GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Protection Systems in the Industry, PG_00038323		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Optional subject group Subject group related to scientific research in the field of study
Mode of study	Part-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Control Engineering -> Faculty of Electrical and Control Engineering		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Kazimierz Kosmowski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	10.0	0.0	10.0	0.0	0.0	20

E-learning hours included: 0.0

Adresy na platformie eNauczanie:

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	20	10.0	45.0	75

Subject objectives

To acquaint the students with methods for the analysis and design of the protection systems in industry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W09	Student has knowledge concerning hazards identification, and defining of protection functions to be implemented in industrial control system (ICS) according to the functional safety concept (IEC 61508) and relevant sector standards, with regard cybersecurity aspects (IEC 62443).	[SW3] Assessment of knowledge contained in written work and projects [SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
K7_U07	Student knows the rules of determining levels: PL (Performance Level) and SIL (Safety Integrity Level) of safety functions on the basis of defined risk matrices, and methods for verification of these levels with regard to results of probabilistic modelling of the control system of given architecture.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information
K7_W13	Student knows how to design and verify the safety function together with human interface on the laboratory stand.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge

Subject contents	Examples of protection systems in various industrial sectors. Advanced methods of reliability and safety analysis of technical systems. Failure mechanisms of elements in protecting systems and models. Failure modes, effect and criticality analysis (FMECA) of programmable systems. Advanced dependability analysis of complex systems using different methods: reliability block diagrams (RDB), fault trees (FT), event trees (ET) and Markov graphs (MG). Optimising of dependability. Requirements of PN-EN 61508 standard and its relations with sector standards PN-EN 61511 and PN-EN 62061. Individual risk and societal risk. Hazards identifying, risk analysis and assessment. Objectives and concepts of functional safety management in life cycle. Analysis of industrial installations using HAZOP methodology. Defining of safety-related functions. Defining of accident scenarios. Determining required safety integrity level based on risk analysis and assessment; risk matrix method. Security of computer networks. Architecture constrains in E/E/PE subsystems. Verifying SIL under uncertainty. Dependent failures and their eliminating. Layers of protection analysis (LOPA) in relation to PN-EN 61511. Human factors in functional safety and layers of protection analysis; functional analysis, designing of interfaces and the alarm system. Requirements concerning functional safety of machinery control systems according to PN-EN 62061. Testing strategy of E/E/PE systems.
Prerequisites and co-requisites	Konwledge concerning the reliability analysis in technical systems, the programmable technologies and the computer systems in industry and economy.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
3 reports	60.0%	50.0%
Test - theory/problems I	60.0%	50.0%

Recommended reading

Basic literature	1. Materiały dydaktyczne dostępne są na stronie internetowej Zespołu Technologii Sieciowych i Inżynierii Bezpieczeństwa (Materials available on web site of the Networks Technology ans Safety Engineering Team). 2. Kosmowski K.T (ed.).: Basics of functional safety (in Polish), GUT Publishers. Gdańsk, 2016-2020 (III edition). 3. Basics of CARE computer application (BQR). 4. Wprowadzenie do oprogramowania Pro-SIL (Introduction to Pro-SIL software). WEiA PG, 2010.
Supplementary literature	1. Hoyland A., Rausand M.: System Reliability Theory. Models and Statistical Methods. New York: John Wiley & Sons, Inc. 1994. 2. MIL-HDBK-217F. Reliability Prediction of Electronic Equipment. Washington, DC: U.S. Department of Defence, 1991. 3. MIL-STD-1629A. Procedures for performing a failure mode, effects and criticality analysis. Washington, DC: U.S. Department of Defence, 1980.
eResources addresses	

Example issues/ example questions/ tasks being completed	Hazards identification and risk assessment oriented on determining PL or SIL of safety function. Designing the protection system of an industrial installation with regard to the functional safety requirements. Safety integrity level (SIL) of the safety function and probabilistic criteria.
Work placement	Not applicable