

STUDY MODULE DESCRIPTION FORM		
Name of the module/subject Digital Communication Systems		Code 1010802111010812862
Field of study Electronics and Telecommunications	Profile of study (general academic, practical) general academic	Year /Semester 1 / 1
Elective path/specialty Information and Communication	Subject offered in: English	Course (compulsory, elective) elective
Cycle of study: Second-cycle studies	Form of study (full-time, part-time) full-time	
No. of hours Lecture: 2 Classes: 2 Laboratory: 2 Project/seminars: -		No. of credits 5
Status of the course in the study program (Basic, major, other) major		(university-wide, from another field) from field
Education areas and fields of science and art technical sciences Technical sciences		ECTS distribution (number and %) 5 100% 5 100%
Responsible for subject / lecturer: prof. dr hab. inż. Krzysztof Wesolowski email: wesolows@et.put.poznan.pl tel. +48 61 665 3812 Faculty of Electronics and Telecommunications ul. Polanka 3, 60-965 Poznań		
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 systematic knowledge, together with necessary mathematical background, of 1D signal theory; this knowledge allows him/her to understand the representation of signals and signal analysis in time domain and frequency domain [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 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 problems related to signal analysis in time domain and frequency domain [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]
Assumptions and objectives of the course: To present the fundamentals of digital communication systems which cover baseband signal transmission, digital modulations of a sinusoidal carrier and transmission of digital signals over intersymbol interference channels.		
Study outcomes and reference to the educational results for a field of study		
Knowledge:		
1. Has a knowledge of selection of elementary signals and data symbol formats for baseband signal transmission, structures of optimal synchronous and asynchronous receiver, digital modulation techniques and equalization of transmission channel characteristics. - [K1_W15] 2. Has a knowledge from communication theory of criteria and design of optimal receiver structures for baseband and passband signal transmission and of determining error probability for digital modulations over AWGN channels - [K1_W17] 3. Has an elementary knowledge of applications of presented digital transmission techniques in contemporary and future digital communication systems - [K1_W24]		
Skills:		
1. Is able to calculate/determine basic parameters of signals used in baseband and passband transmission and of digital communication systems utilizing these signals - [K1_U15] 2. Is able to analyze the operation of receivers for digital signals and to design the key blocks of the transmitter and receiver of digital transmission systems - [K1_U19]		

Social competencies:
1. Is able to notice and formulate directions of digital communication systems evolution both in the dimension of fundamental research and system view. - [K1_K04]

Assessment methods of study outcomes
Credit for exercise classes. Written exam of lecture content.

Course description
<p>Lectures:</p> <ol style="list-style-type: none"> Digital baseband transmission: shaping of elementary signals, selection of the data symbol format, optimal reception of binary and multilevel signals Digital modulations of the sinusoidal carrier: optimal synchronous and asynchronous receivers, ASK, FSK, PSK, DPSK, QAM modulations, constant envelope modulations, Continuous Phase Modulation (CPM), Trellis Coded Modulation (TCM), multitone modulations (OFDM), Digital transmission on channels introducing intersymbol interference: phenomenon of intersymbol interference, linear equalizers, nonlinear equalizers <p>Exercises:</p> <ol style="list-style-type: none"> PSDs of baseband digital modulation signals Optimal receiver for binary digital baseband transmission Multilevel signals in digital baseband transmission Digital transmission systems with regenerative repeaters Cross-correlation coefficient of digital modulation signals Optimal receiver for signals of digital modulations of the sinusoidal carrier Average power of signals of digital modulations of the sinusoidal carrier Error probability for optimal synchronous receiver with inexact carrier phase estimation Differential encoding of QPSK signals CPM signals Reception of TCM signals Design of an OFDM signal

Basic bibliography:
1. K. Wesolowski, Introduction to Digital Communication Systems, Wiley, Chichester 2009

Additional bibliography:
1. J. G. Proakis, Digital Communications, 4th Ed., McGraw-Hill, New York, 2000

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in exercise classes	30
3. Presence at the lab	30
4. Solving problems given as a homework during exercise classes and self-reliant preparation to exercise classes	20
5. Presence on the final test of exercise classes	2
6. Preparation to the completion of exercises	10
7. Preparation for passing the examination	13
8. Presence at the exam	2
9. Consulting with teachers	3

Student's workload

Source of workload	hours	ECTS
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Total workload	140	5
Contact hours	97	2
Practical activities	80	3