Zał. nr 2 do ZW 64/2012

Attachment no. 2 to Programme of Education

PROGRAMME OF STUDIES

1. Description

Number of semesters:7	*Number ECTS points necessary to obtain qualifications:210*
Prerequisites: *The competition of grades from maturity certificate and certificate of secondary school.* *In case of foreign students, secondary school certificate, received after the completion of a recognized secondary school (total 12 years of education), being the equivalent of Polish maturity certificate accepted by Kuratorium Oświaty.* *Detailed requirements are stated by the Senate of Wroclaw University of Technology and the Faculty of Electronics Council every year*	*Upon completion of studies graduate obtains* *professional degree of: engineer; 1st level qualifications*
Possibility of continuing studies: *Second level of study in the fields of Electrical Engineering or Computer Science or Automation and Robotics or Telecommunication or other related field.*	*Graduate profile, employability:* *Undergraduate studies are not divided into specializations. They enable to get primary and organized knowledge in the field of electronics, automation and robotics, and computer science. After graduation, the graduate will be able to:* • *To design, implement, test and operate analog, digital and mixed signal electronic circuits with the use of electronic components and optoelectronic integrated circuits and microprocessors, plan and design circuits and systems, optimize measurement conditions and to analyze and interpret the test results.*

	• *Use personal computing for the acquisition of measurement results, technological process control, design, commissioning, maintenance of automation and industrial robotics exchange of information based on standard data protocols.* • *To solve computing tasks using computer tools, prepare, execute, and analyze computer simulations and experiments, make by yourself computer programs, including programs for implementation of DSP algorithms.*
Indicate connection with University's mission and its development strategy: *The program is consistent with the Electronic Faculty Development Plan established by the Faculty Council on 22nd February 2012.* *The Faculty Development Plan is fully correlated with the university's mission and its development strategy adopted by the Senate of Wrocław University of Technology in 2011. The relations are apparent for example in par. 3 of the Development Plan "Faculty Mission and Perspectives" and in par. 4 "Sector Models", where the Educational Model and Study Model are described, together with the Model for External Cooperation that considers job opportunities and forming of the network of influence*	

2. Fields of science and scientific disciplines to which educational effects apply:

- FIELD: technical science
- DISCIPLINE: Automation and Robotics, Electronics, Computer Science, Telecommunication
- LEADING DISCIPLINE: Electronics

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[4]University-wide course /group of courses – enter O
[5]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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[7] Optional – enter W, obligatory – enter Ob

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

The work market for engineering graduates majoring in Electronic and Computer Engineering (ECE) covers the whole country, region of Lower Silesia and Wroclaw. The program of study covers all the basic needs and requirements of the work market for electronics and computer engineers. Profile of the companies that will benefit from the competence of graduates is mainly manufacturing and service companies. In this area, there is and will be a significant demand for professionals with the title of electronics engineer, possessing the skills of integration of the electronic equipment and analogue and digital systems (including microprocessor) in broadly covered industrial automation. These skills include, among others, PLC programming, PAC, SCADA systems and robotic systems, conduct commissioning of control systems, local and remote maintenance, supervision over operating control systems of production. Also the ability to design broadly defined control systems, telemetry systems and the measurement will be on the work market received very positively. Currently there is a significant increase in the number of companies specializing in buildings and homes automation. These objects require care and conservation engineers. In the Lower Silesia region operates a significant number of small and medium-sized enterprises and factories, where engineering skills are and will find appreciation in the period of many years to come.

An additional advantage of graduates will be the practical knowledge of English, which will expand its opportunities in the growing number of foreign companies with their research and development and / or production facilities in the Lower Silesia and the whole Poland.

