

**DESCRIPTION OF THE PROGRAM OF STUDIES**

<b>MAIN FIELD OF STUDY: Algorithmic Computer Science, SPECIALIZATION: Cryptography and Computer Security</b>	<b>PROFILE: general academic</b>
<b>LEVEL OF STUDIES: second-level studies</b>	<b>FORM OF STUDIES: full-time studies</b>

# 1 General description

<p>1.1 Number of semesters: <b>3</b></p>	<p>1.2 Total number of ECTS points necessary to complete studies at given level: <b>90</b></p>
<p>1.3 Total number of hours: <b>885</b></p>	<p>1.4 Prerequisites (particularly for second-level studies): The conditions and procedure of recruitment for a given academic year are approved annually by the Senate of Wrocław University of Science and Technology and announced by an appropriate Internal Ordinance.</p>
<p>1.5 Upon completion of studies graduate obtains professional degree of: <b>Master of Science</b></p>	<p>1.6 Graduate profile, employability:</p> <p>A graduate of studies will have advanced theoretical and practical knowledge allowing for taking up jobs in the computer security sector, both as an analyst, auditor and system operator, as well as a designer and contractor of advanced technological solutions.</p> <p>Teaching focuses on universal skills and aspects that enable deep understanding of issues so as to prepare for the extremely dynamically changing challenges facing a computer security specialist. The graduate will have balanced knowledge in many areas that make up computer security - starting from cryptographic tools, ending with procedural issues and legal issues.</p> <p>Through the implementation of courses from other IT departments, the graduate can prepare for specialization in various areas of IT security.</p> <p>The graduate will operate English in professional activities. Classes will be conducted in English.</p> <p>Graduate</p> <ol style="list-style-type: none"> <li>1. will have the ability to design and implement modern solutions in the field of computer security;</li> <li>2. will have the ability to manage teams and work in innovative security projects with a high degree of technological advancement;</li> <li>3. will have general knowledge allowing him to easily adapt to the requirements of the labor market and to carry out tasks of a high degree of complexity, in particular will acquire appropriate education in the field of basic sciences: mathematics, physics, electronics;</li> <li>4. will be prepared for research and R&amp;D works;</li> <li>5. will use English at work.</li> </ol>
<p>1.7 Possibility of continuing studies: eligibility to apply for admission to a doctoral school, non-degree postgraduate programmes</p>	<p>1.8 Indicate connection with University's mission and its development strategy: The program of studies in the field of Algorithmic Computer Science is in line with the mission of Wrocław University of Science and Technology and its development strategy. It provides the opportunity to acquire new, as well as deepen previously acquired, knowledge and skills necessary for a modern master's degree in the field of Technical Informatics and Telecommunications. The acquired education enables entry into the labor market as well as further doctoral studies and a scientific career.</p>

## 2 Detailed description

2.1 **Total number of learning outcomes in the program of study:** W (knowledge) = 10, U (skills) = 13, K (competences) = 12, W+U+K = 35.

2.2 **For the main field of study assigned to more than one discipline - the number of learning outcomes assigned to the discipline:** Technical Informatics and Telecommunications: 100%

2.3 **For the main field of study assigned to more than one discipline - percentage share of the number of ECTS points for each discipline:** Technical Informatics and Telecommunications: 100%

2.4 **For the general academic profile field of study – the number of ECTS points assigned to the classes related to the University’s academic activity in the discipline or disciplines to which the faculty is assigned:** 81

2.5 **Concise analysis of compliance of the assumed learning outcomes with the needs of the labor market:** Graduates of IT studies are sought-after specialists in the modern labor market.

2.6 **The total number of ECTS points that a student must obtain in classes requiring direct participation of academic teachers or other persons conducting classes and students:** 67 ECTS

2.7 **Total number of ECTS points, which student has to obtain from basic sciences classes**

Number of ECTS points for obligatory subjects	1
Number of ECTS points for optional subjects	0
Total number of ECTS points	1

2.8 **Total number of ECTS points, which student has to obtain from practical classes, including laboratory classes**

Number of ECTS points for obligatory subjects	42
Number of ECTS points for optional subjects	15
Total number of ECTS points	57

2.9 **Minimum number of ECTS points, which student has to obtain doing education blocks offered as part of university-wide classes or other main field of study:** 9 ECTS points

2.10 **Total number of ECTS points, which student may obtain doing optional blocks (min. 30% of total number of ECTS points):** 30 ECTS points

## 3 Description of the process leading to learning outcomes acquisition:

The description of the process leading to learning outcomes is included in the description of the study program and the study plan, and its details are set out in the subject cards documenting the method of obtaining and verifying individual learning outcomes.

