

## PROGRAMME OF EDUCATION

FACULTY: Faculty of Computer Science and Management

MAIN FIELD OF STUDY: Computer Science

in area of science Technical Sciences

EDUCATION LEVEL: 1st / ~~2nd~~\* level, ~~licencjat~~ / inżynier / ~~magister~~ / ~~magister inżynier~~ studies\*

FORM OF STUDIES: full-time / ~~part-time~~\*

PROFILE: general academic / ~~practical~~ \*

SPECIALIZATION\*: no specialization

LANGUAGE OF STUDY: English

Faculty Council Resolution of 29.05.2018  
In effect since 01.10.2018

## PROGRAMME OF STUDIES

## 1. Description

<i>Number of semesters: 7</i>	<i>Number ECTS points necessary to obtain qualifications: 210</i>
<p><i>Prerequisites (particularly for second-level studies):</i></p> <p>Qualification for first-cycle studies is based on the results of the matriculation examination, in accordance with the terms and recruitment policy adopted for a given academic year by the Faculty Council and the Senate of the Wrocław University of Technology.</p>	<p><i>Upon completion of studies graduate obtains professional degree of: <b>Engineer (inż)</b></i></p> <p><i>1st/2nd* level qualifications</i></p>
<p><i>Possibility of continuing studies:</i></p> <p>Completion of the first cycle studies entitles a student to apply for admission to the second degree studies.</p>	<p><i>Graduate profile, employability:</i></p> <p>A graduate of the 1st-degree studies program. Computer science has qualifications covering knowledge, skills and engineering competences in the scope of:</p> <ul style="list-style-type: none"> <li>• Architecture and organization of computers and programming of low-level devices, including elements of the Internet of Things,</li> <li>• Programming languages, algorithms and data structures, programming paradigms and effective programming techniques,</li> <li>• Computer networks, system administration, and cybersecurity,</li> <li>• Databases and data warehouses, including database design</li> <li>• Software design and programming project management,</li> <li>• Advanced methods and programming tools, artificial intelligence and</li> </ul>

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<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob

	<p>knowledge engineering, mobile applications and distributed systems</p> <ul style="list-style-type: none"> <li>• Different aspects of multimedia</li> <li>• Development trends in IT.</li> </ul> <p>The graduate also has knowledge of basic sciences: mathematical analysis, algebra with analytic geometry, logic, discrete mathematics, probability and statistics, and physics, which are necessary from the point of view of solving engineering problems and possible continuation of studies at the second level studies. The knowledge about the foundations of entrepreneurship and social and professional IT problems is a very important component of the IT engineer education. In addition, the graduate knows English to an extent that allows him to freely express, also in writing, on topics related to the work performed. A lot of role in educating IT engineers is also attached to soft skills, such as the ability to present, eg the results of their own work and the ability to work in a team.</p> <p>A graduate of the first-cycle degree in Computer Science can be employed in IT companies and IT departments of banks and financial institutions, enterprises and economic institutions in Wrocław, as well as throughout Poland or abroad. They are employed in the positions of software designers, programmers, software testers, service technicians, system administrators or specialists in digital security.</p>
<p><i>Indicate connection with University's mission and its development strategy:</i></p>	<p><i>The first level education program for Computer Science at the Faculty of Computer Science and Management is fully consistent with the mission of the Wrocław University of Science and Technology and its strategy of development.</i></p> <p><i>The program provides the opportunity to acquire diverse knowledge, skills, engineering competencies and social skills necessary for a modern</i></p>

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	<p><i>IT engineer. The compulsory courses and modules of elective courses offered as part of the education program. On the one hand, they meet the requirements of the Polish Qualifications Framework, on the other hand, in accordance with the University's mission they meet the dynamically changing needs of the socio-economic environment.</i></p> <p><i>This is expressed, inter alia, through:</i></p> <ul style="list-style-type: none"> <li><i>• involvement of the members of the Department's Convention composed of representatives of leading IT companies in the region in the work on the education program,</i></li> <li><i>• participation of highly qualified specialists from outside the university in conducting didactic classes, especially those of a practical nature,</i></li> <li><i>• offering opportunities to implement compulsory student internships in companies or IT departments.</i></li> </ul> <p><i>Practical classes take place in specialized laboratories equipped with modern telecommunications equipment, unique equipment, and software, regularly developed and modernized.</i></p> <p><i>Acting in accordance with the strategy of the Wrocław University of Technology in the field of internationalization, the Faculty of Computer Science and Management offers first-cycle studies in Computer Science also in English for candidates from Poland and for foreigners. In addition, students have the opportunity to participate in international exchange programs (eg. ERASMUS +).</i></p>
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## **2. Fields of science and scientific disciplines to which educational effects apply:**

