Semester 6

STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Practical design of communication networks**		Code
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**	Year /Semester **3 / 6**
Elective path/specialty **Information and Comm. Technologies**	Subject offered in: **English**	Course (compulsory, elective) **elective**
Cycle of study: **First-cycle studies**	Form of study (full-time,part-time) **full-time**	
No. of hours Lecture: **2** Classes: **-** Laboratory: **2** Project/seminars: **-**		No. of credits **5**
Status of the course in the study program (Basic, major, other) **Other**	(university-wide, from another field) **university-wide**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **5**

Responsible for subject / lecturer:

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Faculty of Electronics and Telecommunications
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Basis of computer networks K1_W22
2	**Skills**	Is able to find information in literature, as well as other reference sources; is able to integrate and interpret obtained information, draws conclusions and justifies opinions K1_U01
3	**Social competencies**	Knows the limitations of her/his own knowledge and skills, understands the need for further education and cooperation. K1_K01

Assumptions and objectives of the course:

To make students familiar with the practical methods for design, configuration and maintenace of local and wide area networks

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has a basic, systematic knowledge of structure, operation and standards related to the technologies of local and wide area networks - [K1_W22]
2. Knows about development trends in the area of local area networks, metropoliatan area network and wide area networks - [K1_W24]
3. Has knowledge of routers - [K1_W20]

Skills:

1. Is able to prepare a well-documented specification, in English or in Polish, on problems related to design of local and wide area netwoks. - [K1_U03]
2. Is able to prepare an oral presentation on the prepared technical specification of the project of local or wide area network(in Polish or in English). - [K1_U04]
3. Is able to configure devices and launch a local computer network. - [K1_U25]
4. Is able to solve standard/typical problems related to design of computer networks and parametrization of network elements - [K1_U26]
5. Is able to select the proper technologies for securing data transmission in wide area networks - [K1_U26]

Social competencies:

1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. - [K1_K01]
2. Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects. - [K1_K02]
3. Demonstrates responsibility for designed communications networks. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced - [K1_K03]
4. Is aware of the impact electronics and ICT systems and networks will have on the development of the information society. - [K1_K04]

Assessment methods of study outcomes
Forming assessment:
Lectures: Written exam; exam is passed when student receives at least 50% points. Exam can be taken after the completion of exercises.
Exercises: on the basis of short questions after each of exercises.
Course description
- analysis of investor's needs and potential for development
- layered model of networks' design
- basics of structured cabling
- planning wireless local area networks
- access networks' technologies
- design of logical topology of local area networks (VLAN)
- selection of appropriate routing protocols
- planning networks with OSPF, ISIS and BGP protocols
- Frame Relay, ATM, Metro(Carrier) Ethernet, Wimax
- MPLS and GMPLS
- design of virtual private networks
- network testing
Basic bibliography:
1. www.ietf.org
2. http://metroethernetforum.org/
3. McCabe, J.D. Network Analysis, Architecture and Design, 3rd ed. San Francisco, California: Morgan Kaufmann Publishers, Inc., 2007.
4. Oppenheimer, P. Top-Down Network Design, 3rd ed. Indianapolis, Indiana: Cisco Press, 2010.
5. Seifert, R. and J. Edwards The All New Switch Book: The Complete Guide to LAN Switching Technology, 2nd ed. New York, New York: John Wiley & Sons, Inc, 2008.
Additional bibliography:

Result of average student's workload

Activity	Time (working hours)
1. Lectures	30
2. Preparation for lectures	10
3. Laboratories	30
4. Preparation for laboratories	30
5. Final test	2
6. Consultations	3
7. Preparation for the final test	20

Student's workload

Source of workload	hours	ECTS
Total workload	125	5
Contact hours	65	3
Practical activities	60	2

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Internet of Things	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Information and Comm. Technologies	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: Laboratory: **2** Project/seminars: **-**	**5**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**5 100%**
Technical sciences	**5 100%**

Responsible for subject / lecturer:

dr hab. inż. Mariusz Głąbowski, prof. nadzw.
email: mariusz.glabowski@put.poznan.pl
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Wydział Elektroniki i Telekomunikacji
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a basic knowledge of local area computer networks [K1_W22]
2	**Skills**	Is able to find information in literature, as well as other reference sources; is able to integrate and interpret obtained information, draws conclusions and justifies opinions K1_U01
3	**Social competencies**	Knows the limitations of her/his own knowledge and skills, understands the need for further education and cooperation. K1_K01

Assumptions and objectives of the course:

To get a basic knowledge about key hardware architectures and protocols constituting the Internet of Things.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has a systematic knowledge of key technologies of the Internet of things - [K1_W22]
2. Has a basic, systematic knowledge of structure, operation and standards related to the Internet of things - [K1_W22]
3. Knows the basics of traffic engineering, services, devices and network protocols used in the Interne of things - [K1_W09]

Skills:

1. Is able to select the proper technologies for securing data transmission in the Internet of things architecture - [K1_U26]
2. Is able to configure devices used in the Internet of things – [K1_U25]

Social competencies:

1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. - [K1_K01]

Assessment methods of study outcomes

Forming assessment:

Lectures: Written exam; exam is passed when student receives at least 50% points. Exam can be taken after the completion of exercises.

Exercises: on the basis of short questions after each of exercises.

Course description
-Internet of things - definitions and frameworks -Application examples of the Internet of things -Structural aspects of the Internet of things (traffic, scalability, interoperability) -Key technologies for the Internet of things -Addressing and routing for the Internet of things -Wireless technologies for the Internet of things -Internet of things vs. Web of things - Securing the Internet of things(Internet of things in critical infrastructure and in personal infrastructure)

Basic bibliography:

1. Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications, Wiley; 1 edition (July 10, 2013)

2. Francis daCosta, Rethinking the Internet of Things: A Scalable Approach to Connecting Everything, Apress; 1 edition (December 29, 2013)

3. Dieter Uckelmann (Editor), Mark Harrison (Editor), Florian Michahelles (Editor), Architecting the Internet of Things, Springer; 2011 edition (April 3, 2011)

Additional bibliography:

1. Adrian McEwen, Hakim Cassimally; Designing the Internet of Things, Wiley; 1 edition (December 16, 2013)

Result of average student's workload

Activity	Time (working hours)
1. Lectures	30
2. Laboratories	30
3. Preparation for lectures	15
4. Preparation for laboratories	30
5. Exam	2
6. Preparation for the exam	20

Student's workload

Source of workload	hours	ECTS
Total workload	127	5
Contact hours	62	3
Practical activities	60	2

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Multimedia Communications	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Information and Comm. Technologies	**English**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **2** Project/seminars: **-**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
major	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a systematic knowledge, together with necessary mathematical background, of basic digital signal processing methods. Introductory knowledge and skills on multimedia, in particular audio and video representation, processing, coding and transmission.. K1_W19
2	**Skills**	Is able to determine basic parameters and properties of signals and telecommunication systems, under predefined constraints. K1_U15 Is able to perform typical calculations and use appropriate software to design and analyze the operation of digital signal processing systems. K1_U18
3	**Social competencies**	Demonstrates responsibility for designed electronic and telecommunication systems. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced. K1_K03 Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. K1_K01

Assumptions and objectives of the course:

The course covers the state-of-the-art in techniques, methods of analysis and technical solutions in speech processing, coding and transmission as well as in multimedia synchronization, protection, retrieval, management and streaming in the context of multimedia systems and communication networks..

