STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Synchronization in telecommunication systems and networks**		Code **1010831161010833986**
Field of study **Electronics and Telecommunications**	Profile of study (general academic, practical) **general academic**	Year /Semester **3 / 6**
Elective path/specialty **Telecommunication Systems**	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: **1** Laboratory: **-** Project/seminars: **-**		No. of credits **3**
Status of the course in the study program (Basic, major, other) **other**	(university-wide, from another field) **from field**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **3 100%** **3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Has a systematic knowledge of mathematical analysis, algebra and theory of probability (K1_W01) Has a basic, systematic knowledge of physics(K1_W02) Has a detailed, systematic knowledge of the fundamentals of circuit theory (K1_W05) Has a systematic knowledge, together with necessary mathematical background, of 1D signal theory (K1_W06) Knows and understands basic concepts and methods of description of linear and non-linear electronic systems, control systems and telecommunications systems (K1_W10)
2	**Skills**	Is able to extract information from literature, databases and other sources (K1_U01) Is competent in a foreign language, knows the electronics and telecommunication terminology in this language (K1_U06) Is able to use known mathematical analysis, algebra and theory of probability concepts to solve basic problems in electronics and telecommunication (K1_U07) Demonstrates the ability to solve typical tasks and problems related to analysis of electrical circuits (K1_U09) Demonstrates the ability to solve problems related to signal analysis (K1_U10)
3	**Social competencies**	Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study (K1_K01) Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects (K1_K02)

Assumptions and objectives of the course:

Presentation of the basic techniques and functioning of synchronization process in the telecommunication systems and 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 a detailed, systematic knowledge, together with necessary mathematical background, of the fundamentals of the telecommunication theory, which is necessary to understand, analyze and evaluate the operation of analogue and digital telecommunications systems. - [K1_W17]
3. Knows about development trends in electronics and telecommunication - [K1_W24]
4. Knows the principle of operation of time and frequency subsystems in modern electronics and telecommunications - [-]

Skills:

1. Is 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]
2. Is able to select the construction of devices according to technical requirements and service conditions - [K1_U21]
3. Is able to analyse the quality of timing signals in the telecommunciation systems and networks - [-]

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. 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

1. Written exam.
2. Activity during classes.
3. Reports of realized projects.

Course description

Synchronization and its contexts. Mathematical model of synchronization signal. Parameters of the synchronization signal. Phase-locked loop for continuous and discret signals. Analog and digital timing recovery. Analog and digital carrier recovery. Synchronization PCM systems, timing and framing. Synchronization in spread-spectrum systems. Synchronization in multimedia systems. Synchronization of telecommunication network, PDH and SDH. Sources of time and frequency signals. Quality analysis of timing signals in telecommunication network.

Basic bibliography:

1. S. Bregni, Synchronization of Digital Telecommunications Networks, Wiley, 2002
2. A. Dobrogowski, Sygnał czasu, Wydawnictwo Politechniki Poznańskiej, Poznań 2003

Additional bibliography:

1. W. Lindsey, Synchronization Systems in Communication and Control, 1972
2. U. Mengali, A. N. D'Andrea, Synchronization Techniques for Digital Receivers, 1997
3. H. Meyr, G. Ascheid, Synchronization in Digital Communications, Vol. 1, Wiley 1990
4. K. Wesołowski, Podstawy cyfrowych systemów telekomunikacyjnych, WKiŁ, 2003
5. J. G. Proakis, Digital Communications, McGraw-Hill 2000

Result of average student's workload

Activity	Time (working hours)
1. participation in lectures	30
2. participation in exercises	15
3. realization of projects	20
4. individual work	20

Student's workload

Source of workload	hours	ECTS
Total workload	90	3
Contact hours	50	2
Practical activities	25	1