

<b>STUDY MODULE DESCRIPTION FORM</b>		
Name of the module/subject <b>Design of RF Circuits</b>		Code <b>1010811161010843663</b>
Field of study <b>Electronics and Telecommunications</b>	Profile of study (general academic, practical) <b>general academic</b>	Year /Semester <b>3 / 6</b>
Elective path/specialty <b>Radio Communications</b>	Subject offered in: <b>Polish</b>	Course (compulsory, elective) <b>elective</b>
Cycle of study: <b>First-cycle studies</b>	Form of study (full-time, part-time) <b>full-time</b>	
No. of hours Lecture: <b>2</b> Classes: <b>1</b> Laboratory: <b>-</b> Project/seminars: <b>-</b>		No. of credits <b>3</b>
Status of the course in the study program (Basic, major, other) <b>other</b>		(university-wide, from another field) <b>from field</b>
Education areas and fields of science and art <b>technical sciences</b>		ECTS distribution (number and %) <b>3 100%</b>
<b>Responsible for subject / lecturer:</b>  eng. Jarosław Szóstka, Ph.D. email: szostka@et.put.poznan.pl tel. 616653895 of Electronics and Telecommunications ul. Polanka 3		
<b>Prerequisites in terms of knowledge, skills and social competencies:</b>		
1	<b>Knowledge</b>	K1_W06 K1_W07 K1_W08
2	<b>Skills</b>	K1_U09
3	<b>Social competencies</b>	brak
<b>Assumptions and objectives of the course:</b> Learning of operation principle, design rules, methods of measurements and construction of RF electronic circuits		
<b>Study outcomes and reference to the educational results for a field of study</b>		
<b>Knowledge:</b>		
1. Has a wide, systematic knowledge of the properties and characteristics of electronic components, as well as of construction, analysis and design of electronic circuits. - [K1_W08]		
2. Has a systematic knowledge, together with necessary mathematical background, of the fundamentals of metrology, which is necessary to measure the signal properties and the parameters of electronic and telecommunication systems components. Has knowledge of measurement methods, measurement equipment and computerized measurement systems. - [K1_W18]		
<b>Skills:</b>		
1. Is capable of studying autonomously. - [K1_U05]		
2. Is able to use catalogues, find required information from application notes of semiconductor elements and electronic circuits, select appropriate elements and electronic circuits. - [K1_U12]		
3. Is able to identify a problem and formulate a design specification of a simple analogue electronic circuit. Is able to design and implement a simple analogue electronic circuit. - [K1_U12]		
4. Is able to measure typical parameters of signals, systems and devices, in particular those used in telecommunication. Is able to choose appropriate methods to measure given electrical quantities and parameters of signals and devices. Is able to plan and perform measurements and analyze the results. - [K1_U17]		
5. Can implement the occupational health and safety principles. - [K1_U27]		
<b>Social competencies:</b>		

1. Is aware of the limitations of his/her current knowledge and skills; is committed to further self-study. - [K1\_K01]  
 2. Demonstrates responsibility and professionalism in solving technical problems. Is able to participate in collaborative projects. - [K1\_K02]

**Assessment methods of study outcomes**

1. Final written exam (theory, analysis and design of chosen RF circuits)  
 2. Design of RF circuit(electrical circuit, PCB, construction and measurements of a prototype)

**Course description**

1. Components for RF circuits: resistors, capacitors, inductors, RF transformers
2. LC resonant circuits, design of impedance matching networks
3. Scattering matrix
4. Noise of electronic components
5. Design rules for RF circuit PCBs'; shielding, basic EMC problems
6. Block diagrams and parameters of receivers and transmitters
7. Analysis, design and parameters of RF amplifiers
8. Analysis, design and parameters of power RF amplifiers
9. Analysis, design and parameters of LC and quartz oscillators
10. Operation principle and design of PLL
11. Design and parameters of mixers
12. Equipment for RF measurements(esp. spectrum analyzer)
13. Basic RF measurements
14. ETSI standards, EU directives and the Polish standards concernig RF equipment, EMC standards
15. Basics of technical documentation, basic information on production process

**Basic bibliography:**

1. P. Young, Electronic Communication Techniques, Prentice Hall, 2004.
2. R. Gilmore, L. Besser., Practical RF Circuit Design for Modern Wireless Systems, Artech House, 2003.
3. J. Szóstka, Mikrofałe. Układy i systemy, Wyd. Komunikacji i Łączności, Warszawa 2006.

**Additional bibliography:**

1. T. Masewicz, Radioelektronika dla praktyków, Wyd. Komunikacji i Łączności, Warszawa, 1985.
2. Poradnik radioamatora, praca zbiorowa, Wyd. Komunikacji i Łączności, Warszawa, 1984.
3. Z. Bieńkowski, Poradnik ultrakrótkofalowca , Wyd. Komunikacji i Łączności, Warszawa, 1988.
4. P. Vizmuller,, RF Design Guide. Systems, Circuits, and Equations, Artech House, London, 1995.
5. J.Baranowski, Z.Nosal, Układy elektroniczne, cz. I i II, WNT, Warszawa 1993.
6. U.L. Rohde, D.P.Newkirk, RF/Microwave Circuit Design for Wireless Applications, Artech House, 2000.
7. W. Marciniak, Przyrządy półprzewodnikowe i układy scalone, Wyd. Naukowo-Techniczne, Warszawa 1984.
8. U. Rohde, J. Whitaker, T. Bucher, Communication Receivers: Principles and Design, McGraw-Hill, 1997.
9. I. Bahl, P. Bhartia, Microwave Solid State Circuit Design, John Wiley&Sons, 1988.
10. RF Application Reports, Motorola HB215/D, 1995.
11. S. C. Cripps, RF Power Amplifiers for Wireless Communications, Artech House 1999.
12. I. Hickman, Practical Radio-Frequency Handbook, Newnes, Oxford 2002.
13. .

**Result of average student's workload**

Activity	Time (working hours)
1. Lecture	30
2. Project	15
3. Additional project time	30
4. Consulting	5
5. Preparation for the exam and the exam	23

**Student's workload**

Source of workload	hours	ECTS
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Total workload	103	3
Contact hours	53	2
Practical activities	45	1