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has a systematic knowledge, together with necessary mathematical background, on speech processing, coding and transmission as well as on multimedia synchronization, protection, retrieval, management and streaming in the context of multimedia systems and communication networks. - [K1_W11]

Skills:

1. Student is able to solve basic problems related to the state-of-the-art in techniques, methods of analysis and technical solutions in speech representation, coding and transmission as well as in multimedia synchronization, protection, retrieval, management and streaming in the multimedia systems and communication networks. - [K_U16]

Social competencies:

1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. - [K1_K01]
2. Is aware of the main challenges facing electronics and telecommunication in the 21st century. Is aware of the impact electronics and ICT systems and networks will have on the development of the information society. - [K1_K04]

Assessment methods of study outcomes
Oral and/or written exam. Laboratory classes are credited on the basis of student activity and tests.
Course description
Lectures: - speech processing and coding, - video and audio streams, - error protection, error concealment for video and audio transmission, - video and audio synchronization, - multimedia interpersonal communications, - multimedia streaming , - multimedia management, digital item representation and adaptation, - watermarking and IP management, - multimedia description, - multimedia servers. Laboratory classes are based on the lecture subjects.
Basic bibliography: 1. J. Ohm, Multimedia Communication Technology, Springer, 2004. 2. E. Carne, Connections for the Digital Age: Multimedia Communications for Mobile, Wiley, 2011.
Additional bibliography:

Result of average student's workload

Activity	Time (working hours)
1. Participation in the lectures	30
2. Participation in various practical activities at laboratory classes	30
3. Preparation for the exam.	20
4. Literature studies	10
5. Preparation laboratory reports	10

Student's workload

Source of workload	hours	ECTS
Total workload	100	4
Contact hours	60	2
Practical activities	50	2

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Radiocommunication	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Information and Comm. Technologies	**English**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **2** Laboratory: **-** Project/seminars: **-**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
major	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	A student knows the basics of digital communication systems, baseband transmission, digital modulation, signal transmission over the channel, reception techniques, spectrum shaping nad techniques for combating channel distortions (K1_W15); A student has detailed knowledge and mathematical foundations in the area of telecomunication theory, necessary for understanding, analysis and testing of the analogue and digital telecommunication systems (K1_W17)
2	**Skills**	A student can draw information from the literature, databases and other sources in Polish and in English; A student can integrate information, interprete it, draw conclusions and provide reasoning for his/her opinions (K1_U01); A student can solve problems in the area of electronics and telecommunications using mathematical tools: mathematical analysis, algebra and probability theory (K1_U07)
3	**Social competencies**	A student knows the limitations of his/her knowledge and competences, understands the necessity of further learning (K1_K01); A student is aware of the necessity of professional approach to technical problems and responsibility for his/her proposed technical solutions (K1_K02)

Assumptions and objectives of the course:

Knowing and understanding the fundamental problems of radio communication in various radio propagation environments and the basics of contemoprary wireless communication systems.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. A student has detailed knowledge and mathematical foundations in the area of teorii pola elektromagnetycznego, propagacji fal elektromagnetycznych oraz budowy i własności anten - [K1_W07]

2. A student has basic knowledge and mathematical foundations in the area of radio communications, has basic knowledge of the 2G, 3G and 4G mobile systems; A student has basic knowledge concerning the architecture and maintainance of radio communication systems and elements of tele-informtion networks, including wireless networks - [K1_W14]

Skills:

1. A student is able to solve basic problems in the area of electromagnetic fields, radio propagation, antenna design - [K1_U11]

2. A student is able to compare radio communication systems and stantards, and to select advantageous radio transmission technique or wireless standard in the given propagation and users mobility conditions. - [K1_U23]

Social competencies:

1. A student is aware of the necessity of professional approach to technical problems and responsibility for his/her proposed technical solutions - [K1_K02]
2. A student feels responsibility the designed electronic and telecommunication systems and is aware of the potential threats for other persons or society of improper use of these systems and designs - [K1_K03]
3. A student is able to formulate opinions concerning challenges of contemporary radio communications; A student is aware of the impact of rario systems and networks on the information society. - [K1_K04]

Assessment methods of study outcomes

Written exam from theory and content of the lectures (test with open questions)

Classes passing based on solved problems and written test.

Course description

Lectures:

1. Classification of radio communication systems
2. Signal propagation in radio communication channels
3. Radio channel models
4. Basic physical layer techniques i radio communication
5. Multiple access techniques in radio communication networks
6. The concept of cellular systems
7. Cellular systems design and capacitity-inreasing methods
8. Basics of GSM: architecture, phsical layer and higher OSI layers
9. Data transmission in GSM (GPRS and EDGE)
10. 3G mobile communication system using CDMA: UMTS
11. Perspectives of future wireless communications

Excercises:

1. Radio signal propagation, multipath fading
2. Power budget in radio communication links
3. Stochastic radio channel models
4. Power loss calculations using deterministic propagation models
5. Traffic load calculations in cellular systems based on Erlang models
6. Signal to interference power ratio calculations for various cell configurations

Basic bibliography:

1. K. Wesołowski, Mobile Communication Systems, John Wiley and Sons, New York 2002
2. T. S. Rappaport, Wireless Communications, Principles and Practice, Prentice Hall PTR, USA 1996

Additional bibliography:

1. A. Molisch, Wireless Communication Systems, John Wiley and Sons, 2005
2. G. Stueber, Principles of Mobile Communication Systems, Kluwer Academic Publishers, 2003

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in excercises	30
3. Individual literature studies	10
4. Preparation for the exam	10
5. Individual work on solving problems	10
6. Preparation for the exam and participation in the exam	20

Student's workload

Source of workload	hours	ECTS
Total workload	110	4
Contact hours	60	2
Practical activities	40	1

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Computer Measurement Systems	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty: **Information and Comm. Technologies**	Subject offered in: **English**	Course (compulsory, elective): **elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **2** Project/seminars: **-**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)

Responsible for subject / lecturer:

