COURSE DESCRIPTION CARD - SYLLABUS

Course name
Digital communication systems

Course

Field of study
Electronics and Telecommunications
Area of study (specialization)
general
Level of study
First-cycle studies
Form of study
full-time

Year/Semester
3/6
Profile of study
general academic
Course offered in
polish
Requirements
elective

Number of hours

Lecture
30
Laboratory classes
0
Other (e.g. online)
0
Tutorials
15
Projects/seminars
0

Number of credit points

3

Lecturers

Responsible for the course/lecturer:
prof. dr hab. inż. Krzysztof Wesołowski

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Responsible for the course/lecturer:

Prerequisites

Student has a systematic knowledge and is able to solve basic problems in the area of methematical analysis, algebra and probability

Student has ordered and mathematically founded knowledge and is able to solve the problems in the area of the theory of one-dimensional signals necessary for understanding representation and analysis of signals in time and frequency domains

Student knows and understands basic concepts anf methods of linear and nonlinear electronic system description and communication systems

Course objective

Presentation of theoretical foundations of digital communication systems containing baseband transmission, digital modulations of sinusoidal carrier and multitone transmission.

Course-related learning outcomes

Knowledge

He/she has knowledge on the selection of elementary signals and the data symbol formats for baseband transmission, structure of optimal synchronous and non-synsynchronous receivers , digital modulation techniques of single and multicarrier transmission

He/she has knowledge in the area of communications related to criteria and selection of optimum receiver structures for baseband transmission and passband transmission; he/she is able to determine error probability for digital modulations used in channels with additive white Gaussian noise

He/she has basic knowledge on application of the described digital transmission techniques applied in modern and future digital communication systems

Skills

He/she is able to determine basic parameters of signals applied in baseband transmission and passband transmission; he/she is able to determine parameters of digitl communication systems applying these signals

He/she is able to analyze operation of digital signal receivers and to design operation of basic transmisster and receiver blocks in digital signals in digital transmission

Social competences

He/she is abe to notice and formulate direction of future development of digital communication systems both in the basic research aspects and the whole systems

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Final test performed during excercises (tutorials) woth answers evaluated up to 25.5 points. Completion of excercises is done after obtaining at least 13 points. Final test is associated with solution of 4 or 5 problems. Additionally, during excercises entrance tests are organized resulting in additional points. Activity of students during solutions of th problems at the bleckboard is also rewarded.

Written exam covering the topics of lectures and exercises is organized using a special form in which students read the stated problems and write their solutions. The questionnaire contains four problems to be solved. Solution of each of them is evaluated in the range of 0 to 3 points. The exam is considered

passed if a student has obtained at least 7 points. If the number of obtained points is between 5 and 6.5 the student participates in an additional meeting in which he/she solves two supplementary problems according to the same rules. The satisfactory grade is given for 7, 7.5 or 8 points. The grades increase by a subsequent value (3.5, 4, 4.5 and 5) after obtaining each additional point. Granularity of the evaluation is 0.5 point.

Programme content

Lectures:

1. Baseband transmission:

Selection of elementary signal shape due to their spectral properties (power density spectrum), selection of data symbol format (line coding and its representtive examples) and its influence on power density spectrum, optimal reeption of binary and multilevel signals, probability of wrong detection

2. Digital modulations of sinusoidal carrier:

Synchronous reception, optimal non-synchronous reception, overview of digital modulations: ASK, FSK, PSK, QAM, differential encoded modulations, trellis-coded modulations, OFDM multi-tone transmission, selection of OFDM system parameters, rules of calculations of error detection for modulated signals transmitted over AWGN channels, application of Gaussian, Rayleigh and Rice probability densities.

Exercises (tutorials):

1. Pulse amplitude modulation (modulation, demodulation, signal constellations, signal energy)
2. Power density spectra of baseband signals including rasied cosine pulses
3. Optimal receiver for binry baseband transmission
4. Quadrature amplitude modulation (modulation, demodulation, signal contellations, signal energy)
5. Optimal receiver for digitally modulated sinusoidal carrier.
6. Differential encoding for QPSK modulation
7. OFDM signals.

Teaching methods

Lectures in the form of multimedia presentation, illustrated by additional explanations shown on the bleckboard, illustration of the systems in which theoretical solutions are practically applied (case studies); presentation in the form of lecture handuts available to the students in the form of PDF files

Tutorials with solutions of the stated problems

Bibliography

Basic

K. Wesołowski, Podstawy cyfrowych systemów telekomunikacyjnych, Wydawnictwa Komunikacji i Łączności, Warszawa, 2003

Additional

1. S. Haykin, Systemy telekomunikacyjne, t. I i II, Wydawnictwa Komunikacji i Łączności, Warszawa, 1999

2. J. G. Proakis, Digital Communications, wyd. 4, McGraw-Hill, New York, 2000

3. K. Wesołowski, Introduction to Digital Communication Systems, John Wiley & Sons, Chichester, 2009

Breakdown of average student's workload

	Hours	ECTS
Total workload	90	3,0
Classes requiring direct contact with the teacher	55	2,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests/exam, project preparation) [1]	35	1

[1] delete or add other activities as appropriate