COURSE DESCRIPTION CARD - SYLLABUS

Course name
Software defined and cognitive radio [S2EiT1E-TIT>SRK]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/3

Area of study (specialization)
Information and Communication Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
English

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
15

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

A student has knowledge of the design and architecture of programmable digital circuits and the potential of their practical applications A student has knowledge of the contemporary mobile radio communication systems and modern technologies applied in these systems

Course objective

Understanding the basics and key challenges of programmable radio systems, cognitive radio and dynamic spectrum access methods; Implementation of the software defined radio system

Course-related learning outcomes

Knowledge:
A student has deep knowledge of the design and architecture of programmable digital circuits and the potential of their practical applications in software defined and cognitive radio
A student has advanced knowledge of the contemporary mobile radio communication systems and modern technologies applied in these systems

Skills:

A student is able to use programmable integrated circuits and microcontrollers for the implementation of projects in electronics and telecommunications
A student can do the calculations and use the apropriate software for the design and analysis of the advanced digital signal processing circuits

Social competences:
A student understands the meaning of information society for successful development of the country
A student is able to formulate opinions concerning key challenges of electronics and telecommunications in XXI century.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Typically written exam on the content of the lectures (open questions), but test-form is also possible. Moreover, if necessary an oral exam is also feasible
For technical module (project) - veryfication of the solution for the stated software design problem and practical implementation of selected sofware radio functions.
In both cases, in order to pass at least 51% of possible points have to be collected by the student.
Typical grade scale is applied, i.e. <= 50% 2.0; 51%-60% 3.0; 61%-70% 3.5; 71%-80% 4.0; 81%-90% 4.5; 91%-100% 5.0

Programme content

The course focuses on the software defined radio (SDR) systems and cognitive radio.

Course topics

Lecture:
1. Introduction: Software Defined Radio ? SDR, definitions, motivations for SDR, desired radio transceiver features, key technical challenges,
2. Conventional and ideal architecture of a radio transceiver, practical architectures, key challenges
3. Requirements of the SDR RF front-end and of the transmission and receiving antennas
4. Analog-to-digital conversion problems and digital IF conversion in SDR
5. Key hardware components for digital signal processing, properties of digital signal processors
6. Basic software modules in SDR
7. Pobieranie oprogramowania (Software download),
8. Development of SDR in the direction of Cognitive Radio (CR), CR features, definitions
9. Sensing, learning and adaptation in CR
10. CR hardware platforms,
11. Preferable CR transmission technologies, protection of primary (licensed) users
12. Decision making in CR- optimization theory, game theory.

Project:
1. Hardware architecture of an SDR transceiver
2. Programming of SDR software platform
3. GNU Radio
4. Universal Software Radio Platform (USRP)

Teaching methods

In most cases, traditional lecture form will be applied, where presentations are displayed by means of a beamer. However, interactive approaches will be also realized, where problem-based lectures and discussion will be applied. For the project, both independent (self) and group work will be applied to solve provided project-topics.

Bibliography

Basic
E. Hossein, D. Niyato, Z. Han, Dynamic Spectrum Access and Management in Cognitive Radio Networks, Cambridge University Press, Cambridge, UK, 2009
Additional

A.M. Wygliński, M. Nekovee, Y.T. Hou, (ed.) Cognitive Radio Communications and Networks. Principles and Practice, Elsevier Academic Press, USA 2010

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	58	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	42	2,00