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email: nawrocki@et.put.poznan.pl
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Electronics and Telecommunications
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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	1. Students have a basic knowledge of physics. (K1_W02) 2. Students have a knowledge of the fundamentals of circuits theory, together with necessary mathematical background; this knowledge allows them to understand, analyze and evaluate the operation of electrical circuits. (K1_W05) Students have a knowledge of fundamentals of telecommunications
2	**Skills**	Students know how to use instruments like digital multimeters, signal oscillators and digital oscilloscopes. Students are able to create and to run a software in C+ or C++ language. 2. Is capable of studying autonomously. (K1_U05) 3. Demonstrates the ability to solve basic problems in physics. (K1_08) 4. Demonstrates the ability to solve typical tasks and problems related to analysis of electrical circuits. (K1_09) 5. Can implement the occupational health and safety principles. (K1_U27)
3	**Social competencies**	1. Students know limitations of theircurrent knowledge and skills; they committed to further self-study. (K1_K01) 2. They are able to participate in collaborative projects. (K1_K02)

Assumptions and objectives of the course:

1. To learn a structure of a computer-based measurement system and its components.
2. To know the limits of a measurement accuracy and of a measurement resolutiont.
3. To learn most frequently used interface standards for measurement systems with serial or paralel data transmission.
4. To learn commonly used programming languages: LabVIEW and VEE.
5. To learn some examples of computer-based measurement systems.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Students got knowledge of a structure of a measurement systems and its components. - [K1_W18]
2. Students got knowledge of measuremnt limits (accuracy, resolution) of particular physical quantities - [K1_W20]
3. Students know principles of analog to digital conversion and digital to analog copnversot of voltage - [-]
4. Students know most important standards of interface for measurement systems with serial data transfer (RS232, RS485, LAN, CAN). - [-]
5. Students know most important standards of interface for measurement systems with parallel data transfer (IEEE488, VXI, PXI) - [-]
6. Students know important standards of wireless interface for measurement systems (GSM, Bluatooth, ZigBee) - [-]
7. Students know the structure of a virtual instrument and know its performances. - [-]
8. Students know economical limits and of activity of experts in control and measurement systems. - [-]

Skills:

1. Students are able to extract information from Polish or English language literature, databases and other sources. Is able to synthesize gathered information, draw conclusions, and justify opinions. - [K1_U01]
2. Students are able to prepare a well-documented study, in English or in Polish, on problems related to electronics and telecommunication. - [K1_U03]
3. Students are capable of studying autonomously. - [K1_U05]
4. Students are able to measure typical parameters of signals, systems and devices, in particular those used in telecommunication. Is able to choose appropriate methods to measure given electrical quantities and parameters of signals and devices. Is able to plan and perform measurements and analyze the results. - [K1_U17]

Social competencies:

1. Demonstrates responsibility and professionalism in solving technical problems. - [K1_K02]
2. Demonstrates responsibility for designed electronic and telecommunication systems. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced. - [K1_K03]
3. Is aware of the main challenges facing electronics and telecommunications in the 21st century. - [K1_K04]

Assessment methods of study outcomes

-Lectures passing based on written test from content of the lectures.
-Tests in laboratory.
-Reports from laboratory experiments.

Course description

- Basic definitions and terms of computer-based measurements systems.
- Methods, principles and procedures of measurements. Digital measurements of frequency and period.
= Sources of errors. Identification of systematic errors.
- Statistics in metrology. Point and range estimation.
- Uncertainty and error in direct and indirect measurements. Calculation of the total standard uncertainty.
- Measurements with analog and digital oscilloscopes.
- Analogue and digital measurements of voltage, current and resistance.
- Metrological attributes of modern measuring instruments.
- Selected characteristics of analog and digital measurements.
- Conditioning circuitry and signal conditioners.
- Digital to analog converters.
- Analog to digital converters: the dual ramp ADC; flash , successive approximation and sub-ranging types. ADC errors.

Basic bibliography:

1. Measurement Systems and Sensors, Nawrocki W., Artech House, London-Boston, 2005.
2. Practical Data Acquisition for Instrumentation and Control Systems, Park J. and Mackey S., Elsevier, Amsterdam, 2003.

Additional bibliography:

1. Sensors and Transducers, Sinclair I., Elsevier, New York, 2000.
2. Advances Instrumentation and Computer I/O Design. Real Time System Computer Engineering, Garrett P/H., IEEE-Press, New York, 1994.

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures and lab exercises.	60
2. Preparation for lab exercises.	15
3. Preparing lab reports.	19
4. Preparation to the test.	14
5. Participation in the test	2

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	110	4
Contact hours	62	2
Practical activities	64	2

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Design of measurement systems	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Information and Comm. Technologies	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **2** Project/seminars: **-**	**4**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**university-wide**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**4 100%**
Technical sciences	**4 100%**

Responsible for subject / lecturer:

prof. dr hab. inż. Waldemar Nawrocki
email: nawrocki@et.put.poznan.pl
tel. 616653888
Electronics and Telecommunications
ul. Piotrowo 3A, Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	1. Students have a basic knowledge of physics. (K1_W02) 2. Students have a knowledge of the fundamentals of circuits theory, together with necessary mathematical background; this knowledge allows them to understand, analyze and evaluate the operation of electrical circuits. (K1_W05) 3. Students have a knowledge of operational ssystems 4. Students have a knowledge in programming in C language (C+, C++)
2	**Skills**	1. Is capable of studying autonomously. (K1_U05) 2. Demonstrates the ability to solve basic problems in physics. (K1_08) 3. Demonstrates the ability to solve typical tasks and problems related to analysis of electrical circuits. (K1_09) 5. Can implement the occupational health and safety principles. (K1_U27)
3	**Social competencies**	1. Students know limitations of their current knowledge and skills; they committed to further self-study. (K1_K01) 2. They are able to participate in collaborative projects. (K1_K02)

Assumptions and objectives of the course:

1. To learn a structure of a computer-based measurement system and its components.
2. To know the limits of a measurement accuracy and of a measurement resolutiont.
3. To learn most frequently used interface standards for measurement systems with serial or paralel data transmission.
4. To learn commonly used advanced programming languages (e.g. LabVIEW).
5. To learn some examples of computer-based measurement systems.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Students got knowledge of a structure of a measurement systems and its components. - [K1_W18]
2. Students got knowledge of measuremnt limits (accuracy, resolution) of particular physical quantities - [K1_W20]
3. Students know most important standards of interface for measurement systems with serial data transfer (RS232, RS485, LAN, CAN). - [-]
5. Students know most important standards of interface for measurement systems with parallel data transfer (IEEE488, VXI, PXI) - [-]
6. Students know important standards of wireless interface for measurement systems (GSM, Bluatooth, ZigBee) - [-]
7. Students know the structure of a virtual instrument and know its performances. - [-]
8. Students know programming of measurement systems in LabVIEW and VEE languages
8. Students know economical limits and of activity of experts in control and measurement systems. - [-]

Skills:

1. Students are able to extract information from Polish or English language literature, databases and other sources. Is able to synthesize gathered information, draw conclusions, and justify opinions. - [K1_U01]
2. Students are able to prepare a well-documented study, in English or in Polish, on problems related to electronics and telecommunication. - [K1_U03]
3. Students are capable of studying autonomously. - [K1_U05]
4. Students are able to measure typical parameters of signals, systems and devices, in particular those used in telecommunication. Is able to choose appropriate methods to measure given electrical quantities and parameters of signals and devices. Is able to plan and perform measurements and analyze the results. - [K1_U17]

Social competencies:

1. Demonstrates responsibility and professionalism in solving technical problems. - [K1_K02]
2. Demonstrates responsibility for designed electronic and telecommunication systems. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced. - [K1_K03]
3. Is aware of the main challenges facing electronics and telecommunication in the 21st century. - [K1_K04]

Assessment methods of study outcomes

-Lectures passing based on written test from content of the lectures.
-Tests in laboratory.
-Reports from laboratory experiments.