## 4 List of education blocks

- Form of group of courses: Traditional - T, Remote - Z (wclps - means lecture, exercise, laboratory, project and seminar respectively), in brackets the ECTS points assigned to the remote forms.
- Way of crediting (Z): Exam - E, crediting - Z;
- Courses/group of courses: University wide - O; Concerning scientific activity - DN; Practical - P; Type (R) : KO - general education, PD - basic science, K - main field of study, S - specialization;

### 4.1 List of obligatory blocks

#### 4.1.1 List of general education blocks

##### 4.1.1.1 Liberal-managerial subjects block (min. 5 ECTS points)

No.	Code	Name of group of courses	Weekly no of hours					LES	No. of hours		ECTS		F	Z	Course/group				
			lec	cl	lab	pr	s		ZZU	CNPS	DN	BU			uw	c	p	t	
1	W08INA-SM4004S	Ethics of New Technologies	0	0	0	0	1	W08 W10 U10 K05 K11 K12	15	60	2	0	1	T/Z	Z	O	-	-	KO
2	W04INA-SM4117G	Legal Issues in Computer Security (Social Lecture)	2	0	0	0	0	W01 W03 W04 W05 W06 W07 W08 W09 W10 U03 U04 U05 U06 U07 U08 U09 U10 U11 U12 U13 K03 K04 K05 K06 K07 K08 K09 K10 K11 K12	30	90	3	0	2	T/Z	Z	O	-	-	KO
Total			2	0	0	0	1		45	150	5	0	3						

##### 4.1.1.2 Foreign languages block (min. 3 ECTS points)

No.	Code	Name of group of courses	Weekly no of hours					LES	No. of hours		ECTS		F	Z	Course/group				
			lec	cl	lab	pr	s		ZZU	CNPS	DN	BU			uw	c	p	t	
1	SJO-SM0001	Foreign language (B2+)	0	1	0	0	0	U07 K11	15	30	1	0	0.5	T	Z	O	-	P(1)	KO

2	SJO-SM0002	Foreign language 2 (A1 lub A2)	0	3	0	0	0	0	K11	45	60	2	0	1.5	T	Z	O	-	P(2)	KO
		Total	0	4	0	0	0			60	90	3	0	2						

### Altogether for general education blocks

Weekly number of hours					No. of hours		ECTS		
lec	cl	lab	pr	s	ZZU	CNPS	total	DN	BU
2	4	0	0	1	105	240	8	0	5

## 4.1.2 List of basic sciences blocks

### 4.1.2.1 Physics

No.	Code	Name of group of courses	Weekly no of hours					LES	No. of hours		ECTS		F	Z	Course/group				
			lec	cl	lab	pr	s		ZZU	CNPS	DN	BU			uw	c	p	t	
1	W04INA-SM4013G	Quantum Physics and Computations	1	0	0	0	0	W01 W02 W03 W04 W05 W07 U03 U04 U05 U06 U08 U10 U11 U12 U13 K01 K02 K03 K04 K05 K06 K08 K09 K10 K11	15	30	1	0	1	T/Z	Z	O	-	-	KO
		Total	1	0	0	0	0		15	30	1	0	1						

### 4.1.2.2 Mathematics

No.	Code	Name of group of courses	Weekly no of hours					LES	No. of hours		ECTS		F	Z	Course/group				
			lec	cl	lab	pr	s		ZZU	CNPS	DN	BU			uw	c	p	t	
1	W04INA-SM4008G	Cryptography	2	2	1	0	0	W01 W02 W03 W04 W05 W07 W08 U01 U02 U03 U04 U05 U06 U09 U10 U11 U12 K01 K02 K03 K05 K07 K08 K09 K10	75	150	5	5	5	Twcl/Zwl(3)	E	-	DN	P(3)	K

		Total	2	2	1	0	0		75	150	5	5	5					
--	--	-------	---	---	---	---	---	--	----	-----	---	---	---	--	--	--	--	--

### Altogether for basic sciences blocks

Weekly number of hours					No. of hours		ECTS		
lec	cl	lab	pr	s	ZZU	CNPS	total	DN	BU
3	2	1	0	0	90	180	6	5	6

### 4.1.3 List of main-field-of-study blocks

#### 4.1.3.1 Obligatory main-field-of-study blocks

No.	Code	Name of group of courses	Weekly no of hours					LES	No. of hours		ECTS			F	Z	Course/group			
			lec	cl	lab	pr	s		ZZU	CNPS	DN	BU	uw			c	p	t	
1	W04INA-SM4002S	MSc Seminar	0	0	0	0	2	W06 W08 W10 U06 U08 U09 K02 K04 K05 K07 K08 K12	30	60	2	2	2	T/Z	Z	-	DN	P(2)	K
		Total	0	0	0	0	2		30	60	2	2	2						