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[7] Optional – enter W, obligatory – enter Ob

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. ..... ECTS points):*

4.1.1.2 *Foreign languages* module *(min. ..... ECTS points):*

4.1.1.3 *Sporting classes* module *(min. .... ECTS points):*

4.1.1.4 *Information technologies* module *(min. .... 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[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	**ECEA00015**	**Introduction to Programming GK**	2		2			K1ECE _W07 K1ECE _U07	60	240	8	2,5	T	Z		P(4)		
		Total	2		2				60	240	8	2,5				4		

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 courses practical[5]
lec	cl	lab	pr	sem				
2		2			60	240	8	4

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[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – enter W, obligatory – enter Ob

4.1.2 List of basic sciences modules

4.1.2.1 *Mathematics* module

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[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	MAT001509	Math - Analysis 1 **GK**	2	2				K1ECE _W02 K1ECE _U02	60	210	7	2	T	E	o	P(3)	KP	OB
2	MAT001511	Math - Analysis 2 **GK**	2	2				K1ECE _W03 K1ECE _U03	60	150	5	2	T	E	o	P(2)	KP	OB
3	MAT001510	Math - Algebra **GK**	2	2				K1ECE_W01 K1ECE _U01	60	210	7	2	T	E	o	P(3)	KP	OB
		Razem	6	6					180	570	19	6				8		

4.1.2.2 *Physics* module

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[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	FZP001127	Physics **GK**	2		2			K1ECE _W05 K1ECE _U05	60	180	6	2	T	E	o	P(3)	KP	OB
		Total	2		2				60	180	6	2				3		

4.1.2.3 *Chemistry* module – not applied

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 courses practical[5]
lec	cl	lab	pr	sem				
8	6	2			240	740	25	8

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[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – enter W, obligatory – enter Ob

4.1.3 List of main-field-of-study modules

4.1.3.1 *Obligatory main-field-of-study* modules

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[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	MAT001512	Math for Electronics **GK**	2	2				K1ECE _W04 K1ECE _U04	60	120	4	2	T	Z		P(2)	KP	OB
2	ECEA00014	Physics for Electronics **GK**	2	2				K1ECE _W15 K1ECE _U15	60	180	6	2	T	Z		P(3)	KP	OB
3	ECEA17004	Object oriented programming GK	2		2			K1ECE _W11 K1ECE_U11	60	180	6	2	T	E		P(3)	K	OB
4	ECEA00007	Scientific_and_Engineering_Programming GK	2		2			K1ECE _W19 K1ECE _U1	60	150	5	2	T	Z		P(3)	K	OB
5	ECEA00010	Programming Systems & Environments GK	2		2			K1ECE _W20 K1ECE _U20	60	120	4	2	T	Z		P(2)	K	OB
6	ECEA00001	Metrology GK	1	1	2			K1ECE _W06 K1ECE _U06	60	120	4	2	T	Z		P(3)	K	OB
7	ECEA00003	Electronics GK	3	3	2			K1ECE _W16 K1ECE _U16	120	240	8	4	T	Z		P(5)	K	OB
8	ECEA00005	Electronic_Components_and_Sensors GK	3	1	2			K1ECE _W17 K1ECE_U17	120	240	8	4	T	E		P(5)	K	OB
9	ECEA00006	Electronic_Technology GK	2		2			K1ECE _W08 K1ECE _U08	60	150	5	2	T	Z		P(3)	K	OB
10	ECEA00009	Electronic_circuits GK	2		2	2		K1ECE _W18 K1ECE _U18	90	210	7	3	T	E		P(4)	K	OB
11	ECEA00012	Introduction_to_Microcontrollers GK	3		2	1		K1ECE _W14 K1ECE _U14	90	240	8	3	T	E		P(4)	K	OB
12	ECEA00101	Computer_Networks GK	2		2			K1ECE _W21 K1ECE _U21	60	120	4	2	T	Z		P(2)	K	OB
13	ECEA00008	Systems_Theory GK	1	1				K1ECE _W10 K1ECE_U10	30	90	3	1	T	Z		P(2)	K	OB
14	ECEA00016	Introduction to Automation and Robotics GK	4		2			K1ECE _W09 K1ECE_U09	90	210	7	3	T	Z		P(4)	K	OB
15	ECEA00102	Digital_Signal_Processing GK	2		3			K1ECE _W13 K1ECE _U13	75	150	5	2,5	T	E		P(3)	K	OB
16	ECEA00011	Fundamentals_of_Telecommunication GK	2		1		1	K1ECE _W12 K1ECE _U12	60	120	4	2	T	Z		P(2)	K	OB
17	ECEA00103	Electroacoustics GK	2		2			K1ECE _W22 K1ECE _U22	60		4	2	T	Z		P(2)	K	OB
		Total	37	10	28	3	1		1215	2640	92	40,5				52		

