COURSE DESCRIPTION CARD - SYLLABUS

Course name
Wireless Programmable Systems [S1MiKC1E>BSP]

Course

Field of study
Microelectronics and Digital Communication

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

The student has knowledge of the design and architecture of programmable digital systems and the possibilities of their practical applications. The student has knowledge of modern mobile radio communication systems and modern communications technologies used in these systems. Student has knowledge about the rules for creating software for communication systems. XD

Course objective

To familiarize students with the possibilities of using SDR platforms to create a software-defined wireless device, cognitive radio, and the resulting application challenges in the software and hardware layer.

Course-related learning outcomes

Knowledge:
1. Understands the concept of open and programmable wireless networks, understands the methodology of their design and program description
2. Knows and understands the algorithms used in open, wireless teleinformatic systems
3. Knows and understands advanced artificial intelligence methods used in the design of open and programmable wireless networks

4. Has knowledge of development trends in the field of wireless telecommunications
5. Has knowledge of selected issues of copyright and industrial property protection from the perspective of providing applications for open systems

Skills:
The student is able to configure the selected software-defined radio platform using software.
Is able to work individually and in a team to propose algorithms for open and programmable wireless networks, and is also able to assess the time-consuming nature of the task
Is able to assess the usefulness and possibility of using new achievements in wireless telecommunications techniques, especially innovative solutions
Is able to assess the changing legal and social environment from the perspective of the development of open wireless networks

Social competences:
The student understands the need for responsible use of flexible, program-defined solutions for the purposes of future ICT systems - knowing their potential, he or she understands the social threats arising from them.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Knowledge acquired during the lecture is verified by a written or oral test. It consists of several open questions (typically 4-5) from the list of provided issues, scored differently. The pass threshold is 50% of points. Skills acquired during laboratory classes are verified by completed exercises, tasks and mini-projects. At least 50% of the maximum number of points is required.
Grading scale: <50% - 2.0; 50% to 59% - 3.0; 60% to 69% - 3.5; 70% to 79% - 4.0; 80% to 89% - 4.5; 90% to 100% - 5.0.
XD

Programme content

The course focuses on issues related to software-defined radio (SDR) systems, cognitive radio and open networks.

Course topics

Lecture:
1. (Class 1) Introduction: Software Defined Radio, SDR, Definitions, Motivations for SDR, Desired Features of Radios, Key Technical Challenges,
2. (Class 1) Conventional and Ideal Radio Architectures, Practical Architectures, Key Challenges
3. (Class 2) SDR RF Front-End and Transceiver Antenna Requirements
4. (Class 2) Basic Hardware and Software Modules in SDR
5. (Class 3-4) Cognitive Radio (CR), Features, Definitions, Challenges
6. (Class 5) Sensing, Learning and Adaptation in CR
7. (Class 5) CR Hardware Platforms
8. (Class 6) OpenRAN - OpenRAN, Technology and Challenges
Assessment will be scheduled to the last meeting
Labs
1. SDR Transceiver Hardware Architecture (2 classes)
2. SDR Software Platform Programming (1 class)
3. Universal Software Radio Platform (USRP) (4 classes - till the end)

Teaching methods

The traditional form will be used as the basis for presenting lecture content, where presentations will be displayed using a projector. However, interactive approaches will also be implemented, in which problem-based lectures and discussions will be used. Laboratory exercises: practical exercises in groups, using physical network devices and virtual environments

Bibliography

Basic:
E. Hossein, D. Niyato, Z. Han, Dynamic Spectrum Access and Management in Cognitive Radio Networks, Cambridge University Press, Cambridge, UK, 2009
Wei Zhang, "Handbook of Cognitive Radio", Springer Nature Link, 2019
XD
Wim Rouwet, "Open Radio Access Network (O-RAN) Systems Architecture and Design", Academic Press, 2022

Additional:
1.Shao Ying Zhu, Sandra Scott-Hayward, Ludovic Jacquin, Richard Hill: Guide to Security in SDN and NFV -
Challenges, Opportunities, and Applications. Computer Communications and Networks, Springer 2017.
A.M. Wygliński, M. Nekovee, Y.T. Hou, (ed.) Cognitive Radio Communications and Networks. Principles and Practice, Elsevier Academic Press, USA 2010
Paul Goransson, "Software Defined Networks: A Comprehensive Approach", Morgan Kaufmann Public Inc, 2016

Breakdown of average student's workload

	Hours	ECTS
Total workload	60	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	30	1,00