

COURSE DESCRIPTION

1. Program identification information

1.1 Higher education institution	University POLITEHNICA of Bucharest
1.2 Faculty	Electronics, Telecommunications and Information Technology
1.3 Department	Telecommunications
1.4 Domain of studies	Electrical Engineering and Telecommunications
1.5 Cycle of studies	License
1.6 Program of studies/Qualification	Telecommunications Technologies and Systems

2. Course identification information

2.1 Name of the course				Communication Systems			
2.2 Lecturer				Prof. Dr. Ing. Simona Halunga,			
2.3 Instructor for practical activities				S.L. Dr. Ing. Carmen Voicu			
2.4 Year of studies	III	2.5 Semester	II	2.6 Evaluation type	Verification	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	4	3.2 course	3	3.3 practical activities	1
3.4 Total hours in the curricula, out of which	56	3.5 course	42	3.6 practical activities	14
Distribution of time					hours
Study according to the manual, course support, bibliography and hand notes					6
Supplemental documentation (library, electronic access resources, in the field, etc)					0
Preparation for practical activities, homework, essays, portfolios, etc.					2
Tutoring					0
Examinations					2
Other activities					0
3.7 Total hours of individual study	10				
3.9 Total hours per semester	52				
3.10 Number of ECTS credit points	2				

4. Prerequisites (if applicable)

4.1 curricular	Signals and Systems Analysis and Synthesis of Circuits
4.2 competence-based	general knowledge regarding signals, systems, modulation, analysis of discrete systems.

5. Requisites (if applicable)

5.1 for running the course	Not applicable
5.2 for running of the applications	Compulsory attendance at laboratories (in accordance with the regulations for license university studies in UPB)

6. Specific competences

Professional competences	<p>C2. Students have to become familiar with general aspects regarding data processing for analogue and digital communications systems. The main types of modulated signals are presented, analyzing their shape in time, frequency spectra, occupied bandwidth and power. The main generation and demodulation procedures are briefly presented for each type of signal. The most important transmission media are presented as well as their general characteristics. A number of modern technologies used in communications, like GSM, GPRS, UMTS, radio and TV broadcast systems and telecommunication services applications are briefly presented.</p> <p>Regarding the laboratory, the students have to become familiar with the main analogue and digital communication techniques and performance evaluation as well as with specific measurement techniques. Several representative communication systems are presented.</p>
Transversal competences	The thorough analysis of the daily issues and the ability to identify the problems for which well-known solutions are already available, thus solving the professional tasks.

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

7.1 General objective of the course	The students have to become familiar with the main aspects regarding analogue and digital communication techniques. A number of modern technologies used in communications and telecommunication services applications are briefly presented.
4.2 Specific objectives	The main fundamental aspects concerning analogue and digital communications are presented. The main analogue modulation techniques are introduced. The steps performed to convert an analogue signal into a digital one, represented on a finite number of bits are presented, as well as a number of baseband techniques used to transmit digital data. The most important transmission media are presented as well as their general characteristics. A number of modern technologies used in communications, like GSM, GPRS, UMTS, radio and TV broadcast systems and telecommunication services applications are briefly presented.

8. Content

8.1 Lectures	Teaching techniques	Remarks
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<p>Introduction. The structure and elements of a communication system. Evolution and perspectives of communication systems.</p>	<p>Teaching is performed using an overhead projector, that covers the communication and demonstration activities.</p>	<p>2 hours</p>
<p>Analogue and digital transmission of information bearing signals. Analogue modulation techniques using a sine-wave carrier signal (linear modulation, exponential modulation) and using a periodic pulse of square-waves signals. Analogue-to-digital conversion: sampling, quantizing, coding. Digital modulation techniques (BPSK, QPSK, MPSK, BFSK, MFSK, BASK, MQAM). The advantages of data transmissions. Multiple access techniques.</p>	<p>The oral communication methods are the expository one and the problem solving method. All the class notes, solved problems, proposed problems, computer problems or other helpful materials are available on the course site.</p>	<p>2 hours</p>
<p>Transmission media. Twisted cables (structure, technical characteristics, applications). Coaxial cables (structure, technical characteristics, applications). Optical fibers (structure, technical characteristics, applications). Electromagnetic waves propagation (radio waves, antennas, propagation, link budget)</p>		<p>5 hours</p>
<p>Numerical information transmission – general aspects. Asynchronous (PDH) and asynchronous (SDH) transmissions. ATM</p>		<p>5 hours</p>
<p>Communication networks and services. Network components and functions. Fundamental services. Communication traffic. Datagrams and virtual circuits. OSI reference model. TCP/IP architecture. LAN, MAN, WAN and Internet.</p>		<p>4 hours</p>
<p>Mobile wireless communication networks. 2nd generation – GSM. 2.5 generation – GPRS. 3rd generation – UMTS. Advantages and disadvantages. Technological trends. 4th generation – LTE.</p>		<p>2 hours</p>
<p>Radio and TV broadcast networks. Analogue broadcast networks implementation. Rules and standards. Digital Radio and TV broadcast networks. Examples (DAB, DVB-S/T, DRM) – facilities, services, emergency between broadcast and mobile networks.</p>		<p>5 hours</p>
<p>Bibliography 1) S. Halunga. "Sisteme de comunicație cu acces multiplu" –Editura PRINTECH, București, 2005, (286 pag.), ISBN973-718-218-9, 2) O. Fratu, S. Halunga, "UMTS – o nouă generație în comunicațiile mobile digitale (Aspecte generale. Interfața radio)", Editura Electronica 2000, București, 2003 3) S.V. Nicolaescu (coordonator), I Marghescu, I. Bogdan, S Halunga, ș.a. „Accesul Wireless de Bandă Largă ”, (2008) vol I (387 pag) și II (214 pag), Editura Printech 2008, ISBN 978-606-521-</p>		

