COURSE DESCRIPTION CARD - SYLLABUS

Course name
Principles of Wireless Communications [S1MiKC2>PR]

Course

Field of study
Microelectronics and Digital Communication

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
15

Other
0

Tutorials
15

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

A student starting this course should know the basics of the theory of signal transmission and processing and have knowledge of the spectral properties of signals. He should also have the ability to obtain information from indicated sources and be ready to cooperate within a team.

Course objective

The aim of the course is to learn the basic problems of wireless transmission in various propagation environments and the principles of operation of modern wireless telecommunications systems.

Course-related learning outcomes

Knowledge:
1. Has structured, mathematically based, detailed knowledge of the propagation of electromagnetic waves in various environments and modeling of radio channels.
2. Has structured, mathematically based knowledge of the basics of radio communication, has basic knowledge of the architecture and operation of next-generation mobile networks.
3. Has basic knowledge in the construction and operation of radiocommunication systems and devices included in radio networks.

Skills:
1. Is able to solve typical tasks related to the design of a radio link, its energy budget and the propagation of electromagnetic waves.
2. Is able to compare radio transmission systems and standards and select the appropriate transmission method or wireless standard in specific transmission conditions and with specific user mobility.

Social competences:
1. Is aware of the basic challenges faced by modern radiocommunication and the need for a professional approach to solving technical problems and taking responsibility for the technical solutions proposed.
2. Is aware of the potential dangers to society in the event of inappropriate use of radio technologies.
3. Is aware of the rapid development of radiocommunication systems and networks and the need to constantly update his knowledge.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Completion of the lecture based on an exam in which you must obtain 51% of all possible points.
Passing the exercises on the basis of a colloquium, from which you must obtain 51% of all possible points
Completion of laboratories on the basis of submitted reports, from which 51% of all possible points must be obtained.
The assessment will primarily be based on understanding the issues discussed in the subject. This includes, but is not limited to: writing down key formulas, parameters, explaining concepts, solving computational problems and performing a problem analysis for the presented issue.
The grades are defined within the following thresholds:
51-60% dst, 61-70% dst+, 71-80% db, 81-91% db+, 92+% bdb

Programme content

Basics of radiocommunication concerns aspects related to radio propagation, its impact on the operation of wireless systems and a discussion of selected examples of radiocommunication systems.

Course topics

Lecture:
During the lectures, the issues of classification and evolution of mobile radio communication systems will first be presented (2h). Then, the propagation of signals in radio channels, its impact on the quality of transmission in radio systems and its modeling will be discussed in detail (14 h). In turn, the basic techniques of the physical layer in radio communication systems to improve the quality of transmission and reception of radio signals, as well as multiple access methods used in radio channels, will be discussed (6 h). In the next stage, the concept of mobile telephony, the principles of designing mobile systems and methods of increasing their capacity will be discussed. The basics of the operation of the cellular system and the prospects for the development of wireless telecommunications will be discussed (8h).
Exercises:
During the exercises, examples of tasks related to signal propagation in free space and in real conditions, reflection, diffraction and multipath phenomena will be solved. The power budget of the radio link will be calculated, tasks will be carried out illustrating the impact of the Doppler effect on radio signals and calculations of the received power level using propagation models (8 h). In turn, calculations will be made of the intensity of telecommunications traffic in cells at a given service level based on Erlang models. Finally, tasks will involve calculating the ratio of useful signal power to interference for various cell configurations (5 h). Final test 2 h.
Laboratories:
During laboratory exercises, practical exercises will be carried out in groups, consisting in the actual generation of a radio signal with given properties, observation and spectral measurements of this signal, spectral measurements of currently used frequency bands, and observation and measurement of the reception quality of radio signals.

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples given on the board.
2. Classes: Examples of tasks solved on the board and carrying out tasks given by the teacher - practical exercises
3. Laboratory: practical tasks in groups of 2-3 people consisting of operating spectrum analyzers, signal generators and measuring selected signal parameters, developing and analyzing their results.
An integral element of both the lecture, exercises and laboratory on the Basics of Radiocommunication are additional classes, including student visits to the base station of a telecommunications operator or the anechoic chamber of the Poznań Institute of Technology (the place of additional classes is determined according to availability).

Bibliography

Basic:
1. K. Wesołowski, Systemy radiokomunikacji ruchomej, Wydawnictwa Komunikacji i Łączności WKŁ, Warszawa 2003.
2. H. Bogucka, Projektowanie i obliczenia w radiokomunikacji, Wyd. II, Wydawnictwo Politechniki Poznańskiej, Poznań 2005

Additional:
1. S. Salous, Radio Propagation Measurement and Channel Modelling, John Wiley&Sons, 2013.
2. R. Katulski, Propagacja fal radiowych w telekomunikacji bezprzewodwoej, Wydawnictwa Komunikacji Łączności, Warszawa 2012.
3. T. S. Rappaport, Wireless Communications, Principles and Practice, Prentice Hall PTR, USA 1996

Breakdown of average student's workload

	Hours	ECTS
Total workload	135	5,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	75	3,00