GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Modern Radio Communication Systems, PG_00047466		
Field of study	Electronics and Telecommunications		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2022/2023
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	1	Language of instruction	English
Semester of study	2	ECTS credits	3.0
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. Małgorzata Gajewska dr inż. Sławomir Gajewski	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	15.0	0.0	45
	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	45	6.0	24.0	75

Subject objectives	The aim of this subject is to familiarize the student with the detailed characteristics of modern radio communication systems as well as trunking and wireless systems.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_W05] Knows and understands, to an increased extent, methods of process and function support, specific to the field of study.	The student knows and understands the methods of supporting system design, and their operation, and selection of capacitive parameters of the radio communication link. Student is able to calculate and analyze capacity and coverage characteristics of systems.	[SW1] Assessment of factual knowledge
	[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 knows the principles of the systems and mechanisms of signal processing in radio interfaces. He knows the principles of radio interfaces.design.	[SW1] Assessment of factual knowledge
	[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 knows the basic characteristics and operating principles of selected radiocommunication systems. The student is able to analyze and design selected elements of radio interfaces of modern radio communication systems	[SU1] Assessment of task fulfilment
	[K7_W06] Knows and understands, to an increased extent, the basic processes taking place in the life cycle of devices, facilities and technical systems.	The student understands the architecture and operating principles of components of telecommunications nodes in modern radio communication systems.	[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	The student knows the methods of multiple access and physical resource allocation. He is able to analyze the architecture of modern radio communication systems.	[SU2] Assessment of ability to analyse information

Subject contents	Modern signal processing techniques CDMA. Modern signal processing techniques OFDMA. Basic properties of GSM, UMTS and LTE. Operating environments of cellular systems, FDD and TDD modes. The GSM cellular system architecture and technical description. GSM subsystems: GPRS, HSCSD. The EDGE subsystem. Basic properties of orthogonal and pseudonoise sequences. Quality of direct spread spectrum systems. Processing gain, bit error probability. Immunity of the DS CDMA system on interference. Evaluation of the capacity of cellular network with direct spread spectrum for voice services. Factors affecting the capacity of the DS CDMA system. The trade-off of capacity, coverage and quality. Integrated architecture of UMTS and GSM. Core and radio access network. Communication interfaces. Bearer services and teleservices. Organisation of protocols and transmission channels in UMTS. Physical, logical and transport channels. Procedure of random access to a channel in UMTS. Data processing in transport channels both in uplink and downlink. Frame structure and packet forming. Forming of physical channel. Orthogonalization and complex spectrum spreading in the WCDMA interface both in uplink and downlink. The QPSK modulation in the WCDMA/FDD radio interface. Hybrid phase shift of uplink scrambling sequences. Analysis of signal constellation properties. Demodulation of signals both in uplink and downlink in the WCDMA/FDD interface. Analysis of complex descrambling and deorthogonalization. The HSPA subsystem. Basic characteristics of LTE system architecture and basic parameters. The LTE radio interface. The OFDM multi-tone modulation. Signal processing and properties of OFDMA and SC-FDMA. Organisation of protocols and transmission channels in the LTE system. Physical, logical and transport channels.

	Modern dispatch-trunking systems. The TETRA system, DMR, GoTa. The LTE trunking systems. The Bluetooth wireless system. The ZigBee wireless system. The WiFi systems. WIMAX and WIMAX mobile systems.
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Project	50.0%	30.0%
Exam	50.0%	70.0%

Recommended reading

Basic literature	1.Halonen T, Romero J, Melero J.: GSM, GPRS and EDGE Performance Evolution Towards 3G/UMTS, Wiley 2003. 2.Holma H., Toskala A. (editors): WCDMA for UMTS, HSPA Evolution and LTE, 4th ed., Wiley & Sons, 2007 3.Gajewski S.: Analiza efektywności techniki WCDMA/FDD w segmencie naziemnym systemu UMTS, praca doktorska, Politechnika Gdańska, 2004 4.Holma H., Toskala A. (editors): LTE for UMTS, Evolution to LTE-Advanced, 2nd ed. Wiley and Sons, 2011
Supplementary literature	1. Sesia S. et al. .: LTE The UMTS Long Term Evolution, John Wiley and Sons, 2009 2. Lee J.S., Miller L.E.: CDMA Systems Engineering Handbook, Artech House, 1998
eResources addresses	Adresy na platformie eNauczanie: Nowoczesne systemy radiokomunikacyjne (luty 2023) - Moodle ID: 28841 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=28841

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