



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Foundations of transmission [S1MiKC1E>PTR]

### Course

Field of study

Microelectronics and Digital Communication

Year/Semester

1/2

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

15

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 is able to extract information from literature, databases and other sources.

### Course objective

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

### Course-related learning outcomes

Knowledge:

Student knows the principles of operation of analog telecommunication systems, including modulation and demodulation techniques.

Student knows the principle of operation of digital transmission systems, including baseband transmission, digital modulations, signal transmission in channels, signal reception, shaping the spectral properties of signals.

Skills:

Student is able to effectively organize individual and team work and cooperate in a group, taking responsibility for the implementation of common tasks.

Student 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.

Student is able to determine the parameters and properties of telecommunication signals and systems in various transmission conditions.

Social competences:

Student knows the limitations of his own knowledge and skills and understands the need for further education.

Student is aware of the need for a professional approach to solving technical problems and taking responsibility for the technical solutions he proposes.

Student is able to formulate opinions on the fundamental challenges facing modern electronics and telecommunications.

## Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge is verified by a written exam. The exam consists of 6-10 questions evaluated using points.

Passing threshold: 50% of total points (e.g. for total 20 points: 10 points - 3.0, 12 points - 3.5, 14 points - 4.0, 16 points - 4.5, 18 points - 5.0).

The skills acquired during the tutorials are verified on the basis of written tests (one in the middle and one at the end of the semester, evaluated using points, consisting of 3-6 tasks each) and assessment of activity during the exercises. The sum of points accumulated during classes translates into the final grade. Credit threshold: 50% points (e.g. for total 20 points: 10 points - 3.0, 12 points - 3.5, 14 points - 4.0, 16 points - 4.5, 18 points - 5.0).

The skills acquired during the laboratory classes 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 necessary condition is to complete all laboratory exercises, obtain a majority of positive grades for reports and at least one positive grade for tests.

## Programme content

Basic concepts: analog and digital transmission systems; information sources, information source model, transmission media, communication channel, noise and interference in the channel and their properties.

Transmission limitations caused by channel parameters.

Matching the signal spectrum to the channel properties; analog modulations.

Pulse modulations PAM, PWM (PDM), PPM, methods of pulse signals generation.

Pulse-code modulation PCM.

Multiplexing methods (FDM, TDM, CDM, WDM).

Line codes.

The process of transmitting the user signal in a telecommunications network, the access layer and the transport layer, error detection, parameters of transport layer signals, e.g. BER error rate, timing recovery, jitter, wander, elimination of digital signal contamination, regeneration of signal.

Hierarchies of transport systems (SDH, NG-SDH, OTH).

## Course topics

Transmission system and its components (2 h)

Communication channel properties (2 h)

Noise and interferences in the channel and their properties (2 h)

Signal spectrum (4 h)

Analog modulations (4 h)

Pulse modulations (2 h)

Pulse-code modulation (2 h)

Digital modulations (2 h)

Multiplexing methods (2 h)

Transmission codes (2 h)

Signal transmission through telecommunication network (2 h)

Access layer (2 h)  
Hierarchies of transport systems (2h)

### Teaching methods

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

### Bibliography

Basic:

1. S. Haykin, Systemy telekomunikacyjne, WKiŁ, Warszawa, 2004
2. B. P. Lathi, Z. Ding, Modern Digital and Analog Communication Systems, Oxford University Press, 2010
3. S. Kula, Systemy teletransmisyjne, WKiŁ, Warszawa, 2004

Additional:

1. S. Haykin, M. Moher, Communication Systems, International Student Version, Wiley, 2010
2. T. Anttalainen, Introduction to Telecommunications Network Engineering, Artech House, 1999
3. K. Wesołowski, Podstawy cyfrowych systemów telekomunikacyjnych, WKiŁ, Warszawa, 2003

### Breakdown of average student's workload

	Hours	ECTS
Total workload	135	5,00
Classes requiring direct contact with the teacher	75	3,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00