Politehnica University of Bucharest
Faculty of Electronics, Telecommunications and Information Technology

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	Politehnica University of Bucharest
1.2 Faculty	Faculty of Electronics, Telecommunications and Information Technology
1.3 Department	Telecommunications
1.4 Domain of studies	Electronic Engineering, Telecommunications and Informational Technologies
1.5 Cycle of studies	License
1.6 Program of studies/Qualification	Technologies and Systems of Telecommunications (TSTeng)

2. Course identification information

2.1 Name of the course				Radio Communication Systems and Equipment			
2.2 Lecturer				Lect. PhD Eng. Alexandru Marţian			
2.3 Instructor for practical activities				Lect. PhD Eng Alexandru Marţian			
2.4 Year of studies	IV	2.5 Semester	7	2.6 Evaluation type	Exam	2.7 Course choice type	Compulsory

3. Total estimated time (hours per semester for academic activities)

3.1 Number of hours per week, out of which	3.5	3.2 course	2	3.3 practical activities	1.5
3.4 Total hours in the curricula, out of which	49	3.5 course	28	3.6 practical activities	21

Distribution of time	hours
Study according to the manual, course support, bibliography and hand notes	28
Supplemental documentation (library, electronic access resources, in the field, etc)	5
Preparation for practical activities, homework, essays, portfolios, etc.	10
Tutoring	0
Examinations	5
Other activities	0

3.7 Total hours of individual study	55
3.9 Total hours per semester	104
3. 10 Number of ECTS credit points	4

4. Prerequisites (if applicable)

4.1 curricular	Signals and Systems Analysis and Synthesis of Circuits Analogic Integrates Circuits Digital Integrated Circuits Electronic Devices and Circuits Analogic and Digital Communications
4.2 competence-based	General knowledge regarding analogic and digital signals, the capacity of understanding the functioning of a principle or block diagram of an electronic circuit, basic knowledge regarding information transmission, the capacity of using measurement equipment.

5. Requisites (if applicable)

5.1 for running the course	Not applicable
5.2 for running of the applications	Attending the laboratories is compulsory (according to the rules for bachelor of science studies in UPB).

6. Specific competences

Professional competences	Selecting, installing and exploiting fixed or mobile telecommunication equipment and conceiving a location with the usual telecommunication networks.
Transversal competences	-

7. Course objectives (as implied by the grid of specific competences)

7.1 General objective of the course	During the course, students become familiar with general problems regarding radio communications: current technological level, problems related to the effect of noise and non-linear processing, propagation, etc. In this way, different block diagrams for analogic radio transmitters and receivers are presented, along with radio broadcasting systems examples.
7.2 Specific objectives	The applications are intended for the students to become familiar with measurement techniques used for evaluating the performances of radio communication equipment: radio receivers and radio transmitters.

8. Content

8.1 Lectures	Teaching techniques	Remarks
General Aspects 1.1. General concepts regarding radio communication systems 1.2. Evolution of radio communications 1.3. Structure of a radio comunication system (RCS) 1.4. Technical characteristics of a RCS 1.5 Introductive concepts regarding antennas	Teaching is based on the use of a video projector (covering the communication and demonstrative methods); oral communication methods used is the expositive method, used in a frontal way. Course materials are: course notes and presentations, solved and proposed problems. All the materials are available in electronic format, on the Moodle page.	5 hours
Radio Transmission (RT) Equipment 2.1. Radio Transmitters basics: the Role of a RT; The Block Diagram of the Radio Frequency Chain; 2.4. Building Blocks used in Radio Transmitters 2.5 Performance Parameters of RT 2.6 Architectures of Radio Transmitters used in Digital Radio Communications Systems		8 hours
Radio Reception Equipment 3.1. General concepts regarding radio receivers 3.2. Classification of radio receivers 3.3 Building Blocks used in Radio receivers 3.4 Performance parameters for radio receivers 3.5. Block diagram analysis of radio receivers i. Direct Amplifying RR ii. RR with one frequency conversion iii. RR used in Digital Communication Systems.		12 hours
Frequency synthesis for producing RF systems 4.1. Frequency synthesizers using digital direct synthesis method 4.2 Frequency synthesizers using indirect methods		10 hours
Noise and distortions in radio communication systems 5.1. Introductions 5.2. Noise and reception of radio signals (external and internal noise, noise		7 hours

