



COURSE DESCRIPTION CARD - SYLLABUS

Course name

Telecommunications systems and services

Course

Field of study

Automatic Control and Robotics

Area of study (specialization)

Vision systems

Level of study

Second-cycle studies

Form of study

full-time

Year/Semester

1/2

Profile of study

general academic

Course offered in

Polish

Requirements

compulsory

Number of hours

Lecture

15

Laboratory classes

15

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

Number of credit points

2

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

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Prerequisites

Knowledge: A student starting this course should have knowledge of the basics of signal theory, signal and information processing, signal compression and coding and computer networks.

Skills: A student should have the ability to use basic methods of signal processing and analysis in the time and frequency domain, digital signal coding (compression, encryption and redundant coding) and the ability to obtain information from the indicated sources. In addition, he or she should also understand the need to expand their competences and be ready to work together as a team.



Social Competences: In addition, in terms of social competences, the student must show such qualities as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, respect for other people.

Course objective

1. To provide students with knowledge of techniques, system construction and design elements of modern telecommunications systems and services.
2. Developing students' skills in solving problems related to the selection of appropriate data transmission techniques with the use of ICT devices.
3. Drawing students' attention to the importance of knowing the standards and recommendations used in telecommunications systems.

Course-related learning outcomes

Knowledge

1. A student has specialist knowledge in the field of remote and distributed systems, real-time systems and network techniques - [K2_W3]
2. He or she understands the methodology of designing specialized analog and digital electronic systems - [K2_W4]
3. A student has knowledge of adaptation systems - [K2_W9]

Skills

1. A student is able to analyze and interpret the design technical documentation and use the scientific literature related to a given problem - [K2_U2]
2. He or she is able to use information and communication techniques - [K2_U8]

Social competences

A student is aware of the need for a professional approach to technical issues, scrupulous reading of the documentation and environmental conditions in which the devices and their components can function - [K2_K4]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Formative assessment:

- a) in the scope of lectures: based on answers to questions about the material discussed in previous lectures,
- b) in the scope of laboratory and design activities: based on the assessment of the current progress of the tasks implementation.

Summative assessment:



a) in the field of lectures, verification of the assumed learning outcomes is carried out by:

- i. assessment of knowledge and skills demonstrated in the multiple-choice written test - 15 test questions, 1 point each and 3 design-problem tasks of 5 points. In total, the student can get 30 points. Rating scale: 0 ... 15 points - unsatisfactory, 16 ... 18 points - sufficient, 19 ... 21 points - sufficient plus, 22 ... 24 points - good, 25 ... 27 points - good plus, 28 ... 30 points - very good,
- ii. discussion of test results,

b) in the field of laboratory classes, verification of the assumed learning outcomes is carried out by:

- i. assessment of the student's preparation for individual laboratory classes ("entry" test) and assessment of skills related to the implementation of laboratory exercises
- ii. evaluation of reports from the performed laboratory exercises
- iii. grading scale for laboratory classes: 0 ... 10 points - unsatisfactory, 11 ... 12 points - sufficient, 13 ... 14 points - sufficient plus, 15 ... 16 points - good, 17 ... 18 points - good plus, 19 ... 20 points - very good,

c) in the field of project activities, verification of the assumed learning outcomes is carried out by:

- i. assessment of knowledge and skills related to the implementation of project tasks
- ii. evaluation and defense by the student reports on the implementation of the project.

Obtaining additional points for activity during classes, in particular for:

- i. discuss additional aspects of the issue
- ii. the ability to cooperate as part of a team practically carrying out a detailed task in the laboratory
- iii. remarks related to the improvement of teaching materials
- iv. identifying students' perceptual difficulties, enabling ongoing improvement of the teaching process.

Programme content

The lecture program covers the following topics:

1. Basic concepts in telecommunications: information sources, telecommunications channels, representation of signals and systems, modulation, transmission codes, digital telecommunications system, telecommunications networks, measure of information, telecommunications traffic, history of telecommunications.
2. Continuous modulations (AM, FM, PM), FDMA frequency multiplication, noise in continuous modulations.
3. Sinusoidal carrier digital modulations: ASK, FSK, PSK, DPSK, QAM, GMSK modulations, TCM trellis coding modulations, techniques of multiple access in telecommunications channels: TDMA, CDMA.



4. Wired transmission: line subscriber unit, telephone exchange tasks, types of signaling, signaling in the analog subscriber line, inter-exchange signaling, numbering, DSL technologies, CATV access systems, fiber-optic access.
5. Wireless transmission: division of radio waves, parameters of terrestrial and satellite antennas, telecommunications law.
6. Bluetooth, ZigBee, WiFi communication modules in automation solutions. Global Positioning System (GPS).
7. Data transmission in cellular networks: the concept of cellular telephony and the basics of its design; organization of radio channels; mobile station and set of base stations, 4G and 5G technologies.
8. Summary.

The program of laboratory classes includes the following issues:

1. AM modulation: generation of amplitude modulated signal, modulation depth coefficient, signal envelope, signal carrier, amplitude modulation of speech signal.
2. FM modulation: generation of phase modulated signal, modulation depth factor, signal carrier, phase modulation of speech signal, spectrum analysis of FM signal, FM signal bandwidth.
3. BPSK modulation: generation of BPSK signals, analysis of block diagrams of circuits for generating these signals, influence of noise on BPSK modulation and demodulation.
4. QPSK modulation: generation of QPSK signals, analysis of block diagrams of circuits for generation of these signals, comparison of QPSK modulation with BPSK, band analysis for transmitting BPSK and QPSK modulated signals.
5. Getting to know Ethernet, XBee, Bluetooth, Wi-Fi, RFID modules dedicated to embedded microprocessor systems.
6. Streaming of audio-video signal: on demand streaming, live streaming, unicast addressing, multicast and broadcast, streamed in a local network using MPEG-2 and MPEG-4 standards, VLC support, use for streaming of TCP, UDP and RTP protocols, comparison of effects; analysis of the impact of computer network load on the quality of the streamed signal, assessment of the use of resources of computers transmitting and receiving the streamed signal.

Teaching methods

1. Lecture: multimedia presentation
2. Laboratory classes: the use of Emona DATEx Telecoms-Trainer 202 modules, simulation tests in Matlab / Simulink environment, communication modules, measuring equipment



Bibliography

Basic

1. S. Haykin, Systemy telekomunikacyjne, cz.1 i 2, Wydawnictwa Komunikacji i Łączności, Warszawa, 2004
2. W. Kabaciński, M. Żal, Sieci telekomunikacyjne, Wydawnictwa Komunikacji i Łączności, Warszawa, 2008
3. K. Wesołowski, Podstawy cyfrowych systemów telekomunikacyjnych, Wydawnictwa Komunikacji i Łączności, Warszawa, 2006.

Additional

1. Annabel Z. Dodd, Essential Guide to Telecommunications, Sixth Edition, Pearson, 2019
2. J. Szóstka, Fale i anteny, Wydawnictwa Komunikacji i Łączności, Warszawa, 2006.

Breakdown of average student's workload

	Hours	ECTS
Total workload	50	2,0
Classes requiring direct contact with the teacher	30	1,0
Student's own work (literature studies, preparation for laboratory classes/tutorials, preparation for tests, project preparation) ¹	20	1,0

¹ delete or add other activities as appropriate