

Politehnica University of Bucharest

Faculty of Electronics, Telecommunications and Information Technology

Domain of studies: **Electronics and Telecommunications Engineering**

Program of studies: **Advanced Wireless Telecommunications (AWT)**

Program Objectives: To provide the theoretical and applied knowledge for engineers in the field of wireless communications. They should have a vision at the system level and conduct designing procedures by highlighting different levels of a wireless system or a wireless communications network, from the physical layer to the application layer. The focus will be particularly on the physical layer, which has to get an adequate level of reliability of the communication link that ensure the required level of application quality of service (QoS) as well as mobility. Due to the special dynamics of the concerned areas, it is aimed at combining all principle aspects regarding the latest technological trends. These objectives can be achieved through:

- Increasing knowledge of the electronic and telecommunications bachelors (graduated engineers) in the field of radio communications;
- Creating conditions for exchanging both students and teachers between universities and for putting them in touch to the latest concerns in Europe and the world by developing teaching in English;
- Attracting major economic players in the industry (operators, equipment development companies, application developers, regulatory bodies and other companies interested in wireless communications and mobility access systems) in preparing students in this field. Based on some informal discussions Orange and FreeScale are interested in the development of this program.

Target groups (potential target candidates for the master program): graduated engineers in the fields of Electronics and Telecommunications, Computer and Information Technology, Automatic Engineering, Industrial Engineering and Management (having in mind the prerequisites only the graduates from the Economic Engineering in electrical, electronic, and Energy study program are eligible).

No.	Course name	Semester	Lectures	Short description
1	Optimization Techniques and Random Signals in Telecommunications	1	S.l. dr.ing. Octaviana Datcu, S.l.dr.ing. Carmen Voicu	For an engineer it is important to understand and manipulate the concepts and tools needed to interpret the effects that time invariant linear systems have on signals modeled as probabilistic outputs of experiments. This type of signals can often occur in the context of applications in communications, control and signal processing. In this sense, this course treats concepts such as statistical averages, stationary random process, the correlation function for stationary random processes, running average, ergodicity, spectral properties, spectral factorization, estimation theory, random process modeling, relations between the parameters of the selected model and the autocorrelation function. Processing of complex-valued random signals is treated in terms of model selection, filtering and separation of sources, resulting in increased performance of studied systems. Convex optimization techniques are common in the areas of signal processing, automatic gain control, estimation, resource allocation, decision, etc. The goal of these techniques is to find the best solution (the optimum solution) for a given problem. The course aims to create the ability of the master students in recognizing and formulating convex optimization problems, developing code (Matlab) for solving optimization problems, characterizing and to indentifying the optimal solution.
2	Advanced Data Transmission Technologies	1	Conf. dr.ing. Calin Vladeanu	This course offers a presentation of the advanced concepts and principles used in the design, operation, and maintenance of data communication systems, and will help students to acquire an understanding of key elements in advanced data communications engineering. Firstly, the principles and methods used for baseband and passband data transmission are described. Then, the remaining (main) part of this course is concerned with the presentation of the advanced signal processing techniques used in modern data communications systems.
3	Advanced Digital Signal Processing Techniques	1	Prof.dr.ing. Constantin Paleologu	The main objective of this subject consist in helping the master students to understand the basic principles of random processes, adaptive systems and their applications, spectral estimation algorithms and their applications. This subject allows the students to acquire the necessary knowledge in order to understand the principles of advanced signal processing (random processes, adaptive systems, spectral estimations). These principles form the basis for many different applications in telecommunication networks. The students will be able to analyze and design such systems, knowing the importance of this technology and the economic aspects related to the implementation's complexity. Laboratory applications aim to let the students to develop advanced digital processing techniques, starting from the specifications list and going to the execution, debugging and results interpretation.

No.	Course name	Semester	Lectures	Short description
4	Mobile Communications Systems	1	Prof. dr.ing. Octavian Fratu	This subject aims to get the students familiar with current mobile communication systems and to acquire knowledge on the fundamental aspects of their principles. The main aspects concerning radio propagation, with emphasis on providing the coverage of the base stations and mobile stations, under specific mobile communications and specific aspects of cellular systems (working principles, consequences on the whole communication system) are reiterated and developed. Also, several key aspects of typical mobile communications systems, such as : GSM, GPRS, UMTS, HSPA, LTE are presented. The laboratory, organized in the Orange Center , aims to present specific operational problems of the GSM system and post-GSM systems.
5	Cryptography and Security in Communication Networks	1	Conf. Dr.ing. Octavian Catrina	Modern cryptography is a mature discipline, with rigorous theoretical foundation and a broad range of proven, practical solutions. However, while cryptography has become ubiquitous, development of secure systems remains a particularly challenging task: intuition is often wrong and insufficient understanding of the subtle underpinnings of the cryptographic primitives often leads to security failures. The main purpose of this course is to provide a rigorous presentation of the main cryptographic algorithms and protocols, and with sufficient breadth and depth to enable the students to analyze the security of existing solutions and correctly use the cryptographic primitives in the development of new systems. The course skips implementation details and variations of the schemes (e.g., for block ciphers, hash functions). Instead, the presentation focuses on the assumptions made in the design of the primitives, their security model, and their properties, providing essential knowledge for using existing, proven cryptographic components.
6	Scientific Research 1	1	Prof. dr.ing. Ion Marghescu	
7	Advanced Communication Networks, Protocols and Services	2	Conf.dr.ing. Obreja Serban	The aim of this subject is to familiarize students with the concepts required to design and implement an IP-based telecommunications networks. Implementation of telecommunications protocols. Professional competences: - Knowledge on designing and implementing IP based telecommunications networks. - Knowledge on designing a network node based on IP layered model.

