



## Subject card

Subject name and code	Fundamentals of Cellular Systems , PG_00048146						
Field of study	Electronics and Telecommunications						
Date of commencement of studies	October 2020		Academic year of realisation of subject		2023/2024		
Education level	first-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	4		Language of instruction		Polish		
Semester of study	7		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 hab. inż. Jarosław Sadowski				
	Teachers		dr hab. inż. Jarosław Sadowski				
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	0.0	15
	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	15		2.0		33.0	50
Subject objectives	To get the knowledge of basic aspects of cellular network design and main characteristics of multipath radio channels which have an impact on cellular network functioning.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_U31] can identify telecommunications network architectures, differentiates their areas and functional elements, evaluates the quality of service delivery, calculates parameters of functional elements		Student can design basic structure of cellular network		[SU3] Assessment of ability to use knowledge gained from the subject		
	[K6_W34] Knows the characteristics of telecommunications channels, methods of securing information, modulation systems, methods of access to the channel.		Student knows the concept of cellular networks and basic physical phenomena in radio links which have impact on cellular network design.		[SW1] Assessment of factual knowledge		
Subject contents	<div>1. Concept of cellular system, principle of topological design, cell pattern and its motivation, cell cluster.</div> <div>2. Analysis of cell cluster size vs. the ratio signal-to-interference, influence of sector antennas on cluster size.</div> <div>3. Adjustment of cellular systems topology to the increasing traffic intensity.</div> <div>4. Calculation of the number of channels per cell for a given traffic intensity and grade of service (GoS), calculation of the cell area for a given number of channels and superficial user density, examples.</div> <div>5. Multioperator systems and their efficiency, example.</div> <div>6. Spectrum efficiency and capacity of cellular systems.</div> <div>7. Physical properties of a multipath radio channel, Doppler effect.</div> <div>8. Baseband equivalent channel impulse response.</div> <div>9. Fading and its probabilistic models.</div> <div>10. Propagation profiles of radio channel for GSM system, demonstration of varying channel impulse response and its transmittance for urban propagation profile in GSM system.</div> <div>11. Influence of terminal speed on fading parameters, universal characteristics for average fade duration and average fading rate vs. level of fade, examples.</div> <div>12. Transmit and receive diversity.</div> <div>13. Handover in cellular systems.</div> <div>14. History of cellular systems and their generations, main targets of cellular systems development.</div> <div>15. 4G-LTE cellular network.</div>						

Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Exam	50.0%	100.0%
Recommended reading	Basic literature	Wesołowski K.: Systemy radiokomunikacji ruchomej, WKŁ, Warszawa, 1998	
	Supplementary literature	No requirements	
	eResources addresses	Adresy na platformie eNauczanie: Podstawy systemów komórkowych (2023) - Moodle ID: 32746 <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32746">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=32746</a>	
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		