Field of Science: Technical sciences, Scientific Discipline of Computer Science

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### 3. Concise analysis of consistency between assumed educational effects and labour market needs

Correspond to the needs of:

- a) institutions and companies engaged in production, commercial, service or research activities for IT departments dealing with the maintenance/development of IT tools or supporting this activity,
- b) developers of various information systems (software designers, programmers, testers, administrators),
- c) companies designing, implementing and maintaining computer systems and networks in various economic or community organizations both public and private

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## 4. List of education modules:

### 4.1. List of obligatory modules:

#### 4.1.1 List of general education modules

##### 4.1.1.1 Liberal-managerial subjects module (min. 6 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Basics of entrepreneurship	2					K1INF_W20	30	60	2	1,2	T	Z				
2.		Presentation Techniques					2	K1INF_U11	30	60	2	1,2	T	Z				
3.		IT Social and Professional Problems	2					K1INF_W21	30	60	2	1,2	T	Z				
		Razem	4				2		90	180	6	3,6						

##### 4.1.1.4 Information technologies module (min. 9 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Computer System Organization (GK)	2	1				K1INF_W07	45	90	3	1,8	T	Z (w)				
2.		Structural and Object oriented Programming (GK)	2	2				K1INF_W04 K1INF_U01 K1INF_U02	60	120	4	2,4	T	E (w)				
3.		Structural and Object oriented Programming			2			K1INF_W04 K1INF_U01 K1INF_U02	30	60	2	1,2	T	Z		P (2)		
		Total	4	3	2				135	270	9	5,4				2		

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<sup>4</sup>University-wide course /group of courses – enter O

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<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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### Altogether for general education modules

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes <sup>1</sup>
lec	cl	lab	pr	sem				
8	3	2		2	225	450	15	9

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<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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## 4.1.2 List of basic sciences modules

### 4.1.2.1 Mathematics module (min. 29 ECTS):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Algebra and Analytic Geometry (GK)	2	2				K1INF_W01	60	180	6	3,6	T	E (w)	O		PD	Ob.
2.		Mathematical Analysis I (GK)	2	2				K1INF_W01	60	180	6	3,6	T	E (w)	O		PD	Ob.
3.		Mathematical Analysis II (GK)	2	1				K1INF_W01	45	150	5	3	T	E (w)	O		PD	Ob.
4.		Discrete Mathematics (GK)	2	2				K1INF_W02	60	150	5	3	T	Z (w)			PD	Ob.
5.		Theory of Probabilistic and Statistics (GK)	2	2				K1INF_W02	60	200	7	4,2	T	E (w)			PD	Ob.
Total			10	9					285	860	29	17,4						

### 4.1.2.2 Physics module (min. 10 ECTS):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		General Physics I (GK)	2	1				K1INF_W03	45	120	4	2,4	T	Z (w)	O		PD	Ob.
2.		General Physics II (GK)	2	1				K1INF_W03	45	120	4	2,4	T	E (w)	O		PD	Ob.
3.		General Physics II			1			K1INF_W03	15	60	2	1,2	T	Z	O	P (2)	PD	Ob.
Total			4	2	1				105	300	10	6				2		

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<sup>4</sup>University-wide course /group of courses – enter O

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**Altogether for basic sciences modules:**

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes <sup>1</sup>
lec	cl	lab	pr	sem				
14	11	1			390	1160	39	23,4

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<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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