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[7] Optional – enter W, obligatory – enter Ob

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 courses practical[5]
lec	cl	lab	pr	sem				
37	10	28	3	1	1215	2640	92	52

4.2 List of optional modules

4.2.1 List of general education modules

4.2.1.1 Liberal-managerial subjects modules *(min. ..5.... 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[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	From the set of Univ.	**Philosophy, Etics**	2					K1ECE_K01	30	60	2	1	T	Z	O		KO	OB
2	From the set of Univ.	**Author Law**	2					K1ECE_K02	30	60	2	1	T	Z	O		KO	OB
3	From the set of Univ.	**Business**	2					K1ECE_K03	30	30	1	1	T	Z	O		KO	OB
		Razem	6						90	150	5	3				0		

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 **GK**)	Weekly number of hours					Field-of-study educational effect symbol	Number of hours		Number of ECTS points		Form[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	From the set of Univ.	**Foreign language 1**			4			K1ECE_U34	60	60	2	2	T	Z	O	2	KO	
2	From the set of Univ.	**Foreign language 2**			4			K1ECE_U35	60	90	3	2	T	Z	O	3	KO	
		Total			8				120	150	5	4				5		

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
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[3]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)
[4]University-wide course /group of courses – enter O
[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – enter W, obligatory – enter Ob

4.2.1.3 Sporting classes module *(min. .1... 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[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	From the set of Univ.	**Sport**		2				K1ECE_K05	30	30	0	1	T	Z	O	1	KO	
		Total		2					30	30	0	1				1		

4.2.1.4 *Information technologies* module - *obligatory only*

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 courses practical[5]
lec	cl	lab	pr	sem				
	2	8			240	330	10	6

4.2.2 List of basic sciences modules

4.2.2.1 *Mathematics* module: *obligatory only*

4.2.2.2 *Physics* module: *obligatory only*

4.2.2.3 *Chemistry* module: *not applied*

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 courses practical[5]
lec	cl	lab	pr	sem				

[1]BK – number of ECTS points assigned to hours of classes requiring direct contact of teachers with students
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[3]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)
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[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – enter W, obligatory – enter Ob

4.2.3 List of main-field-of-study modules

4.2.3.1. Module 1 (SEMESTER 5 – choice 3 of 5) *(min. ..21.. 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[2] of course/group of courses	Way[3] of crediting	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	total	BK classes[1]			university-wide[4]	practical[5]	kind[6]	type[7]
1	ECEA00201	Advanced Topics in Robotics GK	2			2	1	K1ECE _W26 K1ECE _U28	75	210	7	2,5	T	Z		P(5)	K	W
2	ECEA00202	Microcontrollers GK	2		2	1		K1ECE _W27 K1ECE _U29	75	210	7	2,5	T	Z		P(4)	K	W
3	ECEA00203	Artificial Intelligence and Computer Vision GK	2		2	1		K1ECE _W28 K1ECE _U30	75	210	7	2,5	T	Z		P(4)	K	W
4	ECEA00204	Optoelectronics GK	2			2	1	K1ECE _W29 K1ECE _U31	75	210	7	2,5	T	Z		P(4)	K	W
5	ECEA00205	Wireless systems GK	3		2			K1ECE _W30 K1ECE _U32	75	210	7	2,5	T	Z		P(3)	K	W
		Total *(2/5)							225	630	21	7,5				>=11		

