

BIALYSTOK UNIVERSITY OF TECHNOLOGY  
**FACULTY OF ELECTRICAL  
ENGINEERING**

**PLAN OF SECOND DEGREE  
POSTGRADUATE STUDY**

course of study  
**ELECTRONICS AND TELECOMMUNICATIONS**

Dean

BIALYSTOK 2015

**1) General course objectives and employment or further education opportunities for the graduates:**

Bialystok University of Technology, the Faculty of Electrical Engineering, offers students full-time and part-time second degree studies in Electronics and Telecommunications.

Second degree studies in Electronics and Telecommunications provide graduates with specialist preparation to engage in a wide range of activities in the field of electronics and telecommunications in design, operation, production and supervision, as well as to undertake innovative activities of different kind. This field of study makes use of advanced technology and includes specialised interdisciplinary knowledge of electronics, telecommunications, optoelectronics, fibre optics and photonics, programmable digital systems, information and coding theory, software engineering and electromagnetic compatibility, as well as the design and management of telecommunication networks and services and the security of information systems.

What is more, the graduates of the second degree studies, after additional training in didactics, may also undertake work at technical universities and in vocational schools or continue their education in third degree studies (doctoral studies).

**Tab. Reference of learning outcomes for field of study to learning outcomes for area of study**

Explanation of symbols:

ET2 – learning outcomes for the field of study for second cycle courses in the field of Electronics and Telecommunications; 01, 02, 03 and subsequent numbers – learning outcome number; W – category of knowledge; U – category of skills; K – category of social competence

T2A – learning outcomes for the area of technical sciences for second cycle courses

<i>Symbol</i>	<i>Learning outcomes for <b>Electronics and Telecommunications</b> After having completed a second cycle course, graduates of <b>Electronics and Telecommunications</b></i>	<i>Reference to learning outcomes for the area of study</i>
<b>KNOWLEDGE</b>		
ET2_W01	have an enhanced and in-depth knowledge of selected areas of technical maths and physics, which are useful for solving problems concerning electronics and telecommunication;	T2A_W01
ET2_W02	have a detailed and theoretically-based knowledge of photonics, including the knowledge needed to understand the principles of optical telecommunication, optical processing, and storage of information;	T2A_W01 T2A_W03 T2A_W04
ET2_W03	have a detailed and theoretically-based knowledge of signal generation and detection;	T2A_W03 T2A_W04
ET2_W04	have a detailed and theoretically-based knowledge of electronic measurements including measurements of optoelectronic quantities;	T2A_W02 T2A_W03 T2A_W07
ET2_W05	have a detailed knowledge of devices which are components of telecommunication networks;	T2A_W03 T2A_W04
ET2_W06	have a systematized knowledge of the production of optoelectronic components, and a basic knowledge of nanotechnologies;	T2A_W02 T2A_W04 T2A_W07
ET2_W07	have a systematized knowledge of the construction and electromagnetic compatibility of electronic, optoelectronic, and telecommunication devices;	T2A_W03 T2A_W04 T2A_W08
ET2_W08	have a detailed and theoretically-based knowledge of the signal theory and modern methods of signal processing and coding as well as the information theory;	T2A_W03 T2A_W04
ET2_W09	have a detailed and theoretically-based knowledge of signal and data transmission in telecommunication and in teleinformatic networks and systems;	T2A_W03 T2A_W04 T2A_W07
ET2_W10	have a detailed knowledge of security in telecommunication systems;	T2A_W02 T2A_W03 T2A_W04