Course description

- Basic definitions and terms of computer-based measurements systems.
- Methods, principles and procedures of measurements. Digital measurements of frequency and period.
= Sources of errors. Identification of systematic errors.
- Statistics in metrology. Point and range estimation.
- Uncertainty and error in direct and indirect measurements. Calculation of the total standard uncertainty.
- Measurements with analog and digital oscilloscopes.
- Analogue and digital measurements of voltage, current and resistance.
- Metrological attributes of modern measuring instruments.
- Selected characteristics of analog and digital measurements.
- Conditioning circuitry and signal conditioners.
- Digital to analog converters.
- Analog to digital converters: the dual ramp ADC; flash , successive approximation and sub-ranging types. ADC errors.

Basic bibliography:

1. Measurement Systems and Sensors, Nawrocki W., Artech House, London-Boston, 2005.
2. Advances Instrumentation and Computer I/O Design. Real Time System Computer Engineering, Garrett P.H., IEEE-Press, New York, 1994.

Additional bibliography:

1. Practical Data Acquisition for Instrumentation and Control Systems, Elsevier, Amsterdam, 2003..

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures and lab exercises.	60
2. Preparation for lab exercises.	25
3. Preparing lab reports.	15
4. Preparation to tests.	10

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	110	4
Contact hours	60	2
Practical activities	70	3

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Database Architectures	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty: **Infromation and Comm. Technologies**	Subject offered in: **English**	Course (compulsory, elective): **elective**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **1** Classes: **0** Laboratory: **1** Project/seminars: **-**	**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**5 100%**
Technical sciences	**5 100%**

Responsible for subject / lecturer:

dr inż. Mariusz Żal
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tel. +48 61 665 3926
Faculty of Electronics and Telecommunications
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Responsible for subject / lecturer:

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tel. +48 61 665 3926
Wydział Elektroniki i Telekomunikacji
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a basic knowledge of computer networks; Has a basic knowledge of C# programming, algebra of sets and relation algebra
2	**Skills**	Is able to find information in literature, as well as other reference sources; is able to integrate and interpret obtained information, draws conclusions and justifies
3	**Social competencies**	Student understands a necessity to acquire a new knowledge and skills stemming from a chosen field of studies.

Assumptions and objectives of the course:

To provide students with database models and architectures, bases SQL, database creation, and available database tools and developer software. To prepare students to database optimization and programming database applications.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has a systematic knowledge of algebra of sets and relation algebra. - [K2_W00]
2. Has a systematic knowledge, with the necessary theoretical background, of optimization methods used in solving engineering problems. - [K2_W03]

Skills:

1. Is able to use bibliography in English (books, scientific and technical journals, application notes, catalogs, instructions, recommendations etc.) - [K2_U01]
2. Can use optimization methods to solve problems in electronics and telecommunications. - [K2_U05]

Social competencies:

1. Understands the importance of communication for the development of individuals and societies, understands the evolutionary development of networks and telecommunications systems include increased needs of users in the development of telecommunications networks - [K2_K02]
2. . Knows the limitations of their own knowledge and skills, he understands the need for further education. - [K2_K04]

Assessment methods of study outcomes

Forming assessment:

Lectures: Written exam; exam is passed when student receives at least 50% points. Exam can be taken after the completion of excercises.

Exercices and laboratories:

- evaluation and assessment of knowledge increment that need to be effective in solving problems covering all tasks within a given subject area;
- continuous assessment during daily classroom practice - rewarding knowledge increment in skills in management of using rules and methods learnt in class.

Course description

Lectures:

1. Definitions: information, data, data processing. Database models. Database management systems.
2. Relation algebra.
3. SQL basis
4. Database creation process
5. Database optimization
6. Database applications
7. Database tools and developer software

Exercises:

1. Database definitions.
2. Simple SQL queries .
3. Database modifications.
4. Extended SQL queries.
5. PL SQL procedures
6. 6. Database applications.

Basic bibliography:

1. Lex deHaan , Toon Koppelaars , Applied Mathematics for Database Professionals, Apress; 1 edition (June 18, 2007)
2. Hernandez, Michael J., Database design for mere mortals: a hands-on guide to relational database design, Addison-Wesley 2005
3. Alex Kriegel, Boris M. Trukhnov, SQL Bible, 2nd Edition, Wiley, 2003

Additional bibliography:

1. Jason Price, Oracle Database 11gSQL, McGrawHill 2008
2. PL/SQL Users Guide and Reference, Release 2 (9.2) Part No. A96624-01
3. Joe Celko, The Guru's Guide to Transact-SQL, Addison-Wesley Professional; 1st edition (March 4, 2000)

Result of average student's workload

Activity	Time (working hours)
1. Lectures	15
2. Laboratories	15
3. Preparation for tests	10
4. Preparation for laboratories and reports	18
5. Consultation	2

Student's workload

Source of workload	hours	ECTS
Total workload	60	2
Contact hours	35	2
Practical activities	35	1

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Database Application Programming	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Information and Comm. Technologies	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
Second-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **1** Classes: **0** Laboratory: **1** Project/seminars: **-**	**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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Faculty of Electronics and Telecommunications
ul. Piotrowo 3A 60-965 Poznań

Responsible for subject / lecturer:

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a basic knowledge of computer networks; Has a basic knowledge of C# programming, algebra of sets and relation algebra
2	**Skills**	Is able to find information in literature, as well as other reference sources; is able to integrate and interpret obtained information, draws conclusions and justifies
3	**Social competencies**	Student understands a necessity to acquire a new knowledge and skills stemming from a chosen field of studies.

