GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Protection Systems in the Industry, PG_00059283		
Field of study	Automation, Robotics and Control Systems		
Date of commencement of studies	February 2022	Academic year of realisation of subject	2022/2023
Education level	second-cycle studies	Subject group	
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	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	dr hab. inż. Marcin Śliwiński	
	Teachers	dr hab. inż. Marcin Śliwiński dr inż. Emilian Piesik	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	15.0	0.0	45

E-learning hours included: 0.0

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	45	5.0	25.0	75

Subject objectives

Familiarize students with methods of analysis and design of industrial safety systems.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_W09	The student knows the principles of determining the levels: PL (Performance Level) and SIL (Safety Integrity Level) of safety functions on the basis of defined risk matrices and the method of verifying these levels taking into account the results of modeling a probabilistic control system with a given architecture.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K7_W13	The student has knowledge of hazard identification and defining security functions to be implemented in the Industrial Control System (ICS) according to the functional safety concept (IEC 61508) and relevant sectoral standards taking into account cybersecurity aspects (IEC 62443).	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K7_U07	The student is able to design and verify the safety function along with the user interface at the laboratory station.	[SU1] Assessment of task fulfilment [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task

Subject contents	Examples of security systems in various sectors of the economy. Advanced methods of analyzing the reliability and safety of technical systems. Probabilistic modeling of objects. Mechanisms of damage to elements in security systems and models. Analysis of types, effects and failure criticality (FMECA) of programmable systems. Advanced reliability analysis of systems assembled by various methods: reliability flowcharts (RDB), damage and error tree (FT), event trees (ET) and Markov graphs (MG). Optimize reliability. The requirements of the PN-EN 61508 standard and its relations with the sectoral standards PN-EN 61511 and PN-EN 62061. Individual and social risk. Hazard identification, analysis and assessment. Objectives and concept of life-cycle functional safety management. Analysis of industrial installations using the HAZOP method. Defining safety-related functions. Define failover scenarios. Determination of the required sil safety integrity level based on risk analysis and assessment; risk matrix method. Potential biases in E/E/PE systems and error avoidance. Software quality and lifecycle requirements. Protection of computer networks. Architectural limitations in E/E/PE subsystems. Verification of the SIL level under conditions of uncertainty. Dependent damage and its elimination. Analysis of LOPA security layers in relation to PN-EN 61511. Human factors in the analysis of functional safety and security layers; functional analysis, design of interfaces and alarm system. Requirements for functional safety of machine control systems according to PN-EN 62061. E/E/PE systems testing strategy.
Prerequisites and co-requisites	Knowledge of reliability analysis in technical systems, programmable technologies and computer systems in industry and the economy.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Colloquium II	50.0%	25.0%
Project	50.0%	50.0%
Colloquium I	50.0%	25.0%

Recommended reading

Basic literature	1. Hoyland A., Rausand M.: System Reliability Theory. Models and Statistical Methods. New York: John Wiley & Sons, Inc. 1994. 2. Teaching materials are available on the website "Zespół Technologii Sieciowych i Inżynierii Bezpieczeństwa". 3. Kosmowski K.T.(red.): Podstawy bezpieczeństwa funkcjonalnego, Wydawnictwo PG. Gdańsk, 2016-2020 (III wyd.). 4. Podstawy komputerowej aplikacji CARE (BQR). 5. Wprowadzenie do oprogramowania Pro-SIL. WEiA PG, 2010.
Supplementary literature	1. MIL-HDBK-217F. Reliability Prediction of Electronic Equipment. Washington, DC: U.S. Department of Defence, 1991. 2. 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	Hazard identification and risk assessment aimed at determining pl or SIL safety functions. Designing the architecture of the industrial installation security system taking into account the requirements of functional safety. Safety Integrity Level (SIL) of safety functions and probabilistic criteria.
Work placement	Not applicable