### 4.1.3.1 Obligatory main-field-of-study modules (min. 85 ECTS)

No.	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Logic for IT Specialists (GK)	2	2				K1INF_W02	60	150	5	3	T	E (w)			K	Ob.
2.		Data Structures and Algorithms			2			K1INF_W04 K1INF_U01	30	60	2	1,2	T	Z		P (2)	K	Ob.
3.		Data Structures and Algorithms (GK)	2	1				K1INF_W04 K1INF_U01	45	120	4	2,4	T	E (w)			K	Ob
4.		Computer Architecture	2					K1INF_W07 K1INF_U06	30	60	2	1,2	T	Z			K	Ob.
5.		Computer Architecture			2			K1INF_W07 K1INF_U06	30	60	2	1,2	T	Z		P (2)	K	Ob.
6.		Operating Systems	2					K1INF_W09 K1INF_U07	30	60	2	1,2	T	Z			K	Ob.
7.		Operating Systems			2			K1INF_W09 K1INF_U07	30	60	2	1,2	T	Z		P (2)	K	Ob
8.		Computer Networks	3					K1INF_W10 K1INF_U08	45	110	4	2,4	T	E			K	Ob.
9.		Computer Networks			2			K1INF_W10 K1INF_U08	30	90	3	1,8	T	Z		P (3)	K	Ob.
10.		Effective Programming Techniques	1					K1INF_W04 K1INF_U01	15	60	2	1,2	T	Z			K	Ob.
11.		Effective Programming Techniques			2			K1INF_W04 K1INF_U01	30	90	3	1,8	T	Z		P (3)	K	
12.		Programming paradigms			2			K1INF_W05 K1INF_U02	30	60	2	1,2	T	Z		P (2)	K	
13.		Programming paradigms (GK)	2	1				K1INF_W05 K1INF_U02	45	140	5	3	T	E (w)			K	
14.		Data Bases			1			K1INF_W13 K1INF_U03	15	60	2	1,2	T	Z		P (2)	K	

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30.		Data Warehouses	2				K1INF_W13 K1INF_U07	30	60	2	1,2	T	E			K	Ob.
31.		Data Warehouses			2		K1INF_W13 K1INF_U07	30	90	3	1,8	T	Z		P (3)	K	Ob.
		Total	29	7	26	2		960	2530	85	51				38		

**Altogether (for main-field-of-study modules):**

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes <sup>1</sup>
lec	cl	lab	pr	sem				
29	7	26	2		960	2530	85	51

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## 4.2 List of optional modules

### 4.2.1 List of general education modules

#### 4.2.1.1 Liberal-managerial subjects module M10 – Humanistic Subject (*min. 3 ECTS points*):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Humanistic Subject 1	2					K1INF_W22	30	90	3	1,8	T	Z	O		KO	W
2.		Humanistic Subject 2	2					K1INF_W22	30	90	3	1,8	T	Z	O		KO	W
		Razem	2						30	90	3	1,8						

#### 4.2.1.2 Foreign languages module (*min. 5 ECTS points*):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		English I		2				K1INF_U17	30	60	2	1,2	T	Z	O		KO	W
2.		English II		4				K1INF_U17	60	90	3	1,8	T	Z	O		KO	W
		Razem		6					90	150	5	3						

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#### 4.2.1.3 Sporting classes module (min. 0 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Sports		2					30	30	0	0	T	Z	O		KO	W
		Total		2					30	30	0	0						

#### Altogether for general education modules:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes <sup>1</sup>
lec	cl	lab	pr	sem				
2	8				150	240	9	4,8

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<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob



## 4.2.3 List of main-field-of-study modules

### 4.2.3.1 Module of optional courses M1 - Administration of Computer Systems (minimum 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Linux server administration (GK)	2		2			K1INF_W09 K1IN_U21	60	120	4	2,4	T	Z (w)		P (2)	K	W
2.		Microsoft systems administration (GK)	2		2			K1INF_W09 K1IN_U21	60	120	4	2,4	T	Z (w)		P (2)	K	W
Total			2		2				60	120	4	2,4						

### 4.2.3.2 Module of optional courses M2 – Web Technologies (minimum 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Web systems programming (GK)	2		2			K1INF_W08 K1INF_U18	60	120	4	2,4	T	Z (w)		P (2)	K	W
2.		.NET Web Applications (GK)	2		2			K1INF_W08 K1INF_U18	60	120	4	2,4	T	Z (w)		P (2)	K	W
Total			2		2				60	120	4	2,4				2		

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup>KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup>Optional – enter W, obligatory – enter Ob

#### 4.2.3.3 Module of optional courses M3 – Database Design (minimum 45 hours in semester, 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Database Systems Engineering (GK)	1			2		K1INF_W15 K1INF_U03 K1INF_U04 K1INF_K03	45	120	4	2,4	T	Z (w)		P (2)	K	W
2.		Oracle Databases – programming (GK)	1			2		K1INF_W15 K1INF_U03 K1INF_U04 K1INF_K03	45	120	4	2,4	T	Z (w)		P (2)	K	W
3.		Database Design (GK)	1			2		K1INF_W15 K1INF_U03 K1INF_U04 K1INF_K03	45	120	4	2,4	T	Z (w)		P (2)	K	W
Total			1			2			45	120	4	2,4				2		

