GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Functional safety in hydrogen technologies, PG_00058354		
Field of study	Hydrogen Technologies and Electromobility		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
Education level	first-cycle studies	Subject group	Obligatory subject group in the field of study Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish
Semester of study	5	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Control Engineering -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Adam Kielak	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	30.0	0.0	0.0	60

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	60	7.0	33.0	100

Subject objectives

Providing students with advanced engineering knowledge regarding hazard identification and analysis risk assessment in hydrogen installations useful in the design of control systems taking into account functional safety requirements in hydrogen technologies.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_K01] is aware of the need for continuous education and self-improvement and knows the possibilities of further education	The student knows the rules of determination SIL levels (Safety Integrity Level) safety functions on based on defined matrices risk and modified risk graphs.	[SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills [SK3] Assessment of ability to organize work
[K6_U07] can build and analyze models of systems and systems in the field related to hydrogen devices and installations as well as control and automation systems	The student is able to make identification threats and carry out risk analyzes and assessments regarding design and use of control systems elevated hydrogen installations risk taking into account the concept of Industry 4.0 and 5.0.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools

Subject contents

Course content – lecture
LECTURE Risk definitions, individual and social risk. ALARP principle, risk matrix and required risk reduction. The concept of functional safety of control and security systems. Design of electrical/electronic and programmable electronic (E/E/PE) systems. Examples of functional safety solutions in industry. Threat analysis and function definition related to security. Determining the SIL safety integrity level based on risk assessment according to PN-EN 61508. DC diagnostic coverage in subsystems. SIL verification qualitative and quantitative methods. Protection and protection layers according to PN-EN 61511. Method LOPA. Design of SIS security instrument functions and the AS alarm system.

LABORATORY EXERCISES Determining the required SIL for safety-related functions. SIL level verification, design and implementation of the structure of the KooN safety system. Application drivers safety. Safety layers (BPCS, human operator and alarm system, SIS/ESD).

<table>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Two tests - theory/tasks</td><td>60.0%</td><td>65.0%</td></tr>
<tr><td>Practical exercises in lab,</td><td>60.0%</td><td>35.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Kosmowski K.T. (red.): Podstawy bezpieczeństwa funkcjonalnego, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2020.
2. Kosmowski K.T. (red.): Functional safety management in critical systems, Gdańsk, 2008.
3. Liderman K.: Analiza ryzyka i ochrona informacji w systemach komputerowych. Wydawnictwo Naukowe PWN SA, Warszawa 2008.</td></tr>
<tr><td>Supplementary literature</td><td>1. Andersen R.: Inżynieria zabezpieczeń. WNT 2005.
2. Białas A.: Bezpieczeństwo informacji i usług w nowoczesnej instytucji i firmie, WNT, Warszawa, 2006.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Risk graph for determining the required Safety Integrity Level (SIL).
2. Qualitative SIL verification of the E/E/PE system.
3. Quantitative SIL verification of the E/E/PE system.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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