Universitatea Naţională de Ştiinţă şi Tehnologie Politehnica Bucureşti
Facultatea de Electronică, Telecomunicaţii şi
Tehnologia Informaţiei

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	**National University of Science and Technology Politehnica Bucharest**
1.2 Faculty	**Electronics, Telecommunications and Information Technology**
1.3 Department	**Telecommunications**
1.4 Domain of studies	Electronic Engineering, Telecommunications and Information Technology
1.5 Cycle of studies	Bachelor/Undergraduate
1.6 Programme of studies	Technologies and Telecommunications Systems

2. Date despre disciplină

2.1 Course name (ro) (en)				Sisteme şi echipamente de comunicaţii radio			
2.2 Course Lecturer				Prof. Dr. Ion Marghescu, Prof. Dr. Alexandru Martian			
2.3 Instructor for practical activities				Prof. Dr. Alexandru Martian			
2.4 Year of studies	4	2.5 Semester	I	2.6. Evaluation type	E	2.7 Course regime	Ob
2.8 Course type		S	2.9 Course code	04.S.07.O.204		2.10 Tipul de notare	Nota

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

3.1 Number of hours per week	3.5	Out of which: 3.2 course	2.00	3.3 seminary/laboratory	1.5
3.4 Total hours in the curricula	49.00	Out of which: 3.5 course	28	3.6 seminary/laboratory	21
Distribution of time:					hours
Study according to the manual, course support, bibliography and hand notes Supplemental documentation (library, electronic access resources, in the field, etc) Preparation for practical activities, homework, essays, portfolios, etc.					47
Tutoring					0
Examinations					4
Other activities (if any):					0

3.7 Total hours of individual study	51.00
3.8 Total hours per semester	100
3.9 Number of ECTS credit points	4

4. Prerequisites (if applicable) (where applicable)

4.1 Curriculum	Attending and/or passing the following lectures: Signals and Systems Analysis and Synthesis of Circuits Analogic Integrated Circuits Digital Integrated Circuits Electronic Devices and Circuits Analogic and Digital Communications
4.2 Results of learning	Accumulation of the following knowledge: • general knowledge about analog and digital signals, • the ability to understand the operation of a block diagram or principle for electronic circuits, • fundamental knowledge of information transmission, • the ability to use measurement equipment

5. Necessary conditions for the optimal development of teaching activities (where applicable)

5.1 Course	The course will take place in a room equipped with video projector and computer.
5.2 Seminary/ Laboratory/Project	• The laboratory will take place in a room with specific equipment, which must include: PCs on which the Matlab/Simulink environment will be installed, teaching RF emission/reception modules, test radio receivers, RF signal generators, spectrum analyzers , multimeters. • Attendance at the laboratories is mandatory (according to the regulation of university undergraduate studies in UPB).

6. General objective *(Reffering to the teachers' intentions for students and to what the students will be thought during the course. It offers an idea on the position of course in the scientific domain, as well as the role it has for the study programme. The course topics, the justification of including the course in the currcula of the study programme, etc. will be described in a general manner)*

This discipline is studied within the Telecommunications Technologies and Systems specialization and aims to familiarize students with the main approaches, models and explanatory theories in the field of radio communications, used in solving practical applications and problems, with relevance for stimulating the learning process in students.
The discipline addresses as a specific topic general notions related to radio communications (the current technological level, aspects related to propagation, the effect of noise and non-linear processing, etc.). Block diagrams are presented for transmission and reception equipment used in analog and digital radio communications with examples for broadcasting systems. All of this contributes to conveying/training to/to students an overview of the methodological and procedural benchmarks related to the field.

7. Competences *(Proven capacity to use knowledge, aptitudes and personal, social and/or methodological abilities in work or study situations and for personal and proffesional growth. They refflect the empolyers requirements.)*

Specific Competences	Demonstrates basic/advanced knowledge of radio communication systems and equipment. Correlate knowledge Apply knowledge in practice It applies standardized methods and tools, specific to the field, to carry out the evaluation and diagnosis process of a situation, depending on the identified/reported problems, and identifies solutions. It argues and analyzes coherently and correctly the context of application of the basic knowledge of the field, using key concepts of the discipline and the specific methodology. Oral and written communication in Romanian: uses the scientific vocabulary specific to the field, in order to communicate effectively, in writing and orally. Oral and written communication in a foreign language (English): demonstrates understanding of subject-related vocabulary in a foreign language.
Transversal (General) Competences	Works in a team and communicates effectively, coordinating efforts with others to solve problem situations of medium complexity. Autonomy and critical thinking: the ability to think in scientific terms, search and analyze data independently, and draw and present conclusions / identify solutions. Ability to analyze and synthesize: presents the acquired knowledge in a synthetic way, as a result of a process of systematic analysis. Respect the principles of academic ethics: correctly cite the bibliographic sources used in the documentation activity. Puts elements of emotional intelligence into practice in the appropriate social-emotional management of real-life/academic/professional situations, demonstrating self-control and objectivity in decision-making or stressful situations.

