

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Coding theory</b>		Code <b>1010805131010812042</b>
Field of study <b>Electronics and Telecommunications</b>	Profile of study (general academic, practical) <b>general academic</b>	Year /Semester <b>2 / 3</b>
Elective path/specialty <b>-</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>obligatory</b>
Cycle of study: <b>Second-cycle studies</b>	Form of study (full-time,part-time) <b>part-time</b>	
No. of hours Lecture: <b>20</b> Classes: <b>10</b> Laboratory: <b>-</b> Project/seminars: <b>-</b>		No. of credits <b>4</b>
Status of the course in the study program (Basic, major, other) <b>major</b>		(university-wide, from another field) <b>from field</b>
Education areas and fields of science and art <b>technical sciences</b> <b>Technical sciences</b>		ECTS distribution (number and %) <b>4 100%</b> <b>4 100%</b>
<b>Responsible for subject / lecturer:</b>  dr inż. Zbigniew Długaszewski email: zbigniew.dlugaszewski@put.poznan.pl tel. 616 665 3813 WEiT Polanka 3		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	Has knowledge about algebra and probability theory[K1_W01] Has knowledge about signal theory required to understand representation and analysis of signals in time and frequency domain [K1_W06] Knows basics about digital telecommunication systems, including baseband transmission, digital modulations and signal reception [K1_W15] Has knowledge about basics methods of DSP [K1_W19]
2	<b>Skills</b>	Can obtain information from literature, databases and other sources in polish and english language; can integrate obtained information, formulate conclusions and [K1_U1] Can solve basics electronics and telecommunication problems using mathematical apparatus[K1_U7]
3	<b>Social competencies</b>	Knows its own limitations and understands need to continue education [K1_K01]
<b>Assumptions and objectives of the course:</b> -Idea of error correction and detection and coding techniques used in telecommunication systems. Providing knowledge about encoding and decoding techniques, especially for block, cyclic and convolutional codes. Idea of Turbo codes and LDPC codes		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
1. Has knowledge about parameters and properties of error correction and detection codes, soft and hard decision decoding methods - [K2_W05] 2. Has knowledge about block, cyclic and convolutional codes: encoding and decoding techniques, parameters and properties, basic codes modifications, CRXC codes, produc and concatenated codes - [K2_W05] 3. Knows about ARQ and techniques used in modern communication systems, especially for fading channel - [K2_W06]		
<b>Skills:</b>		
1. Can encode and hard and softdecision decode block, cyclic and convolutional codes. Can determine codes parameters - [K2_U09] 2. Can use knowledge about ARQ - [K2_U16]		
<b>Social competencies:</b>		
1. Can observe and analyze developments in coding theory and need for codes - [K2_K04]		

<b>Assessment methods of study outcomes</b>		
- written test to pass exercises and exam in written form		
<b>Course description</b>		
<p>-Lecture</p> <p>Introduction, impact of Information Theory , classification of codes, coding gain</p> <p>Block codes: generation of codewords, systematic form, Hamming distance, soft and hard decision decoding, standard decoding array, generating and parity check matrices, Hamming and Singleton bound, Hamming codes, equivalent codes, using syndrome, codes' properties error bursts</p> <p>Cyclic codes: polynomial codes, generating codewords in systematic form, cyclic property, properties of cyclic codes, syndrome, decoding, Meggit decoder, codes described by roots, BCH bound, majority logic decoder, decoding using information sets</p> <p>BCH and RS codes, parameters and properties, idea of algebraic decoding</p> <p>Modifications of block codes: shortened cyclic codes and CRC codes, product and concatenated codes, softdecision decoding of block codes</p> <p>Convolutional codes: description in different domains, as a filter and FSSM, properties, catastrophic encoder, state diagram, ML decoding, Viterbi algorithm, error analysis, puncturing, systematic encoder, RSCC encoder</p> <p>ARQ and hybrid ARQ techniques</p> <p>Codes decoded iteratively: Turbo codes, PCCC, encoder, interleaver, results, LDPC codes</p> <p>Exercises:</p> <p>ML decision rule, block codes syndrome, cyclic, BCH and RS codes, convolutional codes, Viterbi algorithm</p>		
<b>Basic bibliography:</b>		
1. Moon, ?Error Correction Coding, Mathematical Methods and Algorithms?, Wiley 2005		
<b>Additional bibliography:</b>		
1. Wicker, ?Error Control Systems for Digital Communication and Storage?, Prentice 1994 2. Huffman, Pless, ?Fundamentals Of Error-Correcting Codes?, Cambridge 2003 3. Lin, Costello, ?Error Control Coding Fundamentals and Applications?, 2ed Prentice 2004 4. Kabatiansky, ?Error Correcting Coding and Security for Data Networks?, Wiley 2005 5. MacKay, ?Information Theory, Inference, and Learning Algorithms?, Cambridge 2003 6. Moreira, Farrell, ?Essentials of Error-Control Coding?, Wiley 2006 7. Morelos-Zaragoza, ?The Art of Error Correcting Coding?, 2ed Wiley 2006		
<b>Result of average student's workload</b>		
Activity	Time (working hours)	
1. Lectures with examples	20	
2. Exercises	10	
3. Calculation of exercises at home	10	
4. Preparation for the test and exam	20	
5. Consultations	10	
<b>Student's workload</b>		
Source of workload	hours	ECTS
Total workload	100	4
Contact hours	43	3
Practical activities	45	0