

TELECOMMUNICATIONS SYSTEMS
ENGINEERING B. Eng.

ELECTIVE COURSES TYPE A

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Year 2015/16

Course Name:	Signal Processing In Communications II	Course Code:	595010346
Year:	3	Semester:	6
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type A
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Signal Processing In Communications	
Coordinator:		José Enrique González	
Bachelor Engineering Program:		Telecommunication Systems Engineering	

Course Contents

1. Low computational load basic algorithms
2. Finite arithmetic problems
3. Block filtering
4. Analog Modulations: demodulators
5. Digital Modulations: demodulators

ABET Student Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (d) An ability to function on multidisciplinary teams
- (e) An ability to identify, formulate, and solve engineering problems
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Study Outcomes (according to the Spanish program definition)

- CE ST06 Ability to analyze, encode, process and transmit multimedia information using analog and digital signal processing techniques.
- CE TEL08 Ability to apply analysis and treatment of signals and modeling system tools
- CG 02 Ability to search and select information, develop critical thinking and produce and defend arguments within the area.
- CG 04 Ability to abstract, analyze, and synthesize, and to solve problems.

CG 10 Ability to handle specifications, rules and regulations and to apply them in the practice of the profession.

Specific outcomes of instruction (according to the Spanish program definition)

- 1.- Choice of digital techniques of processing, usually based on the Discrete Fourier Transform (DFT), for efficient signal filtering using FIR filters .
- 2.- Capacity for the implementation of communications systems from signal digitalization.
- 3.- Capacity to implement, verify and compare algorithms of filtering, coding, analysis, etc.
- 4.- Capacity for programming of simulations of systems and subsystems in communications, including the generation of signal transfer channel, and analysis of the quality of the received signal (once demodulated or decoded), as for instance: carrier to noise, signal to noise, energy per bit to noise spectral density, ratio of bits or erroneous symbols , etc.

Bibliography

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Year 2015/16

Course Name:	Global Navigation Satellite Systems	Course Code:	595010347
Year:	3	Semester:	6
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type A
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Communication Theory	
Coordinator:		Carlos Felipe Rueda	
Bachelor Engineering Program:		Telecommunication Systems Engineering	

Course Contents

1. Introduction
2. GNSS Description
3. GNSS Functioning
4. GNSS Precision and errors
5. GPS
6. Other GNSS
7. Applications

ABET Student Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (e) An ability to identify, formulate, and solve engineering problems
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Study Outcomes (according to the Spanish program definition)

- CE B1 Ability to solve mathematic problems that may come up in engineering. Ability to apply knowledge on: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations, partial-differential equations, numeric methods, numeric algorithmic, statistics and optimization.
- CE B3 Knowledge and command of basic concepts on the general laws of Mechanics, Thermodynamics, electromagnetic fields and waves, and its application to solve engineering problems.
- CE TEL01 Ability to independently learn new knowledge and skills adequate for the design, development or utilization of telecommunication systems and services.

CE TEL04 Ability to analyze and specify the fundamental parameters of a communication system.

CG 02 Ability to search and select information, develop critical thinking and produce and defend arguments within the area.

CG 04 Ability to abstract, analyze, and synthesize, and to solve problems.

Specific outcomes of instruction (according to the Spanish program definition)

1.- Acquire sufficient theoretical and practical knowledge to understand the functioning of a GNSS system

2.- Acquire sufficient theoretical and practical knowledge to understand a GNSS system utilities as well as applications that can be used.

3.- Acquire sufficient theoretical and practical knowledge to employ, user-level, the data resulting

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Year 2015/16

Course Name:	Communication System Architecture	Course Code:	595010341
Year:	3	Semester:	7
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type A
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:			
Coordinator:		César Briso	
Bachelor Engineering Program:		Telecommunication Systems Engineering	

Course Contents

1. Communications Systems Basic Concepts
2. Features of intelligent transport
3. Signalling and control systems

ABET Student Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering
- (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (e) An ability to identify, formulate, and solve engineering problems
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Study Outcomes (according to the Spanish program definition)

- CE B1 Ability to solve mathematic problems that may come up in engineering. Ability to apply knowledge on: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations, partial-differential equations, numeric methods, numeric algorithmic, statistics and optimization.
- CE B3 Knowledge and command of basic concepts on the general laws of Mechanics, Thermodynamics, electromagnetic fields and waves, and its application to solve engineering problems.
- CE B4 Knowledge and command of basic concepts on linear systems and related functions and transforms, theory of electrical circuits, electronic circuits, physical principles of semiconductors and logic families, electronic and photonic devices, materials technology and its application for solving problems of engineering.