8. Learning outcomes *(Synthetic descriptions for what a student will be capable of doing or showing at the completion of a course. The learning outcomes reflect the student's acomplishments and to a lesser extent the teachers' intentions. The learning outcomes inform the students of what is expected from them with respect to performance and to obtain the desired grades and ECTS points. They are defined in concise terms, using verbs similar to the examples below and indicate what will be required for evaluation. The learning outcomes will be formulated so that the correlation with the competences defined in section 7 is highlighted.)*

Knowledge	*The result of knowledge aquisition through learning. The knowledge represents the totality of facts, priciples, theories and practices for a given work or study field. They can be theoretical and/or factual.* • Lists the most important stages that marked the development of the field. • Defines domain-specific notions. • Describes/classifies notions/processes/phenomena/structures. • Highlights consequences and relationships.

Skills	*The capacity to apply the knowledge and use the know-how for completing tasks and solving problems. The skills are described as being cognitive (requiring the use of logical, intuitive and creative thinking) or practical (implying manual dexterity and the use of methods, materials, tools and intrumentation).* Selects and groups relevant information in a given context. • Work productively in a team. • Elaborate a scientific text. • Experimentally verifies identified solutions. • Solve practical applications. • Adequately interpret causal relationships. • Identifies solutions and develops solution/project plans. • Formulates conclusions to the experiments carried out. • Argue the identified solutions/solutions.
Responsability and autonomy	*The student's capacity to autonomously and responsably apply their knowledge and skills.* Select appropriate bibliographic sources and analyze them. • Respect the principles of academic ethics, correctly citing the bibliographic sources used. • Demonstrates responsiveness to new learning contexts. • Demonstrates collaboration with other colleagues and teaching staff in carrying out teaching activities • Demonstrates autonomy in organizing the learning situation/context or the problem situation to be solved • Demonstrates social responsibility through active involvement in student social life/involvement in academic community events • Promotes/contributes through new solutions related to the specialized field to improve the quality of social life. • Realizes the value of his contribution in the field of engineering to the identification of viable/sustainable solutions to solve problems in social and economic life (social responsibility). • Apply principles of professional ethics/deontology in the analysis of the technological impact of the proposed solutions in the specialized field on the environment. • Analyzes and capitalizes on business/entrepreneurial development opportunities in the specialized field. • Demonstrates real-life situation management skills (collaborative vs. conflict time management).

9. Teaching techniques *(Student centric techniques will be considered. The means for students to participate in defining their own study path, the identification of eventual fallbacks and the remedial measures that will be adopted in those cases will be described.)*

Starting from the analysis of students' learning characteristics and their specific needs, the teaching process will explore both expository (lecture, exposition) and conversational-interactive teaching methods, based on discovery learning models facilitated by direct exploration and indirect of reality (experiment, demonstration, modelling), but also on action-based methods, such as exercise, practical activities and problem solving.
In the teaching activity, lectures will be used, based on Power Point presentations or different videos that will be made available to the students. Each course will start with a recap of the chapters already covered, with an emphasis on the concepts covered in the last course.
Presentations use images and diagrams so that the information presented is easy to understand and assimilate.
This discipline covers information and practical activities designed to support students in their learning efforts and the development of optimal collaborative and communicative relationships in a climate conducive to discovery learning.

It will be considered the practice of active listening and assertive communication skills, as well as feedback construction mechanisms, as ways of regulating behavior in various situations and adapting the pedagogical approach to the students' learning needs.
Teamwork skills will be practiced to solve different learning tasks.