ET2_W11	have an in-depth knowledge of the architecture and application of programmable logic devices and microprocessors;	T2A_W03 T2A_W04 T2A_W07
ET2_W12	know and understand methods and techniques used during the design process of electronic equipment (including CAD software for designing and simulating circuits and systems);	T2A_W03 T2A_W04 T2A_W07
ET2_W13	have the knowledge of development trends and the most important achievements in electronics, telecommunication, photonics, optical fiber technology, and, to a lesser extent, in computer science;	T2A_W05
ET2_W14	know the basic Artificial Intelligence (AI) methods and understand the application of AI in electronics and telecommunication;	T2A_W04 T2A_W05
ET2_W15	know and understand the necessity to manage intellectual property resources;	T2A_W10
ET2_W16	have a systematized knowledge of a foreign language (general knowledge and the knowledge of grammar and vocabulary, including specialist vocabulary), allowing them to form precise and complex written and oral presentations connected with electronics and telecommunication;	T2A_W01
<b>SKILLS</b>		
ET2_U01	can acquire information from books, databases, and other sources, also in a foreign language; graduates can integrate the acquired information, interpret it, and assess it in a critical way; they can also draw conclusions, and form and comprehensively justify their opinions;	T2A_U01
ET2_U02	can work individually as well as in a group; graduates can estimate the time period needed for the realization of a designated task; they can lead a small team in a way that assures completing tasks within the specified period of time;	T2A_U02 T2A_U03
ET2_U03	can prepare documentation concerning the realization of experiments and design or research tasks, and prepare reports including overviews of their results;	T2A_U04
ET2_U04	can prepare and give presentations on the results of experiments and design or research tasks and discuss the presentations, also in a foreign language;	T2A_U04
ET2_U05	use a foreign language at a level enabling communication, also on professional matters, reading specialist books, as well as preparing and giving short presentations on the results of experiments and design or research tasks;	T2A_U01 T2A_U06
ET2_U06	are capable of self-education, among others, in order to raise their own competences;	T2A_U05
ET2_U07	can use methods and mathematical models they have studied, modifying them if necessary, for analyzing and designing electronic circuits as well as telecommunication and photonic	T2A_U08 T2A_U15 T2A_U17

	systems;	
ET2_U08	can plan and run simulations and measurements of electrical and optical characteristics as well as parameters describing selected electronic circuits, devices, and telecommunication systems, taking the Electromagnetic compatibility (EMC) requirements into account;	T2A_U08
ET2_U09	can plan testing processes of devices, complex electronic circuits, and telecommunication systems; graduates can also perform the tests;	T2A_U08 T2A_U09 T2A_U18
ET2_U10	can formulate design specifications of complex electronic circuits and telecommunication systems, taking into account legal aspects (including the intellectual property protection) and other non-technical aspects, applying, among others, engineering standards and legal provisions;	T2A_U01 T2A_U17
ET2_U11	can design electronic circuits and telecommunication systems and apply them (or at least some parts of them), taking into account the predefined functional and economic criteria, using appropriate methods, techniques and tools;	T2A_U18 T2A_U19
ET2_U12	can formulate and, using appropriate analytic, simulative, and experimental tools, test hypotheses connected with modelling and designing of electronic and telecommunication systems;	T2A_U11
ET2_U13	can integrate the knowledge of electronics, telecommunication, computer science, electrical engineering, photonics, optical fiber technologies, automatics, and other disciplines, using various knowledge sources and applying a system approach, taking into consideration non-technical aspects, while planning and solving tasks connected with modelling and designing of electronic circuits and telecommunication systems;	T2A_U10 T2A_U18
ET2_U14	can suggest improvements to the existing design solutions and models of electronic circuits and telecommunication systems;	T2A_U15 T2A_U16
ET2_U15	can assess the usefulness of new achievements in materials (including micro- and nanotechnologies), elements, and methods used for designing of electronic circuits and telecommunication systems, including innovative solutions;	T2A_U12 T2A_U17
<b>SOCIAL COMPETENCE</b>		
ET2_K01	can think and work in a creative and enterprising way;	T2A_K06
ET2_K02	understand the need to formulate and communicate to the society (among others, through the mass media) information and opinions concerning achievements in electronics, telecommunication, and other aspects of engineering; graduates endeavour to communicate such information and opinions in a commonly understandable way, presenting various points of view;	T2A_K07

## 1) Programme of studies:

- a) form: *full-time*,
- b) number of semesters: 3,
- c) number of ECTS points necessary to obtain qualifications related to The degree of studies: 90,
- d) plan of studies, including elective modules the structure of studies.

## EXPLANATIONS FOR THE PLAN OF STUDIES

### Abbreviations:

L – lecture, C – class, LC – laboratory class, P – project, SW – specialization workshop, S – seminar;  
LE – lecture followed by examination;  
HES – module belonging to the group of humanistic, economical and management modules.

### Others:

- There is 15 weeks of classes in each semester.
- Each module lasts for only one semester.
- Prerequisites – modules, which student should obligatory have finished before the beginning of a given module.
- Form of assessment:
  - examination at the end of a lecture and assessment with final mark at the end of other forms of classes for a given module or assessment with final mark of each form of classes for a given module.
  - points for a module (ECTS) student obtain after the assessment of a module, e.g. positive marks from all forms of classes.
  - nominal number of points in each semester is 30.
- In the course of the second degree studies, student learns foreign language on B2+ level, in accordance with the Common European Framework of Reference (CERN) for Languages.