4.2.3.2 Modul 2 (SEMESTER 6 – chice 3 of 5) *(min. .21.. pts ECTS):*

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[2] of course/ group of courses lec	Way[3] of crediting cl	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	łączna	zajęć BK[1]			lab	pr	sem	typ[7]
1	ECEA00206	Control Systems Engineering GK	2		2	1		K1ECE _W31 K1ECE _U33	75	210	7	2,5	T	E		P(5)	K	W
2	ECEA00207	Embedded Systems GK	2		2	1		K1ECE _W32 K1ECE _U34	75	210	7	2,5	T	E		P(5)	K	W
3	ECEA00208	Real Time Operating Systems GK	2			3		K1ECE _W33 K1ECE _U35	75	210	7	2,5	T	E		P(4)	K	W
4	ECEA00209	Lasers, Fibers and Applications GK	2		2		1	K1ECE _W34 K1ECE _U36	75	210	7	2,5	T	E		P(4)	K	W
5	ECEA00210	Communication systems and networks GK	2		2		1	K1ECE _W35 K1ECE _U37	75	210	7	2,5	T	E		P(4)	K	W
		Total *(2/5)							225	630	21	7,5				>=12		

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[3]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)
[4]University-wide course /group of courses – enter O
[5]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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[7] Optional – enter W, obligatory – enter Ob

4.2.3.3 Modul 3 (SEMESTER 7 - choice 2 from all). *(min. 6 ptst ECTS):*

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[2] of course/ group of courses lec	Way[3] of crediting cl	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	łączna	zajęć BK[1]			lab	pr	sem	typ[7]
1	ECEA00211	Electrotechnics GK	2		1			K1ECE _W36 K1ECE _U38	45	90	3	1,5	T	Z		P(1)	K	W
2	ECEA00212	Medical Electronics GK	2				1	K1ECE _W37 K1ECE _U39	45	90	3	1,5	T	Z		P(1)	K	W
3	ECEA00213	Fiber Optics Technology GK	2		1			K1ECE _W38 K1ECE _U40	45	90	3	1,5	T	Z		P(1)	K	W
4	ECEA00214	Electronics for Renewable Energy Sources GK	2				1	K1ECE _W39 K1ECE _U41	45	90	3	1,5	T	Z		P(1)	K	W
5	ECEA00215	Satellite_Communication_Network GK	2				1	K1ECE _W40 K1ECE _U42	45	90	3	1,5	T	Z		P(1)	K	W
6	ECEA00216	Virtualization and Cloud Computing GK	1		2			K1ECE _W41 K1ECE _U43	45	90	3	1,5	T	Z		P(2)	K	W
7	ECEA00217	Machine learning GK	1			2		K1ECE _W42 K1ECE _U44	45	90	3	1,5	T	Z		P(2)	K	W
8	ECEA00218	Selected topics in Artificial Intelligence GK	2		1			K1ECE _W43 K1ECE _U45	45	90	3	1,5	T	Z		P(1)	K	W
9	ECEA00219	Hybrid Telecommunication Networks GK	1		1		1	K1ECE _W44 K1ECE _U46	45	90	3	1,5	T	Z		P(2)	K	W
10	ECEA00220	Ultrasonic technology GK	1		2			K1ECE _W45 K1ECE _U47	45	90	3	1,5	T	Z		P(2)	K	W
11	ECEA00221	Speech communication GK	1		2			K1ECE _W46 K1ECE _U48	45	90	3	1,5	T	Z		P(2)	K	W
		Total (2 of the set)							90	180	6	3				>=2		

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[4]University-wide course /group of courses – enter O
[5]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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[7] Optional – enter W, obligatory – enter Ob

4.2.3.4 Module ELECTIV COURCES *(min. .26. pts ECTS):*

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[2] of course/ group of courses lec	Way[3] of crediting cl	Course/group of courses			
			lec	cl	lab	pr	sem		ZZU	CNPS	łączna	zajęć BK[1]			lab	pr	sem	typ[7]
1	ECEA00106	Team & preengineering project			3			K1ECE_K04	75	150	5	2,5	T	Z		P(5)		
2	ECEA17105	Diploma seminar					2	K1ECE _U24	30	30	2	1	T	Z		P(3)		
3	ECEA00106	Final project			12			K1ECE _U25		420	13	3	T	E		P(12)		
4	ECEA16001Q	Intership						K1ECE_U23		180	6	6	T	Z		P(6)		
		Total			17		2		105	780	26	12,5				26		

