COURSE DESCRIPTION CARD - SYLLABUS

Course name

PO 2.3.2 Technologie mobilne przyszłych generacji - EC 2.3.2 Next generation mobile technologies

Course

Field of study
Teleinformatics

Year/Semester
1/2

Area of study (specialization)

Profile of study
general academic

Level of study
second-cycle studies

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other (e.g. online)

Tutorials
0

Projects/seminars
0/0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

dr hab. inż. Adrian Kliks, prof. PP
Faculty of Computing and Telecommunications, Institute of Radiocommunications, email: adrian.kliks@put.poznan.pl, phone: +48 61 665 3813

Responsible for the course/lecturer:

Prerequisites

Student:

- Has basic knowledge of the most important standards, architecture, and operation of wireless local networks and radio access methods
- Can define the basic parameters and properties of signals and telecommunication systems with imposed restrictions
- Can compare radio transmission systems and standards and select the appropriate transmission method or wireless standard in specific transmission conditions and with specific user mobility
- He knows the limitations of his knowledge and skills, understands the need for further training
- Can formulate opinions on the fundamental challenges faced by contemporary radiocommunication systems, is aware of the impact of such systems on shaping the information society

Course objective

Discussion of the latest achievements and prospects for the development of future generations of mobile technologies, in particular, cellular systems (e.g., 5G, 6G), systems for the so-called smart cities (e.g., V2X, ITS, NB-IoT, LoRa), along with new transmission and system management techniques taking into account the aspects of virtualization, artificial intelligence, and contextual data processing.

Course-related learning outcomes

Knowledge

Student:
- has structured knowledge in the field of information transfer and processing from the perspective of future generations of mobile systems
- understands the principles of designing mobile systems depending on the application guidelines for these systems
- knows the principles of target selection of mobile wireless networks from the point of view of maximizing computing and energy efficiency

Skills

Student:
- can evaluate and compare the operation of mobile systems depending on the requirements
- knows how to estimate and assess the impact of wrongly selected resources (energy, computing power) from the point of view of the reliability of the mobile system
- can make a justified selection of a mobile network for given application conditions
- is able to gain knowledge in the field of the latest solutions in the field of mobile telecommunications

Social competences

Student:
- understands the importance of the need to constantly acquire knowledge in the field of the latest telecommunications solutions
- has a sense of responsibility for the implementation of the mobile network project and its importance for the environment and man
- understands the importance of wireless mobile systems for the development of the information society

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

The condition for passing the content of the lectures is a positive assessment of the theoretical exam covering the content presented in the lecture in the form of, for example, a test with problematic and descriptive questions. Complement laboratory tasks are required to pass the laboratory exercises; it is also possible that a colloquium will be organized to support laboratory evaluation. Students' activity during classes will also be taken into account for the final assessment, especially in the context of promoting active participation.
Passing the lecture will occur if at least 50% of the issues presented in the exam are correctly discussed. Similar rules apply to passing individual laboratory tasks and a test.

A grading scale was adopted: very good (A) - 5.0; good plus (B) - 4.5; good (C) - 4.0; sufficient plus (D) - 3.5; satisfactory (E) - 3.0; insufficient (F) - 2.0

Programme content

Lecture:
1. Summary of the current knowledge in mobile wireless systems.
2. Presentation of the development of cellular networks
3. Discussion of the concept of Cloud-RAN, MEC, network slicing, and FOG computing
4. Discussion of the concept of cell densification (Small cells) and offloading traffic to other networks
5. Presentation of modern solutions within mobile wireless systems, especially in relation to the so-called smart cities
6. Presentation of the concept of using rich contextual data
7. The Open RAN concept

Laboratory: a set of exercises adapted to the content presented in the lecture, allowing you to acquire the skills assigned to this module

Lecture:
1. Summary of the current knowledge in mobile wireless systems.
2. Presentation of the development of cellular networks, in particular: discussion of the development of 4G, 5G, and 6G systems architecture, discussion of selected solutions from the L1, L2, and L3 layers, discussion of MIMO and MMIMO techniques, discussion of the concept of relay stations, discussion of resource allocation algorithms
3. Discussion of the concept of Cloud-RAN, MEC, network slicing, and FOG computing
4. Discussion of the concept of cell densification (Small cells) and offloading traffic, including the concept of convergence of cellular networks and wireless local networks
5. Presentation of modern solutions within mobile wireless systems, especially concerning the so-called smart cities, e.g., solutions from the ITS / V2X family (e.g., DSRC, C-V2X), communication with UAV (drones), systems for the needs of smart grid, e-health, smart metering, LoRa, NB-IoT
6. Presentation of the concept of using rich contextual data
7. The Open RAN concept

Laboratory: a set of exercises adapted to the content presented in the lecture, allowing one to acquire the skills assigned to this module

Teaching methods

The lecture will be conducted in the form of both lectures and conversations with elements of the discussion. Laboratories set up work in groups to carry out selected component tasks

Bibliography

Basic

- S. Sesia, I. Toufik, M. Baker (eds.), LTE: The UMTS Long Term Evolution: From Theory to Practice, Chichester, 2010
- E. Dahlman, S. Parkvall, J. Skold, "5G NR: The next generation wireless access technology", Acedemic Press Elsevier, London, 2018
- P. Marsch, O, Bulkaci, O. Queseth, M. Boldi, "5G Systems Design. Architectural and Functional Considerations and Long Term Research", Wiley, 2018

Additional

- A. Sendin, et al., "Telecommunication Networks for the Smart Grid", Artech House, London, 2016
- M. Kleppmann, "Designing Data-Intensive Applications", O'Reilly, Boston, 2017

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4.0
Classes requiring direct contact with the teacher	64	3.0
Student's own work (preparation for tests, preparation for laboratory classes, preparation for exam, literature studies)	56	1.0