Tab.3. Plan of postgraduate second degree (MSc) full-time studies in **Electronics and telecommunications**

Specialisation: **Telecommunication**

Semester I		Semester II		Semester III	
Foreign language	2 C 2 ECTS	CAD tools for designing telecommunication networks	1 L 2 SW 3 ECTS	Seminar	2 S 2 ECTS
Numerical methods	1 L 1 SW 3 ECTS	Electromagnetic compatibility	1 LE 2 LC 3 ECTS	Master's thesis	20 ECTS
Methods of optimization	1 L 1 SW 3 ECTS	Management of telecommunications networks and services	1 LE 2 LC 3 ECTS	Telecommunication building infrastructure	1 L 1 P 2 ECTS
Optical fiber technology and photonics	2 LE 2 LC 4 ECTS	Fiberoptic telecommunication networks design	1 P 2 ECTS	Security of information systems	2 LE 2 ECTS
Antennas and propagation 1	2 LE 3 ECTS	ICT network design	1 P 2 ECTS	Work placement 2	1 ECTS
Programmable digital circuits	1 L 2 LC 3 ECTS	Antennas and propagation 2	1 LC 1 SW 2 ECTS	HES - Professional liability, construction law	2 L 2 ECTS
Theory of information and coding	1 LE 2 SW 4 ECTS	Electronic measurement equipment	1 L 2 LC 3 ECTS	Telecommunication systems of navigation and localization	1 L 1 ECTS
Reliability and diagnostics	1 L 1 ECTS	Methods of modulation and detection optical radiation	1 L 1 C 2 ECTS	Free-space optical communications	1 L 1 ECTS
TCP/IP networks and applications	1 L 2 LC 3 ECTS	Powering in the optical telecommunications systems	1 P 1 ECTS		
Lasers and optical amplifiers	1 L 1 LC 1 P 4 ECTS	Elective module 1*	1 L 1 LC/SW/P 3 ECTS		
		Elective module 2*	1 L 1 LC/SW/P 3 ECTS		
		Elective module 3*	1 L 1 LC/SW/P 3 ECTS		
<b>Sum</b>	<b>30 ECTS</b>		<b>30 ECTS</b>		<b>30 ECTS</b>
<b>Hours per week</b>	<b>25</b>		<b>25</b>		<b>10</b>
<b>Hours per semester</b>	<b>375</b>		<b>375</b>		<b>150</b>
<b>Total number of hours on second degree studies</b>					<b>900</b>

Elective modules:

Elective module 1			Elective module 2			Elective module 3		
Mobile applications	1	L	Digital signal processors in telecommunication systems	1	L	Embedded network systems	1	L
	1	SW		1	LC		1	SW
Databases and data warehouses	1	L	Software defined radio	1	L	Single chip microcontrollers in telecommunication	1	L
	1	SW		1	SW		1	LC
Digital radio links	1	L	Wireless broadcasting systems	1	L	Integrated circuits and systems	1	L
	1	P		1	LC		1	SW
Wave optics	1	L	Photonic structures	1	L	Nonlinear integrated optical systems	1	L
	1	LC		1	C		1	P
Optical sensors and microsystems	1	L	Diagnostics of telecommunication optical fiber networks	1	L	On-chip digital systems	2 LC	
	1	LC		1	LC			
Methods of artificial intelligence	1	L	Elements of nanotechnology	2 L		Statistical theory of communications	1	L
	1	SW		1	SW			
Optoelectronic medical devices	2	L						



List of modules provided for the programme **Electronics and telecommunications** – full-time studies.