### Altogether (for main-field-of-study blocks)

Weekly number of hours					No. of hours		ECTS		
lec	cl	lab	pr	s	ZZU	CNPS	total	DN	BU
0	0	0	0	2	30	60	2	2	2

### 4.1.4 List of specialization blocks

#### 4.1.4.1 Obligatory specialization blocks

No.	Code	Name of group of courses	Weekly no of hours					LES	No. of hours		ECTS			F	Z	Course/group			
			lec	cl	lab	pr	s		ZZU	CNPS	DN	BU	uw			c	p	t	

1	W04INA-SM4009G	High Level Security - Vulnerabilities and Attacks	2	1	1	0	0	W01 W02 W03 W04 W05 W06 W07 W08 W10 U01 U02 U03 U04 U05 U06 U11 U12 U13 K02 K03 K05 K06 K07 K08 K09 K10 K12	60	120	4	4	4	Twcl/Zwl(3)	E	-	DN	P(2)	S
2	W04INA-SM4005G	Embedded Security Systems	2	0	2	0	0	W01 W02 W03 W04 W05 W06 W07 W08 W09 W10 U01 U02 U03 U04 U05 U06 U09 U10 U12 U13 K02 K03 K05 K06 K07 K08 K09 K10 K12	60	150	5	5	4	Twl/Zw(2)	Z	-	DN	P(3)	S
3	W04INA-SM4001G	Compliance and Operational Security	2	2	0	0	0		60	120	4	4	4	Twc/Zw(2)	E	-	DN	P(2)	S
4	W04INA-SM4010G	Algorithmic Number Theory	1	1	0	0	0	W01 W02 W03 W04 U01 U02 U03 U05 K03 K10	30	60	2	2	2	Twc/Zw(1)	Z	-	DN	P(1)	S
5	W04INA-SM4007G	Security and Privacy by Design	2	1	1	0	0	W01 W02 W04 U01 U02 U03 U04 U06 U08 K03 K05 K07	60	90	3	3	3	Twcl/Zw(1)	E	-	DN	P(2)	S
6	W04INA-SM4011G	Communication and Security Infrastructure	2	0	2	0	0	W01 W02 W03 W04 W06 W07 U01 U02 U03 U06 U10 U13 K02 K04 K09 K10	60	120	4	4	4	Twl/Zw(2)	Z	-	DN	P(2)	S
7	W04INA-SM4012G	Software Engineering Lab in Cybersecurity	0	0	2	0	0	W01 W02 W03 W04 W05 W06 W07 W08 W09 U01 U02 U03 U04 U05 U06 U08 U09 U10 U11 U12 U13 K01 K02 K03 K04 K05 K06 K07 K08 K09 K10 K11 K12	30	60	2	2	2	T	Z	-	DN	P(2)	S
Total			11	5	8	0	0		360	720	24	24	23						

**Altogether (for specialization blocks)**

Weekly number of hours	No. of hours	ECTS
------------------------	--------------	------

lec	cl	lab	pr	s	ZZU	CNPS	total	DN	BU
11	5	8	0	0	360	720	24	24	23

## 4.2 List of optional blocks

### 4.2.1 List of specialization blocks

#### 4.2.1.1 List of optional specialization blocks (min. 30 ECTS points)

No.	Code	Name of group of courses	Weekly no of hours					LES	No. of hours		ECTS			F	Z	Course/group			
			lec	cl	lab	pr	s		ZZU	CNPS	DN	BU	uw			c	p	t	
1	W04INA-SM4101G	Distributed Algorithms	2	1	1	0	0	W01 W02 W03 W04 U01 U02 U03 U04 U05 K01 K03 K04 K07	60	180	6	6	4	Twcl/Zw(2)	Z	-	DN	P(4)	S
2	W04INA-SM4102G	Data Mining	2	1	1	0	0	W01 W02 W04 W07 U01 U03 U05 U06 U12 U13 K02 K03 K04 K07 K08 K10	60	180	6	6	4	Twcl/Zw(2)	Z	-	DN	P(4)	S
3	W04INA-SM4103G	Applied Stochastic with Applications for Security and Privacy	2	2	0	0	0	W01 W02 W03 W04 W05 U01 U02 U03 U04 U05 U06 U08 U10 U12 K02 K03 K05 K06 K07 K10 K12	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S
4	W04INA-SM4105G	Digital Signal Processing	2	2	0	0	0	W01 W02 W03 W04 W05 U01 U02 U03 U04 U06 U08 K02 K03 K07 K10	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S
5	W04INA-SM4107G	Introduction to Electronics for Security Engineers	2	2	0	0	0	W01 W02 W03 W04 W05 W06 W07 W08 W09 W10 U01 U02 U03 U04 U05 U06 U08 U10 U11 U12 K02 K03 K04 K06 K07 K08 K09 K10	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S



