GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Data-transmission Code Protection, PG_00048362		
Field of study	Electronics and Telecommunications, Biomedical Engineering, Biomedical Engineering, Biomedical Engineering		
Date of commencement of studies	February 2027	Academic year of realisation of subject	2027/2028
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group Subject group related to scientific research in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	2	Language of instruction	Polish
Semester of study	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Teleinformation Networks -> Faculty of Electronics Telecommunications and Informatics -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mariusz Dzwonkowski	
	Teachers	dr inż. Mariusz Dzwonkowski	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	0.0	0.0	15.0	30

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	30	3.0	42.0	75

Subject objectives

Knowledge of basic error control codes used in communication systems, methods of describing, construction and protection capabilities against errors in communication channels.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] knows and understands, to an increased extent, the construction and operating principles of components and systems related to the field of study, including theories, methods and complex relationships between them and selected specific issues - appropriate for the curriculum	Student classifies, identifies and describes the most important error correction codes used in telecommunications, calculates quality characteristics for data transmission systems, solves issues of matching the right error correction code for specific noise channels.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge
[K7_U12] is able, to an increased extent, to analyze the operation of components and systems related to the field of study, as well as to measure their parameters and study their technical characteristics, and to plan and carry out experiments related to the field of study, including computer simulations, interpret the obtained results and draw conclusions	Student classifies, identifies and describes the most important error correction codes used in telecommunications, calculates quality characteristics for data transmission systems, solves issues of matching the right error correction code for specific noise channels.	[SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K7_W10] knows and understands, to an increased extent, the basic processes occurring in the life cycle of equipment, objects and technical systems, as well as methods of supporting processes and functions, specific to the field of study	Student classifies, identifies and describes the most important error correction codes used in telecommunications, calculates quality characteristics for data transmission systems, solves issues of matching the right error correction code for specific noise channels.	[SW2] Assessment of knowledge contained in presentation [SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Introduction, classification of error control coding, block structure of communication system. Noise and errors in data transmission channels: additive and multiplicative noise. The use of error control codes: ARQ and FEC systems. Basic concepts related to information theory: code gain, codeword weight, Hamming distance, information content. Decoding methods: hard and soft decision decoder. Optimal correction decoding rule: maximum a'posteriori probability MAP decoder, maximum likelihood ML decoder. Classification of error control codes: block, convolutional, linear, cyclic, binary, non-binary, systematic, and non-systematic codes. Elements of algebra for the purposes of code theory: groups, rings, fields, finite fields and their extensions, matrix and polynomial representation of field elements, division of polynomials. Block Codes. Algebraic structures used in block codes, detection and correction capability of the code. Linear codes. Standard table of linear code, matrix representation of linear code, linear dual code, coding and decoding for linear block codes, Hamming bound. Examples of linear block codes: Hamming linear codes, LDPC codes. Basic modifications of linear codes: lengthening, shortening, extending, puncturing, augmenting, expurgating. Iterated and merged codes. Fixed weight code. Cyclic codes. Polynomial representation, polynomials generating cyclic codes, cyclic dual code, cyclic coding and decoding algorithm, matrix representation of cyclic codes. Examples of cyclic block codes: cyclic Hamming codes, maximum length codes, BCH codes, Reed-Solomon codes.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>No requirements.</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Exam</td><td>50.0%</td><td>60.0%</td></tr>
<tr><td>Seminar presentation</td><td>50.0%</td><td>40.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>Lin S., Costello D. J., Error Control Coding: Fundamentals and Applications, Prentice-Hall 1983

Wesołowski K., Podstawy cyfrowych systemów telekomunikacyjnych, WKiŁ 2006</td></tr>
<tr><td>Supplementary literature</td><td>MacKay D. J.C., Information Theory, Inference, and Learning Algorithms, Cambridge University Press (2003)

Siedler J., Systemy przesyłania informacji cyfrowych, Wydawnictwo Naukowo-Techniczne (1972)</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>Define the types of errors based on the noise in communication channels.

Compare ARQ and FEC systems.

Classify error control codes.

Encode information word using selected linear and cyclic codes.

Decode a received word for selected linear and cyclic codes.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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