#### 4.2.3.4 Module of optional courses M4 – Mobile Applications (minimum 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Developing mobile applications for Android Platform (GK)	2		2			K1INF_W08 K1INF_U18	60	120	4	2,4	T	Z (w)		P (2)	K	W
2.		Developing mobile applications for IOS Platform (GK)	2		2			K1INF_W08 K1INF_U18	60	120	4	2,4	T	Z (w)		P (2)	K	W
Total			2		2				60	120	4	2,4				2		

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob

#### 4.2.3.5 Module of optional courses M5 – Project Management Basics (minimum 3 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Introduction to IT Project Management (GK)	1		2			K1INF_W18 K1INF_U10 K1INF_U11 K1INF_U12	60	90	3	1,8	T	Z (w)		P (1)	K	Ob.
2.		IT Project Management Support (GK)	1		2			K1INF_W18 K1INF_U10 K1INF_U11 K1INF_U12	60	90	3	1,8	T	Z (w)		P (1)	K	Ob
3.		Process - Based Management of IT Project (GK)	1		2			K1INF_W18 K1INF_U10 K1INF_U11 K1INF_U12	60	90	3	1,8	T	Z (w)		P (1)	K	Ob.
Total			1		2				60	90	3	1,8				1		

#### 4.2.3.6 Module of optional courses M6 – Distributed Systems (minimum 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Distributed Computer System (GK)	2		2			K1INF_W08 K1INF_U11 K1INF_U18	60	120	4	2,4	T	Z (w)		P (2)	K	Ob.
2.		Programming Microsoft Azure (GK)	2		2			K1INF_W08 K1INF_U11 K1INF_U18	60	120	4	2,4	T	Z (w)		P (2)	K	Ob
Total			2		2				60	120	4	2,4				2		

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob

#### 4.2.3.7 Module of optional courses M7 – Programming Tools and Technologies (minimum 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		.NET Software Development (GK)	2		2			K1INF_W17 K1INF_U20	60	110	4	2,4	T	Z (w)		P (2)	K	Ob.
2.		Computer Game Programming (GK)	2		2			K1INF_W17 K1INF_U20	60	110	4	2,4	T	Z (w)		P (2)	K	Ob
3.		Advanced Web Technologies (GK)	2		2			K1INF_W17 K1INF_U20	60	110	4	2,4	T	Z (w)		P (2)	K	Ob.
Total			2		2				60	110	4	2,4				2		

#### 4.2.3.8 Module of optional courses M8 – Multimedia (minimum 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Computer Graphics GK)	2		2			K1INF_W16 K1INF_U19	60	120	4	2,4	T	E (w)		P (2)	K	Ob.
2.		Programming Multimedia Applications (GK)	2		2			K1INF_W16 K1INF_U19	60	120	4	2,4	T	E (w)		P (2)	K	Ob
3.		Digital Media Processing Techniques (GK)	2		2			K1INF_W16 K1INF_U19	60	120	4	2,4	T	E (w)		P (2)	K	Ob.
Total			2		2				60	120	4	2,4				2		

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup>KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup>Optional – enter W, obligatory – enter Ob

#### 4.2.3.9 Module of optional courses M9 – Current trends in Computer Science (minimum 4 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol GK)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Data Science (GK)	2		2			K1INF_W19 K1INF_U16	60	120	4	2,4	T	Z (w)		P (2)	K	W
2.		Neural Networks (GK)	2		2			K1INF_W19 K1INF_U16	60	120	4	2,4	T	Z (w)		P (2)	K	W
3.		Problem Solving Using Metaheuristics (GK)	2		2			K1INF_W19 K1INF_U16	60	120	4	2,4	T	Z (w)		P (2)	K	W
4.		Human-Computer Interaction (GK)	2		2			K1INF_W19 K1INF_U16	60	120	4	2,4	T	Z (w)		P (2)	K	W
Total			2		2				60	120	4	2,,4				2		

