COURSE DESCRIPTION CARD - SYLLABUS

Course name
Compression methods [S1MNT1>K-MK]

Course

Field of study
Mathematics of Modern Technologies

Year/Semester
4/7

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

The student should have previously mastered the following subjects: Probability, Mathematical Statistics, Discrete Mathematics, Introduction to Programming.

Course objective

The aim of the course is to familiarize the student with selected methods of data compression and elements of information theory.

Course-related learning outcomes

Knowledge:
• knows and understands issues in the field of technical sciences, including automation, robotics, electrical engineering and electronics to a sufficient degree [K_W04(P6S_WG)];
• knowsandunderstandstherelationshipbetweenmathematicsandmoderntechnologies[K_W05(P6S_WG)];
• knows and understands issues in computer science, including numerical methods; knows at least one software package, programming language [K_W07(P6S_WG)];
• knows and understands engineering technologies and is aware of the latest development trends in the field of study [K_W11(P6S_WG)].

Skills:
• can use mathematical tools and methods, including numerical ones, to solve engineering problems [K_U03(P6S_UW)];
• canapplymoderntechnologiestosolvemathematicalandengineering-technicalproblems[K_U05(P6S_UW)];
• can use mathematical tools to support and develop modern technologies used in engineering and technical sciences [K_U06(P6S_UW)].

Social competences:
• is ready to critically assess the level of his/her knowledge in relation to research in exact and natural sciences as well as engineering and technical sciences [K_K01(P6S_KK)];
• is ready to deepen and expand knowledge to solve emerging technical problems [K_K02(P6S_KK)].

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures: knowledge is verified on a written test;
Laboratory classes: knowledge and skills are verified on the basis of the evaluation of the programming colloquium;
Projects/seminars: knowledge and skills are verified based on the assessment of project implementation, its functionality and goals;
Grading scale: 0%-49% - NDST, 50%-59% - DST, 60%-69% - DST+, 70%-79% - DB, 80%-89% - DB+, 90%-100%-BD.

Programme content

- selected methods of data compression
- elements of information theory.

Course topics

Lectures:
• basic concept related to data compression, compression ratio, information source models
• basics of information theory; Shannon entropy;
• Shannon's source coding theorem;
• Shannon's fundamental theorem;
• Huffman coding; Shannon-Fano coding;
• arithmetic coding;
• dictionary coding;
- metric theory of error correction.
- conditions for uniquness decodability.
- basics of linear code theory.

Lab:
Implement the following coding methods using programming tools

• entropy calculation,

• Huffman codes.

• dictionary codes.

• arithmetic codes.

• correction codes.

Teaching methods

Lectures: multimedia presentation, presentation illustrated with examples given on the board, problem solving, multimedia show, demonstration;

Laboratory classes: solving practical problems, discussion, individual or team work.

Bibliography

Basic:
• A. Przelaskowski: Kompresja danych, BTC 2005;
• A. Drozdek: Wprowadzenie do kompresji danych, WNT 2016;
• Khalid Sayood: Kompresja danych. Wprowadzenie, Wydawnictwo RM 2002.

Additional:
• Khalid Sayood: Introduction to data compression, Vth edition 2019;
• Maan Hameed: Low Power Approach for Implementation of Huffman Coding: For High Data Compression, Scholar Press 2018;
• James V Stone: Information Theory, A Tutorial Introduction, Sebtel Press 2014;
• Cover, T. and Thomas, J.: Elements of Information Theory. New York, John Wiley and Sons, 1991.

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	1,50