COURSE DESCRIPTION CARD - SYLLABUS

Course name
Foundations of telecommunications [S1EiT1E>PT2]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
30

Projects/seminars
0

Number of credit points

5,00

Coordinators

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Lecturers

Prerequisites

Student has a systematic knowledge of mathematical analysis, algebra and theory of probability. He has a detailed, systematic knowledge of the fundamentals of circuit and signal theory. He is able to extract information from literature, databases and other sources. Student demonstrates the ability to solve typical tasks and problems related to analysis of electrical circuits and signal analysis.

Course objective

Presentation of the basic ideas of telecommunications, the techniques and principles that underlie the analysis, design, construction and maintenance of telecommunications systems and networks.

Course-related learning outcomes

Knowledge:
1. Student knows the principles of operation of analog telecommunication systems, including modulation and demodulation techniques.
2. Student knows the principle of operation of digital transmission systems, including baseband transmission, digital modulations, signal transmission in channels, signal reception, forming the spectral properties of signals, countering channel distortions.

3. Student has a detailed, systematic knowledge, together with necessary mathematical background, of the fundamentals of the telecommunication theory, which is necessary to understand, analyze and evaluate the operation of analogue and digital telecommunications systems.
4. Knows about development trends in telecommunication systems.

Skills:
1. Student demonstrates the ability to solve problems related to signal analysis in time domain and frequency.
2. Student is able to measure typical parameters of signals, systems and devices, in particular those used in telecommunication. Is able to choose appropriate methods to measure given electrical quantities and parameters of signals and devices. Is able to plan and perform measurements and analyze the results.
3. Is able to select the construction of devices according to technical requirements and service conditions.

Social competences:
1. Student is aware of the limitations of his/her current knowledge and skills; is committed to further self-study.
2. Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects.
3. Is aware of the main challenges facing modern telecommunication.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Knowledge is verified by a written exam after two semesters. The exam consists of 6-10 questions evaluated using points. Passing threshold: 50% of total points (it may change depending on the difficulty of the questions, how they are scored etc.).
The skills acquired during the classes are verified on the basis of written tests (one test at the end of 3th semester, two tests in 4th semester - one in the middle and one at the end of the semester, evaluated using points, consisting of 4-6 tasks each) and assessment of activity during the exercises. The sum of points accumulated during classes translates into the final grade. Credit threshold: 51% points.
The skills acquired during the laboratory classes (4th semester) are verified on the basis of two written tests (in the middle and at the end of the semester, consisting of 3-5 questions on the subject of the implemented issues) and evaluation of the written reports on the performed exercises. The final grade is the average of the grades for the tests and reports. A prerequisite is to obtain the majority of positive marks for reports and at least one positive mark for tests.

Programme content

Lecture:
1st semester (3th semester of study): Characteristics of telecommunications: social significance, historical perspective. Telecommunication system; information sources and their models and properties; the concept of a signal in telecommunications; basic techniques for transmitting signals over a distance; transmitter and receiver functions; telecommunications channel and its properties; channel models. Representation of analog signals in the time and frequency domain; complex representation of bandpass signals; deterministic and random signals; parameters and properties of random signals. Analog modulations of harmonic carrier: mathematical description of modulation and demodulation processes; implementation of modulation and demodulation processes.
2nd semester (4th semester of study): Pulse modulations: sampling and quantization of signals; pulse-code modulation PCM; quantization noise. Methods of speech coding. Time-division multiplexing and frequency-division multiplexing. Basics of PDH and SDH hierarchy. Digital pulse modulation and digital modulations of harmonic carrier. Representation of digital signals in the time and frequency domain; spectrum of signal and bandwidth of signal; baseband and bandpass transmission; correlation receiver. Examples of the use of digital modulations in modern telecommunications systems.
Classes:
1st semester (3th semester of study): parameters of deterministic signals, spectral analysis of deterministic signals, parameters of random signals, spectral analysis of random signals, complex baseband representation of bandpass signals.

2nd semester (4th semester of study): graphic representation of modulated signals (waveform, spectrum, vector diagrams); mathematical description of AM, DSB-SC, SSB modulation and demodulation processes; parameters of angle modulated signals; noise in frequency modulation; sampling, quantization, PCM modulation, quantization noise.
Laboratory classes (4th semester):
AM modulation and demodulation; DSB-SC modulation and demodulation; SSB modulation and demodulation; FM modulation and demodulation; phase-locked loop in telecommunications systems.

Course topics

none

Teaching methods

1. Lecture: multimedia presentations illustrated with examples and mathematical or graphic descriptions presented on the board.
2. Classes: solving tasks in the field of mathematical description of signals and mathematical description of modulation and demodulation processes of analog and digital signals.
3. Laboratory classes: practical exercises - implementation of modulator and demodulator devices and observation of their function using electronic devices based on the instructions for particular exercises, work in teams.

Bibliography

Basic
1. S. Haykin, Communication Systems, Wiley
2. S. Haykin, M. Moher, Communication Systems, International Student Version, Wiley, 2010
2. B. P. Lathi, Z. Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2010
Additional
1. T. Anttalainen, Introduction to Telecommunications Nework Engineering, Artech House, 1999
2. T. Oeberg, Modulation, Detection and Coding, Wiley, 2001

Breakdown of average student's workload

	Hours	ECTS
Total workload	215	8,00
Classes requiring direct contact with the teacher	155	6,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00