Assumptions and objectives of the course:

To provide students with database models, SQL and PL SQL languages, query formats, embeded functions and extensions and programming database applications.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Has a systematic knowledge of algebra of sets and relation algebra. - [K2_W00]
2. Has a systematic knowledge, with the necessary theoretical background, of optimization methods used in solving engineering problems. - [K2_W03]

Skills:

1. Is able to use bibliography in English (books, scientific and technical journals, application notes, catalogs, instructions, recommendations etc.) - [K2_U01]
2. Can use optimization methods to solve problems in electronics and telecommunications. - [K2_U05]

Social competencies:

1. Understands the importance of communication for the development of individuals and societies, understands the evolutionary development of networks and telecommunications systems include increased needs of users in the development of telecommunications networks - [K2_K02]
2. . Knows the limitations of their own knowledge and skills, he understands the need for further education. - [K2_K04]

Assessment methods of study outcomes

Forming assessment:

Lectures: Written exam; exam is passed when student receives at least 50% points. Exam can be taken after the completion of excercises.

Exercices and laboratories:

- evaluation and assessment of knowledge increment that need to be effective in solving problems covering all tasks within a given subject area;
- continuous assessment during daily classroom practice - rewarding knowledge increment in skills in management of using rules and methods learnt in class.

Course description

Lectures:

8. SQL basis, views, sequences,
9. Extendend SQL queries,
10. PL SQL, T-SQL.
11. Triggers, indexes.
12. Embedded SQL functions,
13. Database users, access to databases.
14. Database applications.

Exercises:

7. Database definitions.
8. Simple SQL queries .
9. Database modifications.
10. Extended SQL queries.
11. PL SQL procedures
12. 6. Database applications.

Basic bibliography:

1. Hernandez, Michael J., Database design for mere mortals: a hands-on guide to relational database design, Addison-Wesley 2005
2. Alex Kriegel, Boris M. Trukhnov, SQL Bible, 2nd Edition, Wiley, 2003

Additional bibliography:

4. Jason Price, Oracle Database 11gSQL, McGrawHill 2008
5. PL/SQL Users Guide and Reference, Release 2 (9.2) Part No. A96624-01
6. Joe Celko, The Guru's Guide to Transact-SQL, Addison-Wesley Professional; 1st edition (March 4, 2000)

Result of average student's workload

Activity	Time (working hours)
1. Lectures	15
2. Laboratories	15
4. Preparation for tests	10
6. Preparation for laboratories	15
7. Consultations	5

Student's workload

Source of workload	hours	ECTS
Total workload	60	2
Contact hours	35	2
Practical activities	35	1

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Internship	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Information and Comm. Technologies	**English**	**obligatory**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **-** Classes: **-** Laboratory: **-** Project/seminars: **160**	**2**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
major	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**2 100%**
Technical sciences	**2 100%**

Responsible for subject / lecturer:

dr inż. Janusz Kleban
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Elektroniki i Telekomunikacji
ul. Piotrowo 3, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	The student has knowledge of basic and major courses (modules) included in the programme for the Electronics and Telecommunications study field. Knows occupational health and safety principles.[K1_W25]
2	**Skills**	The student is able to perform tasks suited to the level of skills expected from the student of Electronics and Telecommunications, according to the teaching of basic and major courses (modules).
3	**Social competencies**	Is aware of the main challenges facing electronics and telecommunications in the 21st century. Is aware of the impact electronics, ICT systems and networks will have on the development of the information society. [K1_K04] Demonstrates responsibility and professionalism in solving technical problems. [K1_K02] Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. [K1_K01]

Assumptions and objectives of the course:

To gain practical skills and practical knowledge related to the field of study.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has knowledge, together with a necessary practical background, of basic and major courses (modules) taught in the Electronics and Telecommunications study field. - [K1_W08, K1_W09, K1_W12, K1_W16, K1_W20]
2. Has basic knowledge of conducting business activities. - [K1_W04]

Skills:

1. The student is able to practically apply the knowledge gained during the academic curriculum. - [K1_U07, K1_U12, K1_U13, K1_U16, K1_U17]
2. Can implement the occupational health and safety principles. - [K1_U27]

Social competencies:

1. Correctly interprets and solves the dilemmas related to working in electronics and telecommunications. Is able to think and act in a businesslike way. - [K1_K05]
2. Demonstrates responsibility for designed electronic and telecommunication systems. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced. - [K1_K03]

Assessment methods of study outcomes
Internship report certified by the internship supervisor. Internship certification issued by the host enterprise. Questionnaire Describing Educational Effects, Student's Evaluation by External Entity Questionnaire Describing Educational Effects: Questionnaire Concerning the Usefulness of and Satisfaction with Completed Training
Course description
OHS training and fire protection regulations training. Instruction on applicable labour code and requirements for the protection of state and public service secrets. Introduction to the enterprise organisation and structure as well as its working procedures. Execution of the individual training programme. Preparation of individual internship report.
Basic bibliography: 1. Academic regulations for first-cycle and second-cycle full-time and part-time courses adopted by the Academic Senate of the Poznan University of Technology
Additional bibliography: 1. Minister of Labour and Social Policy regulation of September 26, 1997 regarding general provisions of occupational health and safety. Dz.U. (Official Law Journal) 1997, no 129, poz. 844.

Result of average student's workload

Activity	**Time (working hours)**
1. OHS training and fire protection regulations training.	2
2. Instruction on applicable labour code.	2
3. Introduction to the enterprise organisation and structure as well as its working procedures.	4
4. Execution of the individual training programme.	148
5. Preparation of individual internship report.	4

Student's workload

Source of workload	**hours**	**ECTS**
Total workload	160	2
Contact hours	80	1
Practical activities	160	2

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Hardware Oriented Network Operating Systems	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Information and Comm. Technologies	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **15** Classes: **0** Laboratory: **30** Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
Other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

dr inż. Marek Michalski
email: marek.michalski@put.poznan.pl
tel. 665 3906
Wydział Elektroniki i Telekomunikacji
ul. Piotrowo 3, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	She/he has deep knowledge in terms of architecture and functionality telecommunication systems (K2_W01) She/he has proactical knowledge in terms of security (K2_W13) She/he has knowledge and experience in terms of rules and network mechanisms (K2_W13) She/he has practical experience in terms of designing teleinformatic networks (K2_W14)
2	**Skills**	She/he can take the information from the literature and databases and other sources in Polish or English; she/he is able to integrate the information, make their interpretation, draw conclusions and justify opinions [K1_U01]. She/he can communicate in English or Polish in workplace and in other environments [K1_U02].
3	**Social competencies**	She/he knows the limits of their own knowledge and skills, understands the need for lifelong education [K1_K01].

