

Faculty of Fundamental Problems of Technology						
COURSE CARD						
Name in polish	:	<b>Fizyka dla Inżynierów Bezpieczeństwa</b>				
Name in english	:	<b>Physics for security engineers</b>				
Field of study	:	Computer Science				
Specialty (if applicable)	:					
Undergraduate degree and form of	:	masters, stationary				
Type of course	:	optional				
Course code	:	E2_W21				
Group rate	:	Yes				
		Lectures	Exercides	Laboratory	Project	Seminar
Number of classes held in schools (ZZU)		30	15	15		
The total number of hours of student work-load (CNPS)		90	75	15		
Assesment		pass				
For a group of courses final course mark		X				
Number of ECTS credits		2	2	2		
including the number of points corresponding to the classes of practical (P)			2	2		
including the number of points corresponding occupations requiring direct contact (BK)		2	2	2		
<b>PREREQUISITES FOR KNOWLEDGE, SKILLS AND OTHER POWERS</b>						
Knowledge of data structures and algorithms. Programming ability in a chosen programming language. Recommended courses: Computer Architecture and Operating Systems, Introduction to Electronics, Data Bases and Information Managements.						
<b>COURSE OBJECTIVES</b>						
<b>C1</b> Discussion of the physics related to the protection and collection of data transfer in ICT systems.						
<b>C2</b> Estimating the complexity of attacks for different physical/hardware protection methods. Calculations and numerical simulations.						
<b>C3</b> Testing of attacks and defenses related to the physics of signal processing. Physical security testing in practice.						

### COURSE LEARNING OUTCOMES

The scope of the student's knowledge:

**W1** Student knows physical aspects of secure signal transmission.

**W2** Student knows physical aspects of secure data recording.

**W3** Student knows physical aspects of devices realizing cryptographic functions.

The student skills:

**U1** Student computes measures related to signal transmission, assesses security and reliability of transmission.

**U2** Student computes measures related to data recording, assesses security and reliability of data recording.

**U3** Student mounts chosen attacks on devices for data transmission and recording.

The student's social competence:

**K1** Student understands physical aspects of data transmission and recording.

**K2** Student understands changes in methods of data transmission and recording, related to technological development.

### COURSE CONTENT

#### Type of classes - lectures

Wy1	Introduction to signal transmission.	2h
Wy2	Electromagnetic spectrum.	2h
Wy3	Tempest Attacks.	2h
Wy4	Interference and protection systems	2h
Wy5	Eavesdrop and its detection.	2h
Wy6	Hardware implemented ciphers. Hardware keyloggers.	2h
Wy7	Physics of optical lines and drives. Protection.	2h
Wy8	Physics of RFID - introduction	4h
Wy9	Physics of magnetic drives.	2h
Wy10	Flash memory - introduction.	2h
Wy11	Microchip cards.	2h
Wy12	Physical Unclonable Functions.	4h
Wy13	'Side channel' attacks.	2h

#### Type of classes - exercises

Ćw1	Signal transmission.	3h
Ćw2	Physics of optical and magnetic drives.	3h
Ćw3	Hardware implemented ciphers and key-loggers.	3h
Ćw4	Flash memory.	3h
Ćw5	'Side channel' attacks.	3h

#### Type of classes - laboratory

Lab1	Signal transmission	3h
Lab2	Physics of optical lines and magnetic drives	3h
Lab3	Hardware implemented ciphers and key-loggers.	3h
Lab4	Flash memory.	3h
Lab5	'Side channel' attacks.	3h

Applied learning tools		
<ol style="list-style-type: none"> <li>1. Traditional lecture</li> <li>2. Multimedia lecture</li> <li>3. Solving tasks and problems</li> <li>4. Solving programming tasks</li> <li>5. Self-study students</li> </ol>		
EVALUATION OF THE EFFECTS OF EDUCATION ACHIEVEMENTS		
Value	Number of training effect	Way to evaluate the effect of education
F1	W1-W3, K1-K2	
F2	U1-U3, K1-K2	
F3	U1-U3, K1-K2	
$P = \%*F1 + \%*F2 + \%*F3$		
BASIC AND ADDITIONAL READING		
<ol style="list-style-type: none"> <li>1. Quantum hacking: Experimental demonstration of time-shift attack against practical quantum-key-distribution systems. Yi Zhao, Chi-Hang Fred Fung, Bing Qi, Christine Chen, and Hoi-Kwong Lo. Phys. Rev. Volume 78, Issue 4.</li> <li>2. Read-Proof Hardware from Protective Coatings. Pim Tuyls, Geert-Jan Schrijen, Boris Škorić, Jan van Geloven, Nynke Verhaegh and Rob Wolters. Lecture Notes in Computer Science, 2006, Volume 4249.</li> <li>3. Soft Tempest: Hidden Data Transmission Using Electromagnetic Emanations. Markus G. Kuhn and Ross J. Anderson. Lecture Notes in Computer Science, 1998, Volume 1525.</li> </ol>		
SUPERVISOR OF COURSE		
dr hab. inż. Włodzimierz Salejda		

RELATIONSHIP MATRIX EFFECTS OF EDUCATION FOR THE COURSE

Physics for security engineers

WITH EFFECTS OF EDUCATION ON THE DIRECTION OF COMPUTER SCIENCE

Course training effect	Reference to the effect of the learning outcomes defined for the field of study and specialization (if applicable)	Objectives of the course**	The contents of the course**	Number of teaching tools**
W1	K2_W01 K2_W03 K2_W04 K2_W07	C1	Wy1-Wy13	1 2 5
W2	K2_W01 K2_W04 K2_W06 K2_W07	C1	Wy1-Wy13	1 2 5
W3	K2_W01 K2_W02 K2_W04 K2_W05 K2_W07	C1	Wy1-Wy13	1 2 5
U1	K2_U01 K2_U02 K2_U04 K2_U09 K2_U11 K2_U13 K2_U15 K2_U18 K2_U21	C2 C3	Ćw1-Ćw5 Lab1-Lab5	3 4 5
U2	K2_U01 K2_U02 K2_U08 K2_U09 K2_U10 K2_U11 K2_U12 K2_U13 K2_U14 K2_U15 K2_U18 K2_U19 K2_U21	C2 C3	Ćw1-Ćw5 Lab1-Lab5	3 4 5
U3	K2_U01 K2_U02 K2_U04 K2_U08 K2_U11 K2_U13 K2_U14 K2_U18 K2_U19 K2_U21	C2 C3	Ćw1-Ćw5 Lab1-Lab5	3 4 5
K1	K2_K01 K2_K04 K2_K05 K2_K13 K2_K16	C1 C2 C3	Wy1-Wy13 Ćw1-Ćw5 Lab1-Lab5	1 2 3 4 5
K2	K2_K01 K2_K04 K2_K10 K2_K13	C1 C2 C3	Wy1-Wy13 Ćw1-Ćw5 Lab1-Lab5	1 2 3 4 5