COURSE DESCRIPTION CARD - SYLLABUS

Course name
Synchronization of devices and ICT networks [S1Teleinf1>SUiST]

Course

Field of study
Teleinformatics

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
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

A student attending this course should have basic knowledge of the fundamentals of telecommunications, telecommunications networks, computer networks, and cellular telephone systems. He should have the ability to design ICT networks and the ability to obtain information from the indicated sources. The student should present such attitudes as honesty, responsibility, perseverance, cognitive curiosity, creativity, personal culture, and respect for other people in terms of social competencies.

Course objective

1. Provide students with knowledge about the sources of timing signals, methods of network synchronization, and methods of assessing the quality of synchronization of ICT networks. 2. Educating students on the ability to design a synchronization network and the ability to detect and respond to failures of a synchronization network. 3. Shaping students' skills in acquiring knowledge about currently implemented solutions in the field of telecommunications and ICT.

Course-related learning outcomes

Knowledge:
Has a structured, detailed knowledge of the basics of telecommunications theory necessary to

understand, analyze and evaluate the operation of synchronization methods in modern digital ICT networks. Knows the basic principles of operation of synchronization systems at the link and network level. Has basic knowledge of clock signals and time and frequency signal distribution systems in ICT networks.

Skills:
Can define the basic parameters and properties of synchronization signals and network synchronization systems, as well as design a synchronization subsystem for simple wired and wireless networks. Can ensure network synchronization and supervise their work, and use synchronization technologies that enable safe data transmission in ICT networks.

Social competences:
Notices changes resulting from technological progress and understands the need to learn about new standards of ICT networks. Has a sense of responsibility for the designed ICT systems and is aware of social risks in the event of inadequate design or implementation.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The knowledge acquired during the lecture is verified by assessing the knowledge shown in the final test. Checking the knowledge consists in giving a written answer to 5 questions. Final topics, on the basis of which the questions are developed, are available to students using the university's remote learning platform. To receive a grade of 3.0, it is necessary to score at least half of the points.
In the laboratory, verification of the assumed learning outcomes is carried out by continuous assessment: oral answers to questions asked during the laboratory exercises, written reports on the exercises, and the assessment obtained from the test summarizing laboratory exercises.

Programme content

Lectures:
1. Introduction (2 hours).
2. Phase-locked loop for continuous and discrete signals (2h).
3. Model and parameters of the synchronization signal (2 hours).
4. Sources of time and frequency signals (2h).
5. Assessment of the quality of device synchronization (2 hours).
6. Synchronization based on the Ethernet network (2 hours).
7. Synchronization in wireless networks (2 hours).
8. Final test (1 hour).

Lab:
1. Sources of the timing signal (4 hours).
2. Sources of the synchronization signal (4 hours).
3. Measurement of device synchronization quality (6 hours).
4. Final test of the laboratory (1 hour).

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4. Sources of time and frequency signals (2h).
5. Assessment of the quality of device synchronization (2 hours).
6. Synchronization based on the Ethernet network: SyncE, PTP, White Rabbit (2 hours).
7. Synchronization in wireless networks: synchronization in 5G/6G networks (2 hours).
8. Final test (1 hour).

Lab:
1. Timing signal sources: digital phase-locked loop (4 hours).
2. Sources of the synchronization signal: NTP, PTP, GNSS (4 hours).
3. Measurement of device synchronization quality: time deviation, Allan deviation, TE/TIE/MTIE (6 hours).
4. Final test of the laboratory (1 hour).

Course topics

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Teaching methods

Lecture: multimedia presentation, supplemented with current examples and additional explanations on the whiteboard.
Laboratory: solving tasks/problems with the active support of the teacher.

Bibliography

Basic:
A. Dobrogowski, Sygnał czasu, Wydawnictwo PP, Poznań, 2003.
Recommendations ITU-T G.810, ITU-T G.8261, ITU-T G.8262, ITU-T G.8264, ITU-T G.781.
Standards IEEE802.3, IEEE 1588-2008.

Additional:
Fuyun Ling, Synchronization in Digital Communication Systems, Cambridge University Press, 2017.
Massoud Salehi, John Proakis, Digital Communications, McGraw-Hill Education, 2007.
Breakdown of average student's workload
Hours ECTS
Total workload 56 3.0
Classes requiring direct contact with the teacher 30 2.0
Student’s own work (preparation for tests, preparation for laboratory 26 1.0
classes, literature studies)

Breakdown of average student's workload

	Hours	ECTS
Total workload	56	3,00
Classes requiring direct contact with the teacher	30	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	26	1,00