### Modules obligatory for the study programme

CODE	Module name	Number of hours in a week						ECTS
		L	C	LC	P	SW	S	
TS2D100 001	Numerical methods	1				1		3
TS2D100 002	Methods of optimization	1				1		3
TS2D100 003	Optical fiber technology and photonics	2E		2				4
TS2D100 004	Antennas and propagation 1	2E						3
TS2D100 005	Programmable digital circuits	1		2				3
TS2D100 006	Theory of information and coding	1E				2		4
TS2D100 007	Reliability and diagnostics	1						1
TS2D100 008	TCP/IP networks and applications	1		2				3
TS2D100 009	Lasers and optical amplifiers	1		1	1			4
TS2D200 010	CAD tools for designing telecommunication networks	1				2		3
TS2D200 011	Electromagnetic compatibility	1E		2				3
TS2D200 012	Management of telecommunications networks and services	1E		2				3
TS2D200 013	Fiber optic telecommunication networks design				1			2
TS2D200 014	ICT network design				1			2
TS2D200 015	Antennas and propagation 2			1		1		2
TS2D200 016	Electronic measurement equipment	1		2				3
TS2D200 017	Methods of modulation and detection optical radiation	1	1					2
TS2D200 018	Powering in the optical telecommunications systems				1			1
TS2D300 019	Seminar						2	1
TS2D300 020	Master's thesis							20
TS2D300 021	Building of telecommunication infrastructure	1			1			2
TS2D300 022	Security of information systems	2E						2
TS2D300 023	Work placement 2							1
TS2D300 024	HES - Professional liability, construction law	2						2
TS2D300 025	Telecommunication systems of navigation and localization	1						1
TS2D300 026	Free-space optical communications	1						1

### Foreign languages

CODE	Module name	Number of hours in a week						ECTS
		L	C	LC	P	SW	S	
TS2D100 051	English	0	2	0	0	0	0	2
TS2D100 052	German	0	2	0	0	0	0	2
TS2D100 053	Russian	0	2	0	0	0	0	2

## Elective modules

CODE	Module name	Number of hours in a week						ECTS
		L	C	LC	P	SW	S	
	<i>Elective module 1</i>							
TS2D200 101	Mobile applications	1				1		3
TS2D200 102	Databases and data warehouses	1				1		3
TS2D200 103	Digital radio links	1			1			3
TS2D200 104	Wave optics	1		1				3
TS2D200 105	Optical sensors and microsystems	1		1				3
TS2D200 106	Methods of artificial intelligence	1				1		3
TS2D200 107	Optoelectronic medical devices	2						3
	<i>Elective module 2</i>							
TS2D200 108	Digital signal processors in telecommunication systems	1		1				3
TS2D200 109	Software defined radio	1				1		3
TS2D200 110	Wireless broadcasting systems	1		1				3
TS2D200 111	Photonic structures	1	1					3
TS2D200 112	Diagnostics of telecommunication optical fiber networks	1		1				3
TS2D200 113	Elements of nanotechnology	2						3
	<i>Elective module 3</i>							
TS2D200 114	Embedded network systems	1				1		3
TS2D200 115	Single chip microcontrollers in telecommunication	1		1				3
TS2D200 116	Integrated circuits and systems	1				1		3
TS2D200 117	Nonlinear integrated optical systems	1			1			3
TS2D200 118	On-chip digital systems			2				3
TS2D200 119	Statistical theory of communications	1				1		3

Total number of didactic hours on full-time second degree MSc studies is **900**.

Total number of lecture hours is **390**.

Number of hours of practical nature is **510**, what is **56,67%** of total number of didactic hours.

Number of ECTS points from elective modules is **29**, what is **32,2%** of total number of points.