10. Contents

COURSE		
Chapter	**Content**	**No. hours**
1	General Aspects 1.1. General concepts regarding radio communication systems 1.2. Evolution of radio communications 1.3. Structure of a radio communication system (RCS) 1.4. Technical characteristics of a RCS 1.5 Introductive concepts regarding antennas	2
2	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	6
3	Radio Reception Equipment 3.1. General concepts regarding radio receivers 3.2. Classification of radio receivers 3.3Building 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.	14
4	Frequency synthesis for producing RF systems 4.1. Frequency synthesizers using digital direct synthesis method 4.2 Frequency synthesizers using indirect methods	4
5	Noise and distorsions in radio communication systems 5.1. Introduction 5.2. Noise and reception of radio signals (external and internal noise, noise sources, noise factor, noise limited sensitivity)	2
	Total:	
Bibliography:		

LABORATORY		
Crt. no.	**Content**	**No. hours**
1	Power budget analysis for a radio communication link	3
2	Analysis of the functional blocks from radio transmitters	3
3	Measurement of gain and noise limited sensitivity of AM and FM radio receivers	3

4	Measurement of selectivity of AM and FM radio receivers	3
5	Measurement of intermediate and image rejection and of fidelity for AM and FM radio receivers	3
6	Simulation of a superheterodyne radio receiver using SIMULINK	3
7	Final test	3
	Total:	

Bibliography:

Marţian Alexandru, Sisteme şi echipamente de comunicaţii radio, suport de curs electronic, https://curs.upb.ro/2021/course/view.php?id=9148.
A.Marţian, I. Marghescu, Radio Communications: Systems and Equipment - Theoretical and Practical Aspects, Editura Politehnica Press, 2022.

11. Evaluation

Activity type	11.1 Evaluation criteria	11.2 Evaluation methods	11.3 Percentage of final grade
11.4 Course	- knowledge of fundamental theoretical notions;	Three unanounced tests during the lectures	10%
	- knowledge of how to apply the theory to specific problems;	Test during the semester, at a date fixed and announced at the beginning of the semester	30%
	- comparative analysis of theoretical techniques and methods.	Final exam during exam session	35%
11.5 Seminary/laboratory/project	- knowledge of the measurement procedures used in radiocommunications;	Evaluation of each lab work	12.5%
	- knowledge of the main performance parameters for radiocommunication equipment;	Final lab test	12.5%
	- the capacity of simulating radiocommunication systems based on block diagrams.		
11.6 Passing conditions			
• Obtaining 50% of the total score. • Obtaining 50% of the score related to the activity during the semester. **Atenţie la Regulamentul de studii aplicabil, se pot include aici referinţe în acest sens!**			

12. Corroborate the content of the course with the expectations of representatives of employers and representative professional associations in the field of the program, as well as with the current state of knowledge in the scientific field approached and practices in higher education institutions in the European Higher Education Area (EHEA)

Radio communications have been and will continue to be an important component of the global communications system. Although they are moving to digital transmissions, they still use the principles and block schemes designed for analog communications. Then observing technological solutions in their evolution allows students to assimilate the necessary fundamental knowledge more easily. Moreover, at least for sound broadcasting, a deadline for achieving the transition has not yet been defined. Industry and communication network operators are in great need of specialists capable of knowing well the fundamental aspects capable of adapting on the fly to the dramatic evolution of technologies.
The course curriculum responds to the current development and evolution requirements, subscribed to the European and world evolution in the field of communications and information technology (ICT). In the context of the current technological progress of electronic devices, the targeted fields of activity are practically unlimited, from "consumer" applications (broadcast radio receivers, mobile terminal remote controls), to professional ones in the field of satellite communications, RFID, radio relays, etc.
In this way, the graduates are provided with adequate competences with the needs of the current qualifications and a modern, quality and competitive scientific and technical training, which will allow them to be employed quickly after graduation, being perfectly framed in the policy of the Politehnica University of Bucharest, both from the point of view of the content and structure, as well as from the point of view of the skills and international openness offered to students.
Through the activities carried out in this discipline, students develop skills to offer solutions to problems and to propose ideas for improving the existing situation in the field of radio communication systems and equipment. It is also considered the development of the graduate's skills to manage practical situations that he may face in real life in order to increase his contribution to the improvement of the socio-economic environment.

Date	Course lecturer	Instructor(s) for practical activities
	Prof. Dr. Ing. Ion Marghescu, Prof. Dr. Ing. Alexandru Martian	Prof. Dr. Alexandru Martian
Date of department approval	Head of department	
Date of approval in the Faculty Council	Dean	