engineering management. John Wiley & Sons.

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
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)	45	2,00