COURSE DESCRIPTION CARD - SYLLABUS

Course name
Wireless digital transmission [S1MiKC2>BTC]

Course

Field of study
Microelectronics and Digital Communication

Year/Semester
3/5

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

3,00

Coordinators

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Lecturers

Prerequisites

- Has a systematic knowledge of mathematical analysis, algebra and theory of probability - Is able to apply mathematical tools, including mathematical analysis, algebra and probability, to solve problems in the area of ICT, particularly in signal analysis and processing. - Demonstrates the ability to solve problems related to signal analysis in time domain and frequency domain - Knows the limitations of his/her own knowledge and skills, understands the need for further education.

Course objective

- To present the fundamentals of digital communication transmission methods applied in wireless systems which cover baseband signal transmission, digital modulations of a sinusoidal carrier, multicarrier transmission, and transmission of digital signals over wireless channels.

Course-related learning outcomes

Knowledge:

He/she knows the principles of broadcasting, transmission and detection of signals in wired and wireless links, including telecommunications systems, wireless networks and mobile technologies.

Skills:
Is able to apply mathematical tools, including mathematical analysis, algebra and probability, to solve problems in the area of ICT, particularly in signal analysis and processing.

Social competences:
Is able to perform the design tasks in a small engineering team

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired in the lecture is verified by an exam.
Knowledge acquired in the tutorial sessions is verified by written colloqium at the end of the course.
Skills acquired in laboratory classes are verified on the basis of fulfilling tasks assigned in class or project.
The exam passing threshold is minumum 7 points out of 12 points which can be obtained on the basis of written exam consisting of solutions for 4 problems/questions.The point ranges of the subsequent grades are the following. 7 - 8.0 "3", 8.5 - 9.0 "3.5", 9.5 - 10.0 "4.0", 10.5 - 11.0 "4.5", 11.5 - 12.0 "5".
Students who received 5.0 - 6.5 points hava a chance to pass the exam after additional checking.
The final colloquim consists of several tasks (at least 3), which can test both theoretical knowledge and reasoning, as well as computational skills based on problems solved during classes. Each task will be scored depending on the complexity of the problem. The sum of points will determine the final grade: (50%-60%>=3.0, (60%-70>=3.5,(70%-80>= 4.0,(80%-90>= 4.5,(90%-100>=5.0)

Programme content

Digital transmission methods in baseband and using a sinusoidal carrier. Multitone transmission.
Principles of receiving signals with digital modulations used in wireless channels

Course topics

Lectures:
1. Digital baseband transmission - 10h
- Shaping of elementary signals
- Selection of the data symbol format
- Optimal reception of binary and multilevel signals
2. Digital modulations of the sinusoidal carrier - 15h
- Optimal synchronous receiver
- ASK, FSK, PSK, DPSK and QAM modulations
- Selected constant envelope modulations - Continuous Phase Modulation (CPM)
- Multitone transmission - OFDM
3. Digital transmission on wireless channels - 5h
Exercises:
1. PSDs of baseband digital modulation signals - 2h
2. Illustration of different line coding methods - 2h
3. Optimal receiver for binary digital baseband transmission - 2h
4. Multilevel signals in digital baseband transmission - 2h
5. Optimal receiver for signals of digital modulations of the sinusoidal carrier - 2h
6. Average power of signals of digital modulations of the sinusoidal carrier - 2h
7. Design of an OFDM signal - 2h
Laboratories:
1. Construction of Matlab/Simulink models of selected digital transmission systems - 8h
2. Evaluating performance of digital transmission systems in relation to robustness against noise, phase jitter and multipath effects using Matlab/Simulink or laboratory equipment (e.g. USRPs) - 7h

Teaching methods

Lectures with available teaching materials
Tutorial sessions performed in a classroom with some problems to be solved as homework
Construction of block diagrams of wireless digital transmission systems using Matlab/Simulink or

experimenting with lab equipment (USRP, R&S signal analyzer)

Bibliography

Basic:
K. Wesołowski, Podstawy cyfrowych systemów telekomunikacyjnych, WKŁ, Warszawa, 2003
T. P. Zieliński, P. Korohoda, R. Rumian [red.], Cyfrowe przetwarzanie sygnałów w telekomunikacji, PWN, Warszawa, 2014, rozdz. 22 i 23

Additional:
S. Haykin, Systemy telekomunikacyjne, WKL, Warszawa 1998
H. Nguyen, E. Shwedyk, A First COurse in Digital Communications, Cambridge University Press 2009

Breakdown of average student's workload

	Hours	ECTS
Total workload	110	4,00
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)	50	2,00