sources, noise factor, noise limited sensitivity) 5.3. Non-linear distortions in radio communication systems (distortions caused by circuits that work in a non-linear regime, interference with high-level RF systems, interference with low frequency signals)		
Bibliography: • Radioreceptoare,partea I, I.Marghescu, Iancu Ceapă, UPB, 1989 • Joseph Carr, The Technician's Radio Receivers Handbook: Wireless and Telecommunications Technology, Newness, 2000 • Paul Young, Electronic Communications Techniques, Prentice Hall, 2004 • Pagina Moodle a facultăţii ETTI		
8.2 Practical applications	Teaching techniques	Remarks
1. Measurement of gain and noise limited sensitivity of AM and FM radio receivers	Teaching is based on oral communication. Students are required to understand the block diagram of the used radio receiver, learn to handle various RF signal generators, measure and calculate various parameters characterizing the performance of the radio receivers, draw graphical characteristics. Teaching materials are contained in the laboratory manual.	2 hours
2. Measurement of the fidelity characteristic of AM and FM radio receivers		2 hours
3. Measurement of selectivity of AM and FM radio receivers		2 hours
4. Measurement of the AGC characteristic of AM radio receivers		2 hours
5. Measurement of the suppression of image and intermediate frequency perturbations for AM and FM radio receivers		2 hours
6. Simulation of a superheterodyne radio receiver using SIMULINK	Students are using the SIMULINK environment to implement a radio communication link in the MW frequency band, using a superheterodyne radio receiver.	2 hours
7. Final test		2 hours
Bibliography: • A.A. Enescu, A. Tărniceriu, I. Marghescu; Sisteme de radiocomunicaţii - Îndrumar de laborator, Editura Electronica 2000, 2007.		

9. Bridging the course content with the expectations of the epistemic community representatives, professional associations and employers representatives for the domain of the program

Radio communication systems are and will be an important component in the global communication systems. Although the digital transmissions are more and more frequently used, the principles and block diagrams conceived for analogical communications are still valid. The technological solutions in their evolution allows the students a easier assimilation of the fundamental knowledge. Moreover, at least for the radio broadcasting, a certain term for the analog switch off was not yet defined. The industry and the communication network operators need specialists with a good knowledge of fundamental aspects, being also capable of adapting to the dramatic evolution of technologies.

The course curriculum corresponds to the current development and evolution, subscribed to the European and global evolution in the field of communications and information technology (CIT). In the context of the current technological progress of electronic devices, the activity domains that are aimed at are practically unlimited, from consumer applications (broadcasting radio receivers, remote controls, mobile terminals), to professional ones (satellite communications, RFID, radiorelays, etc.).

The graduates are provided with competences adequate to the current necessities and a scientific and technical training, competitive and of good quality, which will allow them a fast employment after graduation, being perfectly suited to the politics of the Politehnica University of Bucharest, both from the structure and contents point of view, and from the international opening and abilities offered to the students.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
10.4 Lectures		Three unannounced tests during the lectures for 10 points, a test during the semester, given at a fixed known date (20 points); one final exam during the session (40 points). The questions cover the whole contents of the lecture, realizing a synthesis between the comparative theoretical study and exercises and problems for the application models.	70%
10.5 Practical applications		Notes for each laboratory (15 points) and final test (15 points), comprising a theoretical component and a practical one. The	30%

		theoretical component is verified through 1-2 questions; the practical component is evaluated by verifying the way in which a set of measurements is performed.	

10.6 Minimal performance standard
- According to the intern regulations, accumulation of minimum 50 points from 100 with a minimum of 15 points form the laboratory activity.

Date	Lecturer	Instructor for practical activities
11.09.2017	Lect. PhD Eng. Alexandru Marţian	Lect. PhD Eng. Alexandru Marţian

Date of department approval

20.10.2017

Director of Department,

Assoc.Prof. PhD Eng. Eduard Popovici