GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Radio Planning, PG_00064096		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	February 2025	Academic year of realisation of subject	2024/2025
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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Department of Radiocommunication Systems and Networks -> Faculty of Electronics, Telecommunications and Informatics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Sławomir Gajewski	
	Teachers	dr inż. Sławomir Gajewski dr inż. Małgorzata Gajewska	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	0.0	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	17.0	50

Subject objectives	The aim of the course is to familiarize students with the principles of radio planning for 4G and 5G networks.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U09] can carry out a critical analysis of the functioning of existing technical solutions and assess these solutions, as well as apply experience related to the maintenance of advanced technical systems, devices and facilities typical for the field of studies, gained in the professional engineering environment	The student can analyse the radio planning process of a new-generation radio communication network, considering the network operating conditions and technical parameters of the component devices. The student can select radio planning methods and network components.	[SU2] Assessment of ability to analyse information
[K7_U03] can design, according to required specifications, and make a complex device, facility, system or carry out a process, specific to the field of study, using suitable methods, techniques, tools and materials, following engineering standards and norms, applying technologies specific to the field of study and experience gained in the professional engineering environment	The student can perform the radio planning procedure of a new-generation radio communication network.	[SU4] Assessment of ability to use methods and tools
[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	The student understands the mechanisms involved in designing a radio communications network.	[SW1] Assessment of factual knowledge

Subject contents

1) Introduction to new-generation cellular radio communication systems. Coexistence of different types of systems. 2) 4G and 5G systems. Frequency resources for 4G LTE and 5G NR systems. Frequency planning in cells. 3) Physical resources in LTE and 5G NR systems, frame formats, resource blocks, data allocation to blocks, and coding-modulation schemes. 4) The principle of OFDM multiplexing and OFDMA techniques, signal processing principles, and PAPR. 5) Basic stages and principles of radio planning in cellular networks. 6) Estimation of 4G LTE and 5G NR system capacity, data rate distributions in cells, and radio interface load. 7) Inter-cell interference in systems and their impact on radio interface capacity. 8) Basics of network dimensioning, estimation of radio traffic and demand for physical resources. Estimation of the number of base stations in the access network area. 9) System operating environments and their impact on the cellular network planning process. 10) Estimation of allowable signal attenuation in a radio link and link balance for 4G/5G systems. 11) Receiver sensitivity in a multi-rate system. Defining range criteria. 12) Modeling propagation attenuation, model properties, principles of their use, and limitations. Example attenuation models and their characteristics. Estimation of ranges in a 4G/5G system. 13) Detailed planning of cellular networks using software tools and network simulators. Measurement parameters and their importance in the network design process. 14) Simulation of a radio communication network. Construction of simulators, simulation stages, criteria, input and output data. 15) Optimization and operational phase, network self-organization, quality measurements, and drive tests.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Passing the project	50.0%	30.0%
Passing the subject	50.0%	70.0%

Recommended reading

Basic literature	1) Holma H., Toskala A., Nakamura T.(editors), 5G Technology. 3GPP Evolution to 5G-Advanced, Second Edition, Wiley 2024. 2) Holma H., Toskala A. (editors), WCDMA for UMTS , HSPA Evolution and LTE , 4th ed., Wiley Sons, 2007. 3) Holma H., Toskala A. (editors), LTE for UMTS , Evolution to LTE Advanced , 2nd ed. Wiley and Sons, 2011.
Supplementary literature	1) Dahlman E., Parkvall S., Skold J.: 5G NR The Next Generation Wireless Access Technology , 2nd . ed., Elsevier, Academic Press, 2021.
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed

Work placement

Not applicable

Document generated electronically. Does not require a seal or signature.