No.	Course name	Semester	Lectures	Short description
8	Access and Broadcasting Digital Radio Technologies	2	Prof. dr.ing. Ion Marghescu	<p>This subject aims to create the ability of the engineers to use the general communications knowledge to analyze, design, and deploy wireless communications networks in order to get access to the INTERNET resources. At the beginning some knowledge about the digital signals used at the PHY level of the new radio access technologies (RAT) is given; Then general architectures of some RAT's and specific problems of the PHY and MAC levels such as: modulation and coding techniques, synchronization procedures, etc. are targeted. Finally the subject aims to increase the ability of the master students in evaluating the performance of wireless communications technologies by means of experimental trials and simulation and in integrating the new RAT's in practical applications;</p>
9	Software Defined Radio and Programmable Circuits Design	2	S.l. dr.ing.Alexandru Martian, S.l.dr.ing. Anghel Cristian	<p>Getting the student familiar with modern software defined radio equipments. We target general architectures of software defined radio systems and also the analysis of the problems in designing functional blocks, such as: A/D and D/A converters, demodulators, analog part, etc.</p> <p>Professional competences to be created:</p> <ul style="list-style-type: none"> - understanding and using specific architectures of software defined radio equipment; - ability in designing methods for different signal processing blocks, necessary along the transmission and reception signal path; - ability in implementating different signal processing blocks using programmable logic devices.
10	Digital Video and Multimedia Processing	2	S.l. dr.ing. Cristina Oprea	<p>The main purpose of this subject is to develop the student abilities to apply the general knowledge of video and multimedia processing and to develop specific projects using a given object-oriented programming language. At the end of the module students are able to understand the basics concepts of multimedia communications. They will be able to judge if specific applications can be deployed on specific networks. The students also gain a deep understanding of how to close the gap between application requirements and network support. Laboratory applications aim to determine the students to develop/analyze advances multimedia communication techniques, starting from the specifications list and going to the execution, debugging and results interpretation.</p>

No.	Course name	Semester	Lectures	Short description
11	Embedded Systems	2	Prof.dr.eng. Sorin Zoican, Conf.dr.eng. Mihnea Udrea Free Scale Engineers	The basic elements for real time systems organization and functions and digital signal processors architectures will be presented. Real time systems example (Microcontroller Operating System, VDK) and applications for telecommunications are pointed out. The main purpose of this subject is to develop the student abilities to apply the general knowledge of the real time systems concepts and DSP architectures in specific projects. The skill to evaluate the performance criteria and to choose the right method and processor for an actual application is pointed out. The laboratory will be organized around Free Scale development kits.
12	Advanced Telecommunications Networks Project	2	Prof. dr.eng. Ion Marghescu	
13	Scientific Research 2	2	Prof. dr.eng. Ion Marghescu	
14	Advanced Procedures in Wireless Communications	3	Conf.dr.eng. Remus Cacoveanu, Conf.dr.eng. Cristian Anghel	This course provides a solid background in the wireless communication systems domain to the students, and also a good description of the basic principles and methods used for these systems analysis. The specific objectives this course will provide refer to multiple access techniques presentation, duplexing methods description, but also to high spectral efficiency techniques study. Also there will be discussed the interference cancellation techniques, the smart antennas topic and the ultra wide band systems characteristics.
15	Software for Integrated Management and Control of Networks and Services	3	Prof. dr.eng. Eugen Borcoci, S.I.dr.eng. Radu Lupu	The aim of this lecture is to offer the students knowledge on the overall architectures and functionalities of the Management and Control subsystems used by the Networks/Services/Content providers and operators in the context of networks and services integration in Future Internet. Also, we aim to develop the student skill to specify, design, implement and operate/exploit specific M&C technologies in Telecom, computer and integrated networks and cloud computing (TMN, SNMP-framework, Web/XML-technologies based management systems, Autonomic networks and services management, Software Defined Networking). Mono and multi-domain network environments will be considered.

No.	Course name	Semester	Lectures	Short description
16	Software Applications for Mobile Terminals	3	Conf.dr.ing. Eduard Popovici	The main purpose of this subject is to develop the student abilities to apply general knowledge of programming technologies taught in several categories of projects. After completing this course students will be able to choose the design architecture and software components required, and to achieve concrete programs to meet the requirements formulated. Discipline aims familiarity with programming technologies widely used in the mobile Internet (Android, Windows Phone, etc.), access to databases, using different programming languages: HTML, Java, C #, XML, SQL. Laboratory applications aim to help students achieve learning skills and techniques needed to use programming technologies. Programs will be developed in which students will use various programming technologies.
17	Satellite Communications	3	Prof. dr.ing. Teodor Petrescu, s.l. dr.ing. Alina Badescu	This course aims at providing the students with a thorough understanding of the fundamental principles when designing global satellite systems for communication purposes. The course will examine satellite telecommunication systems with an emphasis on modern systems and their link budgets. Topics will include a historical perspective, orbital mechanics and constellations, choice of orbital parameters, propagation considerations, link budgets, interference issues and other obstacles, and existing and proposed mobile satellite systems. It will also look at some of the business aspects such as the cost of deploying and maintaining such systems.
18	Integrator Research Project	3	Prof. dr.ing. Ion Marghescu	
19	Optical Communications	3	S.l.dr.ing. Adrian Păun	The discipline aims to familiarize the students with the concepts and terminology in optical communication systems to create them an overview of the field starting from optical fiber up to the new optical transmissions solutions.
20	Scientific Research 3	3	Prof. dr.ing. Ion Marghescu	
21	Practical Work, Research and Dissertation Development	3	Prof. dr.ing. Ion Marghescu	