STUDY MODULE DESCRIPTION FORM

Name of the module/subject		Code
Software Defined and Cognitive Radio		**1010812131010812441**
Field of study: **Electronics and Telecommunications**	Profile of study (general academic, practical): **general academic**	Year /Semester: **2 / 3**
Elective path/specialty: **Radio Communications**	Subject offered in: **Polish**	Course (compulsory, elective): **elective**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time): **full-time**	
No. of hours: Lecture: **2** Classes: **-** Laboratory: **-** Project/seminars: **1**		No. of credits: **3**
Status of the course in the study program (Basic, major, other): **major**	(university-wide, from another field): **from field**	
Education areas and fields of science and art: **technical sciences** **Technical sciences**		ECTS distribution (number and %): **3 100%** **3 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	A student has knowledge of the design and architecture of programmable digital circuits and the potential of their practical applications(K2_W02); A student has knowledge of the contemporary mobile radio communication systems and modern technologies applied in these systems (K2_W06)
2	**Skills**	A student is able to easily communiate in English, to discuss professional issues in English, to read professional literature in English (books, technical and scientific journals, ppliction notes,catalogues, instructions, norms, etc.) (K2_U01); A student is able to choose approprite numerical methods and computer simulation methods to complete typical tasks associated with the analysis, design and optimisation of systems and calculations in telecommunications (K2_U09)
3	**Social competencies**	A student is able to be a leader of the group of collaborators, and to direct a small team (K2_K01).

Assumptions and objectives of the course:

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

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. 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; - [K2_W02]

2. A student has advanced knowledge of the contemporary mobile radio communication systems and modern technologies applied in these systems. - [K2_W06]

Skills:

1. A student is able to use programmable integrated circuits and microcontrollers for the implementation of projects in electronics and telecommunications; - [K2_U04]

2. A student can do the calculations and use the apropriate software for the design and analysis of the advanced digital signal processing circuits. - [K2_U12]

Social competencies:

1. A student understands the meaning of information society for successful development of the country; - [K2_K02]

2. A student is able to formulate opinions concerning key challenges of electronics and telecommunications in XXI century. - [K2_K07]

Assessment methods of study outcomes

Written exam on the content of the lectures (open questions);
Solution of the stated software design problem and practical implementation of selected sofware radio functions.

Course description

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)

Basic bibliography:

1. H. Bogucka, Technologie radia kognitywnego, Wydawnictwo naukowe PWN, Warszawa 2013

Additional bibliography:

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

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in project classes	15
3. Individual study, literature study, consultations with the lecturer	15
4. Team work on the project, consultations	15

Student's workload

Source of workload	hours	ECTS
Total workload	80	3
Contact hours	50	2
Practical activities	30	1