COURSE DESCRIPTION CARD - SYLLABUS

Course name
Wireless Networks and Systems [S1Cybez1>SiSB]

Course

Field of study
Cybersecurity

Year/Semester
2/4

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
24

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowledge of mathematical methods at a level enabling the fluent use of both basic and advanced mathematical tools (including the ability to efficiently work with formulas, equations, and algebraic transformations). Basic skills in mathematical modeling, covering the construction of models that describe phenomena and processes, as well as understanding the relationships between variables and interpreting them in the context of practical problems.

Course objective

The aim of the subject "Wireless networks and systems" is to provide theoretical and practical knowledge about the design, operation and security of modern wireless networks. Students will acquire skills in analyzing, configuring and optimizing wireless systems in various applications.

Course-related learning outcomes

Knowledge:

• Understands the fundamental principles of radio wave propagation as well as modulation and transmission techniques used in wireless networks. [K1_W02]
• Comprehends the architecture and operational principles of modern wireless networks, including WLAN and cellular systems such as 4G/5G.[K1_W07]
• Possesses knowledge of frequency spectrum management and legal regulations related to the operation of wireless networks.[K1_W21]
• Is familiar with threats and security mechanisms used in wireless networks, as well as methods of protection against attacks.[K1_W10]
• Understands interference analysis methods and the impact of disturbances on connection quality in wireless networks.[K1_W02]
• Is aware of the latest trends and developments in wireless technology and their applications across various industries. [K1_W20]

Skills:
• Can plan and configure wireless networks, taking into account performance and security requirements. [K1_U11]
• Uses tools for signal spectrum analysis, throughput measurement, and troubleshooting in wireless networks. [K1_U04]
• Is able to implement and test various WLAN operating modes, such as Multi SSID and WDS. [K1_U03]
• Can design and conduct tests related to interference and security of cellular networks. [K1_U02]

Social competences:
• Is aware of the importance of security and the ethical use of wireless technologies. [K1_05]
• Understands the need for continuous improvement of skills in the field of wireless networks and systems. [K1_01]
• Is aware of the impact of wireless technologies on societal development, as well as issues related to privacy and cybersecurity. [K1_03]

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture credit is based on an exam, requiring 51% of the total possible points to pass.
Laboratory credit is based on submitted reports and a test conducted during the final session, which also requires 51% of the total possible points to pass.

Programme content

The course "Wireless Networks and Systems" covers topics related to the design, operation, and security of modern wireless technologies. The lectures address the basics of radio wave physics, signal propagation, and modulation and transmission techniques used in networks. Topics such as network architecture, security, frequency spectrum management, and standards like WLAN and 4G/5G cellular systems are also discussed. Students gain knowledge in wireless network planning, interference analysis, and future technological trends. Laboratory sessions focus on practical aspects, such as device configuration, signal spectrum analysis, throughput measurements, network operation in Multi-SSID and WDS modes, as well as cellular network design and disruption.

Course topics

Lecture Topics:
1. Introduction to wireless networks and systems
2. Physics of radio waves and signal propagation
3. Modulation and transmission techniques in wireless networks
4. Wireless network architecture
5. Wireless network security and security protocols
6. Wireless network planning and design
7. Spectrum management and interference handling
8. Wireless network standards (WLAN)
9. Higher layers of wireless networks
10. Cellular systems and 4G/5G networks
11. Military and industrial technologies in defense systems

12. The future of wireless networks
Laboratory Topics:
1. Disruption of cellular networks
2. Spectral aspects of wireless systems
3. Cellular network design
4. Beamforming in wireless systems
5. Signaling in cellular networks
6. Wireless signal propagation
7. Configuration of access point parameters
8. WLAN operation in Multi-SSID mode, using VLAN techniques to isolate WiFi networks
9. Configuration of a wireless network controller
10. Operation in WDS (Wireless Distribution System) mode
11. Measurement of maximum throughput in 802.11 radio link
12. Observation and analysis of radio signal spectrum in the 802.11 wireless network band

Teaching methods

Lecture: informative lecture with interactive elements, demonstration experiment (showcase), Group discussion, case study;
Laboratory sessions: practical experiment, group discussion on results, case study, short lecture combined with exercises;

Bibliography

Basic:
1. K. Wesołowski, Podstawy cyfrowych systemów telekomunikacyjnych , WKŁ, 2006
2. R. Katulski, Propagacja fal radiowych w telekomunikacji bezprzewodwoej, WKŁ. 2024

Additional:
1. K. Wesołowski, Systemy radiokomunikacji ruchomej, WKŁ. 2006

Breakdown of average student's workload

	Hours	ECTS
Total workload	109	4,00
Classes requiring direct contact with the teacher	54	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	55	2,00