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob

#### 4.2.3.10 Optional Courses (minimum 21 ECTS points):

No..	Course/group of courses code	Name of course/group of courses (denote group of courses with symbol <b>GK</b> )	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form <sup>2</sup> of course/group of courses	Way <sup>3</sup> of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes <sup>1</sup>			university-wide <sup>4</sup>	practical <sup>5</sup>	kind <sup>6</sup>	type <sup>7</sup>
1.		Team Project				6		K1INF_U05 K1INF_U14 K1INF_U16 K1INF_K01 K1INF_K03 K1INF_K04	90	420	14	8,4	T	Z		P (14)	K	W
2.		Diploma Seminar					2	K1INF_U11 K1INF_U12 K1INF_U13	30	60	2	1,2	T	Z			K	W
3.		Diploma Thesis				3		K1INF_U05 K1INF_U11 K1INF_U13 K1INF_U15 K1INF_K01	45	150	5	3	T	Z		P (5)	K	W
4.		Practical Training								160	5	3						
Total						9	2		165	790	26	15,6				19		

#### Altogether for main-field-of-study modules:

Total number of hours					Total number of ZZU hours	Total number of CNPS hours	Total number of ECTS points	Number of ECTS points for BK classes <sup>1</sup>
lec	cl	lab	pr	sem				
16		16	11	3	690	1840 (160 hours of practical training included)	61 (5 ECTS of practical training included)	36,6 (3 ECTS of practical training included)

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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<sup>7</sup> Optional – enter W, obligatory – enter Ob

#### 4.3 Training module (Faculty Council resolution on principles of crediting training – attachment no. ...)

<b>Name of training</b>			
<b>Number of ECTS points</b>	<b>Number of ECTS points for BK classes<sup>1</sup></b>	<b>Training crediting mode</b>	<b>Code</b>
<b>5</b>	<b>3</b>	<b>Z</b>	
<b>Training duration</b>	<b>Training objective</b>		
<b>4 weeks</b>	Attainment of Knowledge about: IT Business or IT department functioning; designing, programming, testing and implementing professional IT solutions and systems administration. Accomplishment of a simple practical task that take the advantage of the skills acquired so far. The task should also develop social competences, especially ability to work in a group.		

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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<sup>7</sup> Optional – enter W, obligatory – enter Ob

#### 4.4 Diploma dissertation module

Type of diploma dissertation	Licencjat / inżynier / magister / magister inżynier	
Number of diploma dissertation semesters	Number of ECTS points	Code
1	5	1
<b>Character of diploma dissertation</b>		
Literature survey, project, computer program, etc.		
Number of BK <sup>1</sup> ECTS points 3	Analysis of solutions, project, project documentation	

#### 5. Ways of verifying assumed educational effects

Type of classes	Ways of verifying assumed educational effects
lecture	e.g. examination, progress/final test
class	e.g. progress/final test
laboratory	e.g. pretest, report from laboratory
project	e.g. project defence
seminar	e.g. participation in discussion, topic presentation, essay
training	e.g. report from training
diploma dissertation	prepared diploma dissertation

#### 6. Total number of ECTS points, which student has to obtain from classes requiring direct academic teacher-student contact (enter total of ECTS points for courses/groups of courses denoted with code BK<sup>1</sup>)

**210 ECTS**

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob



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

Number of ECTS points for obligatory subjects .....	<b>39</b>
Number of ECTS points for optional subjects ....	<b>0</b>
Total number of ECTS points	<b>39</b>

**8. Total number of ECTS points, which student has to obtain from practical classes, including laboratory classes** (enter total number of ECTS points for courses/group of courses denoted with code P)

Number of ECTS points for obligatory subjects .....	<b>38</b>
Number of ECTS points for optional subjects ....	<b>36</b>
Total number of ECTS points	<b>74</b>

**9. Minimum number of ECTS points, which student has to obtain doing education modules offered as part of university-wide classes or other main field of study** (enter number of ECTS points for courses/groups of courses denoted with code OG)

**35** ECTS points

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

**74** ECTS points

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

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<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob

## 11. Range of diploma dissertation

1. Basic Digital Circuits: Logic Gates, Switches, Sequential Circuits.
2. Binary Arithmetics, Boolean Functions, Karnaugh table
3. Structural programming - principles. Review of structural instructions.
4. Object-oriented programming - basic concepts, applications.
5. Basic operations on sets, functions and relations. Sentence calculus. Calculus of quantifiers.
6. Deterministic Finite State Automata – definition, applications.
7. Examples of computer architectures: von Neumann, Princeton, Harvard.
8. RISC and CISC processors - characteristics, differences.
9. Graphs. Spanning trees. Euler and Hamilton cycles. Cohesion. Graph traversal algorithms.
10. The concept of the algorithm. Sorting algorithms. Search algorithms.
11. Basics of algorithm analysis. Computational complexity.
12. The layered structure of operating system, the concept of the system kernel.
13. OSI layered model.
14. Data link layer protocols. Ethernet network. A stack of TCP / IP Internet protocols.
15. Application layer protocols.
16. Techniques for effective programming - examples.
17. Memory management. Typical problems. Pointers.
18. Selection of programming paradigms to solve IT problems.
19. Functional programming vs imperative programming.
20. Abstract data types and their implementation in programming languages.
21. Algorithms for identifying static objects. Analytical and numerical optimization methods.
22. The specificity of the Internet of Things, application areas, solving problems with addressing a large number of devices, their dispersion and a very large amount of generated data.
23. Hardware solutions supporting communication and communication protocols used in embedded hardware and the Internet of Things
24. Database models. Relational database. Normalization. Transactions.
25. SQL language. Characteristic. Sublanguages.
26. Software life cycle models.
27. Software development processes.