080-6, 978-606-521-081-3		
4) Constantin, I. Marghescu, „Transmisiuni analogice și digitale”, Ed. Tehnică, București, 1995.		
5) V. Croitoru (coordonator), „Comunicații digitale. Teorie și experiment”, Ediția a II –a, Ed. Printech, București, 2003.		
6) H.Taub, Schilling, ” Principles of communication systems” 3rd edition, Mc Graw Hill, 2007		
7) R. E. Ziemer, W. H. Tranter, ” Principles of Communications” 2nd edition, John Wiley & Sons, 2007.		
11) Class notes available online – Moodle / Folders		
8.2 Practical applications	Teaching techniques	Remarks
Simulation and analysis of LM modulated signals	Teaching is based on problem expository by the teaching assistant and their solving by all students with his / her explanations and help. The students will solve the problem on their own, and confront their results with the ones provided by the teaching assistant. An important number of the exercises are checked by simulating them and directly on measuring the circuit.	2 hours
Simulation and analysis of FM modulated signals		2 hours
Sampling, quantizing, compression, coding. PCM, APCM, ΔM.		2 hours
Simulation and analysis of BPSK, BFSK, 16QAM modulated signals		2 hours
Simulation and analysis of a wireless LAN network.		2 hours
Presentation and analysis of the parameters of a communication network (GSM, UMTS)		2 hours
Presentation and analysis of a DVB communication network		2 hours
Bibliografie:		
1) S. Halunga, O. Fratu “Simularea sistemelor de transmisiune analogice și digitale folosind mediul Matlab/Simulink ”(Simulation of analog and digital communication systems using Matlab)- Editura Matrix Rom, București, 2004		
2) I. Constantin, S. Halunga, I. Marcu, „Transmisiuni analogice și digitale – culegere de probleme”, editura Electronica 2000, 2010		
3) V. Croitoru (coordonator), „Comunicații digitale. Teorie și experiment”, Ediția a II –a, Ed. Printech, București, 2003.		
4) Laboratory platforms in electronic format – Moodle / Folders		

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

Fixed and mobile communications systems and networks became a mature market with an increased has become a mature market with high rate growth. Specific equipment manufacturers and operators have a high demand for qualified engineers with specializations related to communications systems and networks and with a solid foundation in telecommunications so as to be able to keep the pace of development of new hardware and software.

10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight in the final mark
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10.4 Lectures	<ul style="list-style-type: none"> - knowledge of the basic theoretical knowledge; - knowledge to apply the theoretical aspects to solve specific problems; - differential analysis and comparison of different theoretical methods. 	<ul style="list-style-type: none"> - lucrare de evaluare in timpul semestrului - evaluare finala 	<p>25%</p> <p>50%</p>
10.5 Practical applications	<ul style="list-style-type: none"> - individual / independent solving of the proposed problems, verified with a control paper and a homework assignment; - understanding fundamental concepts in data communication systems. 		25%
10.6 Minimal performance standard			
<ul style="list-style-type: none"> - capacity to solve standard problems connected to the material presented in class and seminars; - capacity to model an end to end communication chain and to demonstrate its functionality. 			

Date
17.09.2015

Lecturer
Prof. Dr. Ing. Simona Halunga

Instructor for practical activities
Sl. Dr. Ing. Carmen Voicu

Date of department approval

Director of Department,

Prof. Dr. Ing. Silviu Ciochină