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 courses practical[5]
lec	cl	lab	pr	sem				
					645	2220	85	>=50

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[5]Practical course / group of courses – enter P. For the group of courses – in brackets enter the number of ECTS points assigned to practical courses
[6] KO – general education, PD – basic sciences, K – field-of-studies, S – specialization
[7] Optional – enter W, obligatory – enter Ob

4.2.4 List of specialization modules

4.2.4.1 ***Specialization subjects (e.g. whole specialization)*** **modules** *(min. .... ECTS points):*
4.2.4.2 ……*(e.g. diploma profile)* **module** *(min. .... ECTS points):*

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

Name of training		profesional	
Number of ECTS points	**Number of ECTS points for BK classes[1]**	**Training crediting mode**	**Code**
6	6		**ECEA16001Q**

Training duration	**Training objective**
4 weeks (160 hours)	Obtain an educational effect: K1ECE_U23

4.4 Diploma dissertation module

Type of diploma dissertation	engineer	
Number of diploma dissertation semesters	**Number of ECTS points**	**Code**
1	12 P(12)	**ECEA00106**
Character of diploma dissertation		
Design of complex electronic system (analog or digital or mixed) or advanced computer program.		
Number of BK[1] ECTS points	3	

5. Ways of verifying assumed educational effects

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Type of classes	Ways of verifying assumed educational effects
lecture	Oral or write exam, test
class	tests, quizzes, oral answers, homework, activity during classes
laboratory	Quizzes, laboratory report, oral answers, skills in kartkówka, sprawozdanie z laboratorium, odpowiedzi ustne, skills in work with measurement apparatus
project	Defense of project, oral or/and written answers, test
seminar	Presentation of a given topic, discussion
training	Report of internship
diploma dissertation	Final project

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[1])

89,5…. ECTS

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

Number of ECTS points for obligatory subjects …….	25
Number of ECTS points for optional subjects ….	
Total number of ECTS points	25

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 …….	66

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Number of ECTS points for optional subjects ….	>=58
Total number of ECTS points	>=124

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)

…36. ECTS points

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

…85. ECTS points

11. Range of diploma dissertation

1) Basic telecommunication system: block diagram, coder/decoder, modulation/demodulation, Signal-to-Nose ratio
2) Types and properties of electromechanic transducers
3) Digital linear filters: classes, properties and applications
4) TCP/IP reference model
5) Characterize the problems of concurrent thread/process synchronization: synchronization criteria, available mechanisms, an example of the synchronization problem (e.g. critical section).
6) Methods of analysis of linear electronic circuits.
7) Operational amplifier, parameters of perfect and real OA, and applications.
8) Microprocessor architecture. Principle of operation of a microprocessor
9) Construction, principles of operation and characteristics of basic semiconductor components and main types of sensors.
10) Parameters of PCB boards. Technology of production of PCB boards
11) Thermal and photonic detectors of optical radiation - types, basic properties and parameters
12) The review of lasing media. Describe one of chosen type of laser, its basic parameters and give an example of its application
13) Building management systems (BMS): architecture, equipment, communication protocols
14) Applications of kinematic and dynamic models of robots
15) Wireless and radio systems: classification, applications, used frequency bands, network architectures and functions of individual elements
16) General characteristics of transmission media used in telecommunication networks
17) HDL Hardware Description Languages: Verilog and VHDL. Components of the language. The structure of the code.
18) Methods for reducing power consumption in microprocessor systems. Microprocessors with minimal power consumption.
19) Problem solving using heuristic search and mathematical logic

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20) Discuss the most important differences between the RTOS (Real-time Operating Systems) and the GPOS (General-purpose Operating Systems); consider the API, scheduler, services, and drivers..

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)*
1		*All courses/groups of courses from the plan of studies for semester 1 and semester 2*	*5*
2	*ECEA16001*	*Intership*	*6*

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

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