



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Digital communication systems

Course

Field of study

Electronics & Telecommunications

Area of study (specialization)

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/1

Profile of study

general academic

Course offered in

English

Requirements

elective

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

30

Projects/seminars

0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

Prof. dr hab. inż. Krzysztof Wesołowski

Responsible for the course/lecturer:

Instytut Radiokomunikacji, 3 Polanka Str., Room

221

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Prerequisites

A student has a systematic knowledge of mathematical analysis, algebra and theory of probability, he/she has a systematic knowledge, together with necessary mathematical background, of 1D signal theory; this knowledge allows him/her to understand the representation of signals and signal analysis in



time domain and frequency domain, he/she knows and understands basic concepts and methods of description of linear and non-linear electronic systems, control systems and telecommunications systems

Course objective

Getting knowledge of the basics in digital communication systems, digital modulations, and elements of channel coding and speech representation, radio propagation of digital signals in various environments, typical phenomena and distortions.

Course-related learning outcomes

Knowledge

A student has basic knowledge and mathematical foundations in the area of digital communication signals. A student has basic knowledge concerning digital modulations, channel codes, multiple access schemes, propagation of digital signals over radio communication channels.

Skills

A student is able to solve basic problems in the area of signal theory and digital communication systems. A student is able to compare digital radio communication systems and standards, and to select appropriate radio transmission technique or wireless standard in the given propagation and users mobility conditions

Social competences

A student is aware of the necessity of professional approach to technical problems and responsibility for his/her proposed technical solutions. A student feels responsibility related to the designed electronic and telecommunication systems and is aware of the potential threats for other persons or society of improper use of these systems and designs. A student is able to formulate opinions concerning challenges of contemporary radio communications. A student is aware of the impact of radio systems and networks on the information society

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written exam checking the knowledge presented during lectures and trained during tutorials (problem sessions). An exam questionnaire is applied in which four problems to solve are presented. Students write their answers to the stated questions/problems in a supplied questionnaire. Solution of each problem is evaluated in the scale from 0 to 3 points. Exam is approved as passed if a student obtained at least 7 points (out of 12 points). If the number of obtained points is between 5 and 6.5 a student participates in an additional exam round in which he/she solves two additional questions using a similar, supplementary questionnaire. The satisfactory grade is received if the number of obtained points is 7, 7.5 or 8. The grades rise each full obtained point. the "very good" grade is assigned when the number of points is 11.5 or 12. Evaluation resolution is 0.5 point.

Evaluation of learning outcomes of exercises is carried by means of a test that is to be taken at the end of a semester. A few questions span the whole material covered during exercises showing knowledge,



reasoning ability and proficiency in engineering calculations. The grade is given in the range from 2 to 5. Students that obtained 2 are asked to retake the test at the time consulted with the tutor.

Programme content

Lectures:

Recalling basic knowledge in signal theory, orthogonality principle, and probability and random processes. Speech encoding methods applied mostly in radio communications. Elements of digital communication systems: overview of digital modulations, multiple access methods (FDMA, TDMA, CDMA, OFDMA), basic information on block and convolutional codes; radio propagation, fading channels, Doppler phenomenon, mobile radio communication channel modeling, propagation modeling, methods of signal reception, including transmit and receive diversity, basic information on MIMO systems

Exercises:

Exercising on sampling and quantization, repetition codes, illustrating basic features of digital modulations (PSK, QPSK, QAM, OFDM), phenomena and properties of radio communication channels, multipath propagation, calculations of link power budget

Teaching methods

Interactive lecture; besides presentation of the course content the students are asked about possible solutions to active them. After a half of each lecture a short break (3 minutes) is done in which the lecturer changes the topic. Due to specific topic of the lectures the students are often asked about wireless systems operating in their home countries.

Exercises are based on a set of tasks solved by students with support from the teacher. Before solving of each task the teacher explains main problems and refers to appropriate material presented during lectures.

Bibliography

Basic

1. K. Wesolowski, Introduction to digital communication systems, John Wiley & Sons, Chichester 2009
2. K. Wesolowski, Mobile communication systems, John Wiley & Sons, Chichester, 2003,
3. Th. Rappaport, Wireless Communications. Principles & Practice, Prentice Hall 2002

Additional

1. A. Molisch, Wireless Communications, Wiley - IEEE, New York, 2010
2. A. Goldsmith, Cambridge University Press, Cambridge, 2005



Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	70	3,0
Student's own work (literature studies, preparation for tutorials, preparation for tests/exam) ¹	30	1,0

¹ delete or add other activities as appropriate