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 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Optional 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		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Mariusz Dzwonkowski	
	Teachers	dr inż. Mariusz Dzwonkowski	

Lesson types and methods of instruction

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_U06] can analyse the operation of components, circuits and systems related to the field of study; measure their parameters; examine technical specifications; interpret 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.	[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools
[K7_W05] Knows and understands, to an increased extent, methods of process and function support, 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

Subject contents	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.
Prerequisites and co-requisites	No requirements.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Seminar presentation	50.0%	40.0%
Exam	50.0%	60.0%

Recommended reading

Basic literature	Lin S., Costello D. J., Error Control Coding: Fundamentals and Applications, Prentice-Hall 1983 Wesołowski K., Podstawy cyfrowych systemów telekomunikacyjnych, WKiŁ 2006
Supplementary literature	MacKay D. J.C., Information Theory, Inference, and Learning Algorithms, Cambridge University Press (2003) Siedler J., Systemy przesyłania informacji cyfrowych, Wydawnictwo Naukowo-Techniczne (1972)
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	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.
Work placement	Not applicable