STUDY MODULE DESCRIPTION FORM

Name of the module/subject **(-)**		Code **1010821161010833603**
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**	Year /Semester **3 / 6**
Elective path/specialty **Computer Networks and Internet**	Subject offered in: **Polish**	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 **4**
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 %) **4 100%** **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) Students have a knowledge of fundamentals of telecommunications
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 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 sstructure 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 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. Komputerowe systemy pomiarowe (wyd. II), Nawrocki W., Wyd. Komunikacji i Łączności, Warszawa, 2006.
2. Measurement Systems and Sensors, Nawrocki W., Artech House, London-Boston, 2005.
3. Komputerowe systemy pomiarowe. Ćwiczenia laboratoryjne, Praca zbiorowa, Wyd. PP, Poznań, 2007.
4. Technika pomiarowa, Tumański S., Wyd. Naukowo-Techniczne, Warszawa, 2007.

Additional bibliography:

1. Sensory i systemy pomiarowe, Nawrocki W., Wydawnictwo PP, 2006

Result of average student's workload

Activity	Time (working hours)

1. Participation in lectures and lab exercises.	62
2. Preparation for lab exercises.	25
3. Preparing lab reports.	19
4. Preparation to tests.	14

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	110	4
Contact hours	65	2
Practical activities	65	2