COURSE DESCRIPTION CARD - SYLLABUS

Course name
Information and coding theory

Course

Field of study
Electronics and Telecommunications
Area of study (specialization)

Level of study
Second-cycle studies
Form of study
full-time

Year/Semester
1 / Sem. 2
Profile of study
general academic
Course offered in
English
Requirements
compulsory

Number of hours

Lecture
30
Laboratory classes
0
Other (e.g. online)

Tutorials
30
Projects/seminars
0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
prof. dr hab. inż. Hanna Bogucka,
hanna.bogucka@put.poznan.pl

Responsible for the course/lecturer:

Prerequisites

At the beginning of this course, a student should know the principles of operation of digital transmission systems, have a detailed, systematic knowledge, together with the necessary mathematical background, of the fundamentals of the telecommunication theory, which is necessary to understand, analyze and evaluate the operation of digital telecommunications systems. He or she should also have a systematic knowledge of mathematical analysis, algebra and theory of probability. Moreover, he/she should also be able to extract information from English language literature, databases and other sources and be able to synthesize gathered information, draw conclusions, and justify opinions.

Course objective

The objective of the course is to learn theoretical foundations of functioning of information systems, determining limits of particular functional blocks of information systems: source coding, channel coding, channel capacity and to learn the basic detection rules and methods of protecting digital symbols blocks against errors

Course-related learning outcomes

Knowledge

1. A student has a systematic knowledge, together with the necessary mathematical background, related to information and coding theory

2. A student has in-depth knowledge of construction and operation of digital information systems

3. A student has a systematic knowledge, with the necessary theoretical background, of optimization methods used in solving engineering problems in communication systems

Skills

1. A student is able to evaluate digital communication systems and compare it with theoretical limits

2. A student knows basic issues in source and channel coding and is able to apply suitable algorithms to posed information coding problems

3. A student is aware of technical background of functioning of selected blocks in data transmission systems

Social competences

1. A student is aware of the necessity of professional approach to solving technical problems in telecommunications and of responsibility for the proposed technical solutions

2. A student is aware of his/her responsibility for design of information systems and is aware of existing limitations

3. A student is aware of the main challenges facing electronics and telecomunication in the 21st century. Is aware of the impact electronics and ICT systems and networks will have on the development of the information society

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Written exam verifying theory and content of the lectures in the form of a test with 5 - 10 open questions will be set at the end of a semester. The answers will be assessed with points (from 0 to 2). The threshold to pass the exam is 50% of the points possible to acquire.

2. The knowledge and skills acquired in the tutorial classes will be verified in the form of written test based on problems to be solved (4 to 6 problems). The answers will be assessed with points (from 0 to 2). The threshold to pass the exam is 50% of the points possible to acquire. Moreover, during the

excercises, activity of students and their social comperences will be assessed and rewarded with points to impact final grade.

Programme content

Lectures:

During the first part of auditory lectures, the model of information transmission, models of message sources, characterization of message sources, the idea of entropy and its application in source characterization will be discussed. Then, the idea of source coding, limits of source coding, the Huffman, Shannon-Fano and Lempel-Ziv coding and arithmetic coding algorithms will be presented. During the second part of lectures, reliable information transfer through unreliable channels, channel models, the notion of channel capacity, capacity calculations, the idea of mutual information, the meaning of channel coding in reaching the transmission rate close to the Shannon limit, the Shannon theorem on reliable information transmission over unreliable channels, and the capacity of several kinds of channels will be discussed. The third part of lectures will address the basics of channel coding: code classification, parity check equations, parity check matrix, generation matrix, syndrome, generation polynomials, basic methods of block code decoding, description methods of convolutional codes, trellis diagram, Viterbi algorithm, convolutional code decoding, information on turbo-codes and LDPC codes.

Tutorials:

During the tutorial excercises, the example and representative problems will be solved by the teacher and by the students, related to the calculation of the source entrophy, application of the source coding and decoding algorithms, calculation of the mutual information and capacity of a channel, application of the selected error-correcting block codes and convolutional codes together with respective decoding algorithms.

Teaching methods

Lectures: multimedia presentation ilustrated by examples presented and problems solved on the blackboard.

Tutorials: Example problems solved on the blackboard and solving other representative problems given by the teacher.

Bibliography

Basic

1. K. Wesolowski, Introduction to digital communication systems, Wiley, Chichester, 2009

Additional

1. J. G. Proakis, Digital Communications, 4th or 5th edition, McGraw-Hill, 2000, 2008

2. T. M. Cover, J. A. Thomas, Elements of Information Theory, Wiley, 1991

3. D. MacKay, Information Theory, Inference and Learning Algorithms, Cambridge University Press, 2003

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	30	1,0

[1] delete or add other activities as appropriate