## Matrix of learning outcomes

**Second degree full-time studies, specialisation: *Telecommunication***

Module name	Program learning outcomes																																				
	ET2_W01	ET2_W02	ET2_W03	ET2_W04	ET2_W05	ET2_W06	ET2_W07	ET2_W08	ET2_W09	ET2_W10	ET2_W11	ET2_W12	ET2_W13	ET2_W14	ET2_W15	ET2_W16	ET2_U01	ET2_U02	ET2_U03	ET2_U04	ET2_U05	ET2_U06	ET2_U07	ET2_U08	ET2_U09	ET2_U10	ET2_U11	ET2_U12	ET2_U13	ET2_U14	ET2_U15	ET2_K01	ET2_K02				
<b>SEMESTER 1</b>																																					
Foreign language																	1	1																			
Numerical methods												1	1																								
Methods of optimization	1																																				
Optical fiber technology and photonics		1	1		1				1																1												
Antennas and propagation 1					1				1				1				1																				
Programmable digital circuits											1		1						1							1		1	1	1	1		1				
Programmable digital circuits								1	1				1																								
Reliability and diagnostics	1																									1	1										
TCP/IP networks and applications									1			1	1							1						1	1		1	1							
Lasers and optical amplifiers		1	1			1			1																1	1											
<b>SEMESTER 2</b>	ET2_W01	ET2_W02	ET2_W03	ET2_W04	ET2_W05	ET2_W06	ET2_W07	ET2_W08	ET2_W09	ET2_W10	ET2_W11	ET2_W12	ET2_W13	ET2_W14	ET2_W15	ET2_W16	ET2_U01	ET2_U02	ET2_U03	ET2_U04	ET2_U05	ET2_U06	ET2_U07	ET2_U08	ET2_U09	ET2_U10	ET2_U11	ET2_U12	ET2_U13	ET2_U14	ET2_U15	ET2_K01	ET2_K02				
CAD tools for designing telecommunication networks				1				1									1		1	1	1						1										
Electromagnetic compatibility							1										1	1	1					1										1			
Management of telecommunications networks and services					1				1								1		1							1	1				1						
Fiber optic telecommunication networks design					1				1	1									1	1	1							1							1		
ICT network design					1				1	1									1	1	1		1						1							1	
Antennas and propagation 2				1													1	1	1	1						1											
Electronic measurement equipment			1	1				1									1								1												
Methods of modulation and detection optical radiation	1	1	1						1																												
Powering in the optical telecommunications systems		1			1			1											1	1	1				1	1											
<b>SEMESTER 3</b>	ET2_W01	ET2_W02	ET2_W03	ET2_W04	ET2_W05	ET2_W06	ET2_W07	ET2_W08	ET2_W09	ET2_W10	ET2_W11	ET2_W12	ET2_W13	ET2_W14	ET2_W15	ET2_W16	ET2_U01	ET2_U02	ET2_U03	ET2_U04	ET2_U05	ET2_U06	ET2_U07	ET2_U08	ET2_U09	ET2_U10	ET2_U11	ET2_U12	ET2_U13	ET2_U14	ET2_U15	ET2_K01	ET2_K02				
Seminar																	1	1	1	1															1		
Master's thesis																	1	1	1				1												1	1	
Telecommunication building infrastructure											1														1	1	1										
Security of information systems											1																1										
Work placement 2																		1	1																	1	1
HES - Professional liability, construction law																1	1																			1	
Telecommunication systems of navigation and localization								1						1											1												
Free-space optical communications		1	1		1				1																												
<b>Number of modules to fulfil the effect</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>3</b>	<b>7</b>	<b>1</b>	<b>1</b>	<b>5</b>	<b>10</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>6</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>11</b>	<b>9</b>	<b>10</b>	<b>8</b>	<b>1</b>	<b>4</b>	<b>6</b>	<b>8</b>	<b>8</b>	<b>3</b>	<b>4</b>	<b>7</b>	<b>6</b>	<b>3</b>	<b>1</b>	<b>7</b>	<b>2</b>				

Second degree full-time studies, specialisation: Telecommunication, Elective modules

Elective modules	ET2_W01	ET2_W02	ET2_W03	ET2_W04	ET2_W05	ET2_W06	ET2_W07	ET2_W08	ET2_W09	ET2_W10	ET2_W11	ET2_W12	ET2_W13	ET2_W14	ET2_W15	ET2_W16	ET2_U01	ET2_U02	ET2_U03	ET2_U04	ET2_U05	ET2_U06	ET2_U07	ET2_U08	ET2_U09	ET2_U10	ET2_U11	ET2_U12	ET2_U13	ET2_U14	ET2_U15	ET2_K01	ET2_K02		
Mobile applications												1	1		1		1	1									1		1						
Databases and data warehouses													1					1	1														1		
Digital radio links					1				1								1		1					1				1							
Wave optics	1			1			1						1					1					1	1											
Optical sensors and microsystems			1	1		1																		1			1				1				
Methods of artificial intelligence															1															1	1				
Optoelectronic medical devices	1	1		1									1																						
Digital signal processors in telecommunication systems											1		1										1					1		1					
Software defined radio			1					1				1		1							1		1					1	1						
Wireless broadcasting systems			1				1						1											1											1
Photonic structures		1	1			1			1																					1		1			
Diagnostics of telecommunication optical fiber networks		1	1	1	1	1							1											1							1				
Elements of nanotechnology	1	1				1							1																				1		1
Embedded network systems												1	1		1			1	1								1	1			1				
Single chip microcontrollers in telecommunication											1	1					1		1									1		1					
Integrated circuits and systems											1	1	1				1								1										
Nonlinear integrated optical systems		1			1			1									1						1								1				
On-chip digital systems																					1			1	1	1			1	1	1	1			
Statistical theory of communications			1					1	1															1	1										
Number of modules to fulfil the effect	3	5	6	4	3	4	2	3	3	0	3	5	10	2	2	0	4	4	5	1	1	1	3	7	3	3	3	6	3	8	3	3	1	2	