6	W04INA-SM4109G	Identification and Biometric Systems	2	2	0	0	0	W01 W02 W04 W05 W06 W07 W08 W09 U01 U02 U03 U04 U05 U06 U07 U08 U09 U10 U11 U12 U13 K03 K05 K06 K07 K08 K09 K11 K12	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S
7	W04INA-SM4110G	Monographic Lecture	2	2	0	0	0	W04 W05 U01 U05 U06 U07 U11 U12 K03	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S
8	W04INA-SM4112G	Secure Cloud Computing	2	0	2	0	0	W02 W03 W04 W05 W07 U03 U05 U06 K01 K03 K05 K09	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S
9	W04INA-SM4113G	Elliptic Curves for Developers	2	0	2	0	0	W02 W03 W04 U03 U06 K02 K03	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S
10	W04INA-SM4114G	Monographic Lecture on Computer Security	2	1	1	0	0	W04 W05 U01 U025 U06 U11 U12 K03	60	180	6	6	4	Twcl/Zw(2)	Z	-	DN	P(4)	S
11	W04INA-SM4118G	Blockchain and Cryptocurrencies	2	0	2	0	0	W01 W02 W03 W04 W05 W07 W08 W09 U01 U02 U03 U04 U05 U06 U07 U08 U10 U11 U12 U13 K01 K02 K03 K04 K05 K06 K07 K08 K09 K10 K11 K12	60	180	6	6	4	Twc/Zw(3)	Z	-	DN	P(3)	S
12	W04INA-SM4119G	Malicious Cryptography and Advanced Defences	2	0	2	0	0	W01 W02 W03 W04 W05 W06 W07 W08 W09 W10 U01 U02 U03 U04 U05 U06 U07 U08 U09 U10 U11 U12 U13 K01 K02 K03 K04 K05 K06 K07 K08 K09 K10 K11 K12	60	180	6	6	4	Twl/Zw(3)	Z	-	DN	P(3)	S

13	W04INA-SM4120G	Privacy Enhancing Technologies	2	2	0	0	0	W01 W02 W03 W04 W05 W07 W08 W09 W10 U01 U02 U03 U04 U05 U06 U07 U08 U09 U10 U11 U12 U13 K01 K02 K03 K04 K05 K06 K07 K08 K09 K10 K11 K12	60	180	6	6	4	Twl/Zw(3)	Z	-	DN	P(3)	S
14	W04INA-SM4121G	Machine Learning and Security	2	0	2	0	0	W01 W02 W03 W04 W05 W06 W07 W08 W09 W10 U01 U02 U03 U04 U05 U06 U07 U08 U09 U10 U11 U12 U3 K01 K02 K03 K04 K05 K06 K07 K08 K09 K19 K11 K12	60	180	6	6	4	Twl/Zw(2)	Z	-	DN	P(3)	S
Total			10	10	0	0			300	900	30	30	20						

**Altogether for specialization blocks**

Weekly number of hours					No. of hours		ECTS		
lec	cl	lab	pr	s	ZZU	CNPS	total	DN	BU
10		10	0	0	300	900	30	30	20

**4.3 Diploma dissertation block**

<b>Type of diploma dissertation:</b> Master of Science		
<b>Number of diploma dissertation semesters</b>	<b>Number of ECTS points</b>	<b>Code</b>
1	20	W04INA-SM4003D
<b>Character of diploma dissertation</b>		
Analytical, analytical-experimental or experimental work.		
<b>Number of BU ECTS points:</b> 10		

## **5 Ways of verifying assumed learning outcomes**

<b>Type of classes</b>	<b>Ways of verifying assumed learning outcomes</b>
lecture	examination, progress/final test
class	progress/final test, activity, reports
laboratory	completed projects, programming tasks
seminar	participation in discussion, topic presentation, essay
diploma dissertation	prepared diploma dissertation

Detailed ways to verify learning outcomes for each subject are attached to their cards.

## **6 Range of diploma examination**

The scope of the diploma examination includes the presentation of the most important achievements of the diploma dissertation and questions regarding the curriculum content included in the teaching standards and passed by the Diploma candidate, which are directly or indirectly related to the subject of the presented diploma dissertation.

## **7 Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular blocks**

The dates of crediting certain courses result from the plan of study for individual semesters and admissible point deficits (expressed in ECTS points) after a given semester, allowing students to study at the next semester, according to the table included in the study plan.

## **8 Plan of studies (attachment no. 3b)**

Approved by faculty student government legislative body:

.....  
Date

.....  
name and surname, signature of student representative

.....  
Date

.....  
Dean's signature