Assumptions and objectives of the course:

To get familiar students with functions and capabilities of operating systems working on actual network devices, practical usage of knowledge (in real networks and in the laboratories), review of nowadays networking devices, preparation own example of network device

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. - [K2_W11]
2. - [K2_W12]

Skills:

1. - [K2_U01]

Social competencies:

1. - [K2_K02]
2. - [K2_K04]

Assessment methods of study outcomes

Lectures
- exam (writen)

Excercises and Laboratories
- continuous verification of knowledge (during classes)
- practical test of knowledge and experience

Course description

Lectures:
- Architecture and functions of networking operating system.
- Hardware with typical and extended functionality of network operating systems
- Hardware aspects of virtualization of network nodes and hosts
- Virtualization of networks
- Hardware realization of remote access - Virtual Private Networks;
- Performance of network, bottlenecks' analysis
- Mechanisms and protocols for communications between network systems;
- Hardware realization of security mechanisms,
- Hardware support of Software Defined Networks, hardware for OpenFlow;
- Example of Network Operating System in hardware network devices (Alcatel-Lucent, Cisco, HP, Juniper Networks);
- Demo of preparing own system with usage NetFPGA cards with interfaces 1Gbps and 10Gbps (hardware and software working together).
- Hardware realization of network protocols (routing, switching)

Basic bibliography:

1. A. Tanenbaum, Computer Networks. Prentis Hall
2. W. Odom CCNP ROUTE , CCNP SITCH, Cisco Press
3. T. Adelstein, B. Lubanovic, Linux System Administration,O'Reilly Media

Additional bibliography:

1. Z. F. Xu Designing and Implementing IP/MPLS-Based Ethernet Layer 2 VPN Services An Advanced Guide for VPLS and VLL, Wiley Publishing
2. D. Hanks, H. Reynolds, Juniper MX Series, O'Reilly Media
3. M. D. Bauer, Linux Server Security, O'Reilly Media

Result of average student's workload

Activity	Time (working hours)
1. Lectures	15
2. Laboratories	30
3. Preparation for laboratories	20
6. Preparation for lectures	10
7. Preparation for exam	10
8. Exam	2
9. Analysis of exam results	2

Student’s workload

Source of workload	hours	ECTS
Total workload	89	3
Contact hours	49	2
Practical activities	49	2

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Application Oriented Network Operating Systems	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty: **Information and Comm. Technologies**	Subject offered in: **English**	Course (compulsory, elective): **elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **15** Classes: **0** Laboratory: **30** Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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email: marek.michalski@put.poznan.pl
tel. 665 3906
Wydział Elektroniki i Telekomunikacji
ul. Piotrowo 3, 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	She/he has deep knowledge in terms of architecture and functionality telecommunication systems (K2_W01) She/he has practical knowledge in terms of security (K2_W13) She/he has knowledge and experience in terms of rules and network mechanisms (K2_W13) She/he has practical experience in terms of designing teleinformatic networks (K2_W14)
2	**Skills**	She/he can take the information from the literature and databases and other sources in Polish or English; she/he is able to integrate the information, make their interpretation, draw conclusions and justify opinions [K1_U01]. She/he can communicate in English or Polish in workplace and in other environments [K1_U02].
3	**Social competencies**	She/he knows the limits of their own knowledge and skills, understands the need for lifelong education [K1_K01].

Assumptions and objectives of the course:

To get familiar students with functions and capabilities of operating systems working on actual network devices, practical usage of knowledge (in real networks and in the laboratories), review of nowadays networking devices, preparation own example of network device

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. - [K2_W11]
2. - [K2_W12]

Skills:

1. - [K2_U01]

Social competencies:

1. - [K2_K02]
2. - [K2_K04]

Assessment methods of study outcomes

Lectures
- exam (writen)

Excercises and Laboratories
- continous verification of knowledge (during classes)
- practical test of knowledge and experience

Course description

Lectures:

- Architecture and functions of networking operating system
- Basic and extended functionality of network operating systems
- Software aspects of virtualization of network nodes and hosts
- Virtualization of networks
- Software realization of remote access - Virtual Private Networks;
- Software realization of security mechanisms,
- Mechanisms and protocols for communications between network systems;
- Software Defined Networks and theirs protocols (OpenFlow, Network Controllers);
- Example of Network Operating System on PC (Android, Linux, Windows);
- Demo of preparing own system with usage NetFPGA cards with interfaces 1Gbps and 10Gbps (hardware and software working together)..
- Software realization of network protocols (routing, switching)

Basic bibliography:

1. A. Tanenbaum, Computer Networks. Prentis Hall
2. W. Odom CCNP ROUTE , CCNP SITCH, Cisco Press
3. T. Adelstein, B. Lubanovic, Linux System Administration,O'Reilly Media

Additional bibliography:

1. Z. F. Xu Designing and Implementing IP/MPLS-Based Ethernet Layer 2 VPN Services An Advanced Guide for VPLS and VLL, Wiley Publishing
2. D. Hanks, H. Reynolds, Juniper MX Series, O'Reilly Media
3. . Bauer Michael D., Linux Server Security, O'Reilly Media

Result of average student's workload

Activity	Time (working hours)
1. Lectures	15
2. Laboratories	30
3. Preparation for laboratories	20
4. Preparation for lectures	10
5. Preparation for exam	10
6. Exam	2
7. Analysis of exam results	2

Student's workload

Source of workload	hours	ECTS
Total workload	89	3
Contact hours	49	2
Practical activities	49	2

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Synchronous Digital Hierarchy in Communication Networks	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Telecommunication Systems	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **-** Project/seminars: **1**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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tel. +48 61 665 38 54
Faculty of Electronics and Telecommunications
ul. Piotrowo 3A 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	K1_W09-Knows the principles of construction of computer programs ; has knowledge from the area of computing science; knows the syntax of C, C++, C#, MatLab. K1_W18-Has a systematic knowledge, together with necessary mathematical background, of the fundamentals of metrology, which is necessary to measure the signal properties and the parameters of electronic and telecommunication systems components.
2	**Skills**	K1_U01-Is able to extract information from Polish or English language literature, databases and other sources. Is able to synthesize gathered information, draw conclusions, and justify opinions. K1_U13-Is able to write software for basic computational algorithms, using popular programming languages (e.g. Matlab, C). Is able to conduct simulation experiments to evaluate parameters of circuits, systems and networks. K1_U24-Is able to analyze and design logic circuits. Is able to build complex digital circuits from commercially available ICs. Is able to analyze and build typical microcontroller and microprocessor systems.
3	**Social competencies**	K1_K02-Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects. K1_K04-Is aware of the main challenges facing electronics and telecommunication in the 21st century. Is aware of the impact electronics and ICT systems and networks will have on the development of the information society.

