COURSE DESCRIPTION CARD - SYLLABUS

Course name
Programmable and cognitive radio systems [S2EiT1-TMiB>SRPiK]

Course

Field of study
Electronics and Telecommunications

Year/Semester
2/3

Area of study (specialization)
Mobile and Wireless Technologies

Profile of study
general academic

Level of study
second-cycle

Course offered in
polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
15

Number of credit points

4,00

Coordinators

dr hab. inż. Adrian Kliks prof. PP
adrian.kliks@put.poznan.pl

Lecturers

Prerequisites

The student has a well-established knowledge of wireless communication (radiocommunication), cellular networks, and propagation of signals through various transmission channels; has a structured and advanced knowledge of modern mobile radiocommunication systems and modern techniques used in them

Course objective

The aim of the course is to provide students with knowledge and skills in the field of operating principles and basic challenges for programmable and cognitive radio systems, as well as in the field of dynamic access to the transmission medium and the implementation of the programmable radio system.

Course-related learning outcomes

Knowledge:
Has knowledge of the construction and architecture of programmable digital circuits and the possibility of their practical use; has a structured and advanced knowledge of modern mobile radiocommunication systems and modern techniques used in them, with particular emphasis on the techniques of programmable and cognitive radio.

Skills:
Student an use available software platforms (e.g. USRP), including programmable integrated circuits and microcontrollers, during the implementation of projects in the field of electronics and telecommunications; can perform typical calculations and use appropriate software to design and analyze the operation of advanced digital signal processing systems

Social competences:
The student understands the need to learn about the emerging new solutions in the field of wireless communication; understands the challenges facing radiocommunication caused by the growing demand for speed and quality of transmission; can formulate opinions on the basic challenges faced by modern electronics and telecommunications

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
The knowledge acquired during the lecture is verified through a written (and / or oral) exam consisting of several larger or a dozen short questions, usually descriptive; the questions are of varying difficulty, with a different number of points assigned to them. Passing threshold - 50% of possible points. The following rating scale is used: <= 50% 2.0; 51% -60% 3.0; 61% -70% 3.5; 71% -80% 4.0; 81% -90% 4.5; 91% -100% 5.0. Exam issues, on the basis of which the questions are developed, will be sent to students by e-mail using the university"s e-mail system.
The skills acquired during the project classes are verified on the basis of partial assessments of the results obtained in the design laboratory, as well as on the basis of the implementation of a joint project of several people in the field of programmable radio. Partial assessments of the results of work in the laboratory will take into account the student"s involvement in the implementation of the project task.
The evaluation for the group project will be based on the prepared report. The final grade takes into account all the partial grades obtained, as well as the student"s commitment and attitude during the classes.

Programme content

554/5000
Lecture:
1. Introductory issues: the idea of Software Defined Radio (SDR), definitions, the need to use SDR technology, desirable features of transmitting and receiving devices, main technical goals
2. Traditional and ideal hardware architecture of the transmitting and receiving system, intermediate practical solutions, the latest research directions
3. Requirements and solutions for radio frequency (RF) front-end in transmitting and receiving systems
4. Problems of analog-to-digital conversion and digital implementation of IF modulation in SDR
5. Basic hardware components of digital signal processing (hardware), properties of signal processors
6. Basic programmable radio software modules
7. Software download
8. Development of programmable radio technology towards Cognitive Radio (CR), CR features, definitions
9. Problems of unused radio resources detection, learning and adaptation in CR
10. CR hardware platforms
11. Transmission technologies specific to CR, protection of licensed users
12. Decision making - application of optimization theory and game theory in CR
Project:
1. Practical introduction to the hardware architecture of the SDR chip
2. Programming SDR systems within the selected software and hardware platform as well as programming tools (e.g. for the GNU Radio environment)
3. Implementation of a group project in the field of programmable radio

Teaching methods

1. Lecture: multimedia presentation prepared by the teacher, illustrated with examples given on the blackboard. The lecture is usually conducted in a traditional way, but also partly in the form of a seminar and / or problem lecture

2. Project classes: carrying out project tasks indicated by the teacher, both individual tasks (in the first part of the project) and in a group (the second part of the project).

Bibliography

Basic
1. H. Bogucka, Technologie radia kognitywnego, Wydawnictwo naukowe PWN, Warszawa 2013.
Additional
1. E. Hossein, D. Niyato, Z. Han, Dynamic Spectrum Access and Management in Cognitive Radio Networks, Cambridge University Press, Cambridge, UK, 2009
2. 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