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<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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<sup>7</sup> Optional – enter W, obligatory – enter Ob

28. The use of lists, collections and dictionaries in Python.
29. Differences and similarities of Java and Python languages.
30. Python Principles of parallel programming in the Python scripting language.
31. UML as the language of the project specification. Diagrams and their application.
32. Architectural and design patterns - classification, examples, applications.
33. Data protection methods.
34. Basic cryptographic algorithms.
35. Multidimensional data modeling (transactional and analytical data systems, types of multidimensional OLAP structures).
36. ETL process
37. Expressions and MDX directives.
38. Methods of knowledge processing in expert systems.
39. Inference in non-monotonic logic - a planning task.

## 12. Requirements concerning deadlines for crediting courses/groups of courses for all courses in particular modules

No.	Course code	Name of course	Crediting by deadline of... (number of semester)
	Wć	General Physics I (GK)	5
	Wć	Computer System Organization (GK)	3
	Wć	Structural and Object oriented Programming (GK)	3
	L	Structural and Object oriented Programming	3
	Wć	Logic for IT Specialists (GK)	5
	Wć	Algebra and Analytic Geometry (GK)	5
	Wć	Mathematical Analysis I (GK)	5
	L	Data Structures and Algorithms	6

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob

	Wć	Data Structures and Algorithms (GK)	6
	W	Computer Architecture	6
	L	Computer Architecture	6
	W	Operating Systems	6
	L	Operating Systems	6
	L	General Physics II	5
	Wć	General Physics II (GK)	5
	Wć	Discrete Mathematics (GK)	5
	Wć	Mathematical Analysis II (GK)	5
	W	Basics of entrepreneurship	6
	W	Computer Networks	6
	L	Computer Networks	6
	W	Effective Programming Techniques	6
	L	Effective Programming Techniques	6
	L	Programming paradigms	6
	Wć	Programming paradigms (GK)	6
	Wć	Theory of Probabilistic and Statistics (GK)	5
	Ć	English I	5
	Ć	Sports	6
	L	Data Bases	6
	Wć	Data Bases (GK)	6
	L	Systems Analysis and Decision Support Methods	6
	Wć	Systems Analysis and Decision Support Methods (GK)	6

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

<sup>6</sup> KO – general education, PD – basic sciences, K – field-of-studies, S – specialization

<sup>7</sup> Optional – enter W, obligatory – enter Ob

	W	Introduction to IoT	6
	L	Introduction to IoT	6
	L	Basics of Software Engineering	5
	Wć	Basics of Software Engineering	5
	Ć	English II	6
	S	Presentation Techniques	6
	W	Cybersecurity	6
	L	Cybersecurity	6
	W	Script Languages	6
	L	Script Languages	6
	W	Software Engineering	6
	P	Software Engineering	6
	W	Artificial intelligence and knowledge engineering	6
	L	Artificial intelligence and knowledge engineering	6
	W	Data Warehouses	6
	L	Data Warehouses	6
	W	IT Social and Professional Problems	6

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

<sup>5</sup>Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses

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<sup>7</sup> Optional – enter W, obligatory – enter Ob

### 13. Plan of studies (attachment no. ....)

Approved by faculty student government legislative body:

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

.....  
Date, Dean's signature

<sup>1</sup>BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students

<sup>2</sup>Traditional – enter T, remote – enter Z

<sup>3</sup>Exam – enter E, crediting – enter Z. For the group of courses – after the letter E or Z - enter in brackets the final course form (lec, cl, lab, pr, sem)

<sup>4</sup>University-wide course /group of courses – enter O

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<sup>7</sup> Optional – enter W, obligatory – enter Ob