Assumptions and objectives of the course:

The presentation of properties of the basic transmission system exploited in modern communication networks. The basic structures of the SDH: line, chain, ring, mesh. SDH hierarchy levels. An exemplary structure of the SDH network. Methods of designing the SDH networks.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. Knows the principle of operation of digital transmission systems, including baseband transmission, digital modulations, signal transmission in channels, signal reception, forming the spectral properties of signals, countering channel distortions. - [K1_W15]
2. Has knowledge of devices and systems exploitation. [K1_W20]
3. Knows and understands the technical meaning of the terms describing telecommunication and computer networks . Has a basic, systematic knowledge of structure, operation and standards related to various types of telecommunication and computer networks. [K1_W22]

Skills:
1. Is able to prepare an oral presentation on particular issues in electronics and telecommunication (in Polish or in English. [K1_U04]
2. Is able to determine basic parameters and properties of signals and telecommunication systems , under predefined constraints. [K1_U15]
3. Is able to select the construction of devices according to technical requirements and service conditions. [K1_U21]
Social competencies:
1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. - [K1_K01]
2. Demonstrates responsibility for designed electronic and telecommunication systems. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced. [K1_K03]

Assessment methods of study outcomes
Written exam. Reports from an individual project. Activity during studies.
Course description
History of the SDH. Introduction to SDH: the layer concept, SDH network model, synchronous transport module, overheads structure, synchronous multiplexing, pointer justifications, virtual containers, tributary signals, mapping of tributary signals. SDH multiplexers: Terminal Multiplexer, Line Multiplexer, Add and Drop Multiplexer, Digital Crossconnect, Regenerator. SDH networks: partitioning concept, layering model, uni- and bi-directional rings, mesh network, protection in SDH, connections of ring subnetworks.
Basic bibliography:
1. Principles of Synchronous Digital Hierarchy, R. K. Jain, CRC Press, Boca Raton, 2012. 3. SDH/SONET Explained in Functional Models, Huub van Helvoort , Wiley, New York, 2005.
Additional bibliography:
1. Broadband Telecommunications Technology, B.G. Lee, M. Kang, J. Lee, Artech House, 2nd. Edn. , Boston, 1996. 2. Broadband Networking, ATM, SDH, and SONET, M. Sexton, A. Reid, , Artech House, Boston, 1997.

Result of average student's workload

Activity	**Time (working hours)**
1. Participation in lectures	30
2. Participation in laboratories/projects	15
3. Individual literature studies	15
4. Preparation for the exam	10
5. Individual work on preparing exercises	10

Student's workload

Source of workload	**hours**	**ECTS**
Total workload	80	3
Contact hours	50	2
Practical activities	30	1

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Hierarchies of Digital Transmission Systems	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
Information and Comm. Technologies	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **-** Project/seminars: **1**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	K1_W09-Knows the principles of construction of computer programs ; has knowledge from the area of computing science; knows the syntax of C, C++, C#, MatLab. K1_W18-Has a systematic knowledge, together with necessary mathematical background, of the fundamentals of metrology, which is necessary to measure the signal properties and the parameters of electronic and telecommunication systems components.
2	**Skills**	K1_U01-Is able to extract information from Polish or English language literature, databases and other sources. Is able to synthesize gathered information, draw conclusions, and justify opinions. K1_U13-Is able to write software for basic computational algorithms, using popular programming languages (e.g. Matlab, C). Is able to conduct simulation experiments to evaluate parameters of circuits, systems and networks. K1_U24-Is able to analyze and design logic circuits. Is able to build complex digital circuits from commercially available ICs. Is able to analyze and build typical microcontroller and microprocessor systems.
3	**Social competencies**	K1_K02-Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects. K1_K04-Is aware of the main challenges facing electronics and telecommunication in the 21st century. Is aware of the impact electronics and ICT systems and networks will have on the development of the information society.

Assumptions and objectives of the course:

The presentation of properties of the basic transmission systems (PDH, SDH) exploited in modern communication networks. The basic structures of the systems, line signals, ITU-T standards. PDH and SDH hierarchy levels. An exemplary structure of the SDH network. Methods of designing the SDH networks.

Study outcomes and reference to the educational results for a field of study

Knowledge:

4. Knows the principle of operation of digital transmission systems, including baseband transmission, digital modulations, signal transmission in channels, signal reception, forming the spectral properties of signals, countering channel distortions. - [K1_W15]
5. Has knowledge of devices and systems exploitation. [K1_W20]
6. Knows and understands the technical meaning of the terms describing telecommunication and computer networks . Has a basic, systematic knowledge of structure, operation and standards related to various types of telecommunication and computer networks. [K1_W22]

Skills:

4. Is able to prepare an oral presentation on particular issues in electronics and telecommunication (in Polish or in English. [K1_U04]
5. Is able to determine basic parameters and properties of signals and telecommunication systems , under predefined constraints. [K1_U15]
6. Is able to select the construction of devices according to technical requirements and service conditions. [K1_U21]

Social competencies:

1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. - [K1_K01]
2. Demonstrates responsibility for designed electronic and telecommunication systems. Is aware of the hazards they pose for individuals and communities if they are improperly designed or produced. [K1_K03]

Assessment methods of study outcomes

Written exam.

Reports from an individual project.

Activity during studies.

Course description

PCM 30/32 system. PDH Hierarchy. Limitations of the PDH hierarchy. ITU-T multiplexing structure. History of the SDH. Introduction to SDH: the layer concept, SDH network model, synchronous transport module, overheads structure, synchronous multiplexing, pointer justifications, virtual containers, tributary signals, mapping of tributary signals. SDH multiplexers: Terminal Multiplexer, Line Multiplexer, Add and Drop Multiplexer, Digital Crossconnect, Regenerator. SDH networks: partitioning concept, layering model, uni- and bi-directional rings, mesh network, protection in SDH, connections of ring subnetworks.

Basic bibliography:

1. Principles of Synchronous Digital Hierarchy, R. K. Jain, CRC Press, Boca Raton, 2012.
3. SDH/SONET Explained in Functional Models, Huub van Helvoort , Wiley, New York, 2005.

Additional bibliography:

1. Broadband Telecommunications Technology, B.G. Lee, M. Kang, J. Lee, Artech House, 2nd. Edn. , Boston, 1996.
2. Broadband Networking, ATM, SDH, and SONET, M. Sexton, A. Reid, , Artech House, Boston, 1997.
3. Synchronization of Digital Telecommunications Networks, S. Bregni, Wiley, New York, 2002.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in laboratories/projects	15
3. Individual literature studies	15
4. Preparation for the exam	10
5. Individual work on preparing excercises	10

Student's workload

Source of workload	hours	ECTS
Total workload	80	3
Contact hours	50	2
Practical activities	30	1

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Introduction to visual data analysis	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Information and Comm. Technologies	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **1** Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
Other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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ul. Piotrowo 3A 60-965 Poznań

Responsible for subject / lecturer:

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	1 Has knowledge of programming in C / C + +. 2 Has basic knowledge in the field of image processing.
2	**Skills**	1. Is able to look for information required during educational process and take educational courses, if needed, especially through Internet and distance education.
3	**Social competencies**	Capable of self-learning (books, computer programs)He acts actively in class, asks questions, knowingly uses the contact with the teacher (eg consultation).

