STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Information theory		**1010805121010810104**
Field of study	Profile of study (general academic, practical)	Year /Semester
Electronics and Telecommunications	**general academic**	**1 / 2**
Elective path/specialty	Subject offered in:	Course (compulsory, elective)
-	**Polish**	**obligatory**
Cycle of study:	Form of study (full-time,part-time)	
Second-cycle studies	**part-time**	
No. of hours		No. of credits
Lecture: **20** Classes: **10** Laboratory: **-** Project/seminars: **-**		**5**
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		**5 100%**
Technical sciences		**5 100%**

Responsible for subject / lecturer:

Piotr Tyczka, Ph.D.
email: tyczka@et.put.poznan.pl
tel. (061) 665 39 18
Faculty of Electronics and Telecommunications
ul. Piotrowo 3A 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 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] Has extended, in-depth knowledge of those branches of mathematics which are used in formulating and solving problems in electronic and telecommunications [K2_W00]
2	**Skills**	Is capable of studying autonomously [K1_U05] Is able to use known mathematical analysis, algebra and theory of probability concepts to solve basic problems in electronics and telecommunication [K1_U07]
3	**Social competencies**	Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study [K1_K01] 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]

Assumptions and objectives of the course:

To present principal concepts and the most important results of information theory which define the limits on the parameters of communication systems and set directions and strategy in their optimization.

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

Knowledge:

1. Has a knowledge of measuring of amount of information, basic discrete message sources and their parameters, source coding using the most important algorithms, channel models from the information theory point of view, channel capacity and decision rules. - [K2_W05]

Skills:

1. Is able to calculate basic parameters of discrete memoryless and memory message sources, to perform source coding and decoding by means of the most important algorithms and to evaluate capacity for information channels. - [K2_U09]

2. Is able to design source encoder and decoder for effective representation of messages be means of sequences of data symbols. - [K2_U16]

Social competencies:

1. Is able to notice and understands the influence and importance of the results of information theory on the directions of progress and optimization of communication systems. - [K2_K07]

Assessment methods of study outcomes

Credit for exercise classes.
Written exam of lecture content.

Course description

Lectures:
1. Concept of Information and Measure of Amount of Information
2. Message Sources and Source Coding
- Discrete Memoryless Source
- Extension of a Memoryless Source
- Markov Sources
- Entropy of the Markov Source
- Source Associated with the Markov Source
3. Discrete Source Coding
- Huffman Coding
- Shannon-Fano Coding
- Dynamic Huffman Coding
- Lempel-Ziv Algorithm
- Arithmetic Coding
- Source Coding in Facsimile Transmission
4. Channel Models from the Information Theory Point of View, Mutual Information
5. Channel Capacity
- Capacity of a Discrete Time Channel
- Capacity of Band-Limited Channel with Additive White Gaussian Noise
- Capacity of a Gaussian Channel with a Given Channel Characteristic
- Capacity of a Flat Fading Channel
6. Decision Process and its Rules
- Idea of Decision Rule
- Maximum a Posteriori Probability (MAP) Decision Rule
- Maximum Likelihood (ML) Decision Rule

Exercises:
1. Measure of Amount of Information
2. Entropy of Discrete Memoryless Source
3. Extension of a Memoryless Source
4. Entropy of the Markov Source
5. Source Associated with the Markov Source
6. Discrete Source Coding - Basic Concepts
7. Huffman Coding
8. Dynamic Huffman Coding
9. Lempel-Ziv Algorithm
10. Arithmetic Coding
11. Channel Capacity

Basic bibliography:

1. Podstawy cyfrowych systemów telekomunikacyjnych, K. Wesołowski, Wydawnictwa Komunikacji i Łączności, Warszawa, 2003
2. Teoria informacji i kodowania, N. Abramson, PWN, Warszawa, 1969

Additional bibliography:

1. Systemy telekomunikacyjne, t. I i II, S. Haykin, Wydawnictwa Komunikacji i Łączności, Warszawa, 1999
2. Nauka o informacji, J. Seidler, WNT, Warszawa, 1983
3. Podstawy probabilistyczne teorii systemów informacyjnych, W. Sobczak, WNT, Warszawa, 1981
4. Principles of Information Theory, R. E. Blahut, Addison Wesley, 1987

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	20
2. Participation in exercise classes	10
3. Solving problems given as a homework during exercise classes and self-reliant preparation to exercise classes (This activity requires a significant amount of self-work)	45
4. Presence on the final test of exercise classes, preparation to the written exam and presence on the exam	25

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	125	5
Contact hours	35	1
Practical activities	55	2