Assumptions and objectives of the course:

Subject concerns about the recording equipment (camera or multiple cameras), devices for data acquisition and processing (such as a frame grabber) and data analysis equipment. When test subjects are off, an integral part of the machine vision systems are a source of light, the illuminators. Machine vision systems for quality - check the physical characteristics of objects, such as size, shape, color, surface, (gloss, roughness, printing, etc.).Industrial Vision, Automatic Video Analysis of the environment on the similarity of the visual modality in humans.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. It has a structured, mathematical underpinnings of knowledge acquisition, human perception, quality assessment, processing, digital representation, compression and transmission of video signals, speech and audio for use in multimedia systems - [K1_W11]
2. It has a basic knowledge on developments in the field of electronics and telecommunications - [K1_W11]
3. He has expertise in the field of non-linear processing of multimedia content, image reconstruction and restaurants, technology acquisition and presentation of stereoscopic images. - [K1_W11]

Skills:

1. He understands the technical conditions for the transmission, storage and presentation of multimedia data and can make appropriate basic requirements for technical systems implementing multimedia services. - [K1_U14]
2. Understand the basic provisions of the relevant international standards. - [K1_U14]
3. Has the ability to record and present of 2D and 3D video. - [K1_U14]
4. Can define the requirements for the system that performs the basic tasks associated with multimedia - [K1_U14]

Social competencies:

1. It is open to the possibility of continuous training and understands the need to improve professional competence. - [K1_K01]

Assessment methods of study outcomes
1. A written or oral exams or test questions.
2. Reports from a thematically block of laboratory.
3. Checking preparation for classes and activities in the laboratory.

Course description
Analysis of the content of the images. Video Converters and improve image quality (restaurant image, removing noise on images, distortion artifacts). Expanding knowledge of advanced techniques of compression (AVC HEVC). Treatment of non-linear multimedia content, image reconstruction and restaurant. Infrared (emissivity, the analysis of thermal images, bolometric arrays, practical performance measurement, thermal imaging devices). Equipment and technology acquisition, recording and presentation of 2D and 3D (including stereoscopic images).

Basic bibliography:

1. Dr Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press; 1 edition (June 18, 2012)
2. Jens R. Ohm, Multimedia Communication Technology, Springer 2004
3. ITU-R Rec., BT.500-1, Methodology for the subjective assessment of the quality of television pictures, 2002.
4. ITU-T Rec., H.264, Advanced video coding for generic audiovisual service, 2003.
5. Nillson, Intelligent Network Video: Understanding Modern Video Surveillance Systems, CRC Press; Har/Dvdr edition (September 10, 2008)

Additional bibliography:

1. ISO/IEC IS 13818-1 / ITU-T Rec. H.262: Information technology ? Generic coding of moving pictures and associated audio information. Part 1: Systems, 1997

Result of average student's workload

Activity	Time (working hours)
1. Lectures and practical classes	45
2. Preparation for the classes and writing a final report	15
3. Literature study	15
4. Preparation for exam	15
5. consultations with lectures and laboratory project	15

Student's workload

Source of workload	hours	ECTS
Total workload	90	3
Contact hours	50	2
Practical activities	30	1

STUDY MODULE DESCRIPTION FORM

Name of the module/subject	Code
Introduction to object and event recognition	

Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**3 / 6**
Elective path/specialty	**Subject offered in:**	**Course (compulsory, elective)**
Information and Comm. Technologies	**English**	**elective**

Cycle of study:	Form of study (full-time,part-time)
First-cycle studies	**full-time**

No. of hours	No. of credits
Lecture: **2** Classes: **-** Laboratory: **1** Project/seminars: **-**	**3**

Status of the course in the study program (Basic, major, other)	(university-wide, from another field)
Other	**from field**

Education areas and fields of science and art	ECTS distribution (number and %)
technical sciences	**3 100%**
Technical sciences	**3 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	1 Has knowledge of programming in C / C + +. 2 Has basic knowledge in the field of image processing.
2	**Skills**	1. Is able to look for information required during educational process and take educational courses, if needed, especially through Internet and distance education.
3	**Social competencies**	1. Capable of self-learning (books, computer programs)He acts actively in class, asks questions, knowingly uses the contact with the teacher (eg. consultation).

Assumptions and objectives of the course:

Understanding of basic concepts in video object recognition, focus is put on the methods of data analysis. Removing the noisy, distortion, filtering the image, object segmentation, classification, basic techniques for detection and tracking.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. It has a structured, mathematical underpinnings of knowledge, video acquisition, human perception, quality assessment, processing, digital representation, compression and transmission of video signals, speech and audio for use in multimedia systems - [K1_W11]
2. It has a basic knowledge on developments in matters relating to the processing and image processing - [K1_W11]
3. He has knowledge in the field of non-linear processing of multimedia content, image reconstruction and restaurants, technology acquisition and presentation of stereoscopic images. - [K1_W11]

Skills:

1. He understands the technical conditions for the transmission, storage and presentation of multimedia data and can make appropriate basic requirements for technical systems implementing multimedia services. - [K1_U14]
2. Can define the requirements for the system that performs the basic tasks associated with multimedia - [K1_U14]
3. Has the ability to analyze media content, in particular the detection and classification of objects. - [K1_U14]
4. Understand the basic provisions of the relevant international standards. - [K1_U14]

Social competencies:

1. Is open to the possibility of continuous training and understands the need to improve professional competence. - [K1_K01]

Assessment methods of study outcomes

1. A written or oral exams or test questions.
2. Reports from a thematically block of laboratory.
3. Checking preparation for classes and activities in the laboratory class.

Course description

Analysis of the content of the images. Removing the noisy images, distortion artifacts. Filtering the image, edge detection, segmentation of objects (methods of sowing area), classification of data (linear and nonlinear methods, LDA, PCA, neural networks), basic techniques for object detection and tracking of moving objects. Methods HOG, SURF, SIFT. Expanding knowledge of stereoscopy, 3D video systems, advanced compression techniques. Treatment of non-linear multimedia content, image reconstruction and restaurant, technology acquisition and presentation of stereoscopic images.

Basic bibliography:

1. Dr Simon J. D. Prince, Computer Vision: Models, Learning, and Inference, Cambridge University Press; 1 edition (June 18, 2012)
2. Jens R. Ohm, Multimedia Communication Technology, Springer 2004
3. Nillson, Intelligent Network Video: Understanding Modern Video Surveillance Systems, CRC Press; Har/Dvdr edition (September 10, 2008)

Additional bibliography:

1. ISO/IEC IS 13818-1 / ITU-T Rec. H.262: Information technology ? Generic coding of moving pictures and associated audio information. Part 1: Systems, 1997

Result of average student's workload

Activity	Time (working hours)
1. Lectures, classes and consulting the teacher.	45
2. Preparation for laboratory classes	15
3. Literature study	15
4. Preparation for the final test	15

Student's workload

Source of workload	hours	ECTS
Total workload	90	3
Contact hours	50	2
Practical activities	30	1