CE CE04	Ability to apply electronic as support technology in other fields and activities, not only in the field of Information Technologies and Communications.
CE CE10	Being able to perform engineering projects of professional character in the field of specific technologies of telecommunication.
CE ST02	Ability to apply techniques on which telecommunication networks, services and applications are based, whether in fixed or mobile environments, personal, local or long distance areas, with different bandwidths, including telephony, radio broadcasting, television and data, from the point of view of transmission systems.
CE ST04	Ability to select radiofrequency, microwave, radio broadcasting, radio link and radio localization circuits, subsystems and systems.
CE SI05	Ability to create, encode, manage, transmit and distribute multimedia contents, according to usability and accessibility criteria of audiovisual, transmitting and interactive services.
CE TEL04	Ability to analyze and specify the fundamental parameters of a communication system.
CE TE05	Ability to follow the technologic progress of transmission, commutation and process to improve the networks and telematic services.
CE TE08	Ability to carry out professional projects in the area of technologies specific to telecommunication engineering, where competencies acquired in the degree need to be synthesized and integrated

Specific outcomes of instruction (according to the Spanish program definition)

- 1.- Relate the scientific and technological aspects with a social environment of increasing complexity: social, economic, political, legal, ethical and environmental aspects.
- 2.- Analyze the process of modulation and demodulation, analog and digital
- 3.- Design and planning of mobile communication systems and networks
- 4.- Knowledge about the management and control of unmanned autonomous vehicles
- 5.- Interpret the techniques used in circuits and subsystems for high frequency
- 6.- Ability to learn, understand and use the concepts of architecture of network, communication interfaces and protocols, specific packages and Internet switching networks
- 7.- Knowledge of the peculiarities of the telecommunication project

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Year 2015/16

Course Name:	Optical Communication Systems	Course Code:	595010343
Year:	4	Semester:	7
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type A
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:	Analog Electronics Wave Transmission and Propagation		
Coordinator:	Miguel Ángel del Casar		
Bachelor Engineering Program:	Telecommunication Systems Engineering		

Course Contents

1. Introduction to Optical Fiber communications systems
2. Optical Generators
3. Attenuation and dispersion in optical fibers.
4. Photodetector.
5. Optical Amplifiers.

ABET Student Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (e) An ability to identify, formulate, and solve engineering problems
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Study Outcomes (according to the Spanish program definition)

- CE CE02 Ability to select circuits and electronic specialized devices for transmitting, routing and terminal equipment, both fixed and mobile environments.
- CE CE08 Ability to specify and use electronic instrumentation and measurement systems.
- CE ST01 Ability to build, utilize and manage telecommunication services and applications for the acquisition, transport, representation, processing, storage, management and presentation of multimedia information, from the point of view of transmission systems.
- CE ST02 Ability to apply techniques on which telecommunication networks, services and

applications are based, whether in fixed or mobile environments, personal, local or long distance areas, with different bandwidths, including telephony, radio broadcasting, television and data, from the point of view of transmission systems.

- CE ST03 Ability to analyze components and their specifications for guided and non-guided communication systems.
- CE ST04 Ability to select radiofrequency, microwave, radio broadcasting, radio link and radio localization circuits, subsystems and systems.
- CE ST05 Ability to select aerials, equipment and transmission systems for guided and non-guided wave propagation, through electromagnetic, radiofrequency or optical channels. Ability to manage the associated radio electric space and frequency allocation.
- CE ST06 Ability to analyze, encode, process and transmit multimedia information using analog and digital signal processing techniques.

Specific outcomes of instruction (according to the Spanish program definition)

- 1.- Ability to analyze fundamental characteristics of wave propagation.
- 2.- Ability to analyze the propagation of electromagnetic waves in dielectrics and conductors.
- 3.- Ability to understand the basic properties of materials in which devices are based on.
- 4.- Be able to characterize different types of systems depending on their frequency discrimination
- 5.- Ability to design, configure, and manage networks, systems services and infrastructures of telecommunications in specific contexts (residential, business and institutional)
- 6.- Handling of the instrumentation and procedures for a basic laboratory of communication systems, (generator/oscilloscope and Spectrum Analyzer RF modulator).
- 7.- Analyze and plan communication systems employing guided communication methods, cables and fiber optic.
- 8.- Calculate the losses of propagation, signal levels, link & balance determination of the quality of the radio communication systems
- 9.- Learn about the different elements of a system of optical communications (fibre, source, photodetector, EDFA, WDM devices, other devices).
- 10.- Familiarize yourself with the basic procedures of measurement in optical communications.
- 11.- Be able to design and evaluate optical communication systems, with balances of power and dispersion, with BER calculations, and the necessary adaptations for WDM.
- 12.- Learn about the elements of a system of telecommunications, in a block diagram, understanding the role of each party.

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- G. Keiser. Optical Fiber Communications. 3^a edición. Ed. Mac-Graw Hill. (2000)
- J. Senior. Optical Fiber Communications. Principles and Practice. Ed. Prentice-Hall. (1992)
- J. Gowar. Optical Communications Systems. Ed. Prentice-Hall International. (1984)
- J.A. Martín Pereda. Sistemas y Redes Ópticas de Comunicaciones. Ed. Pearson Educación. (2004)

Year 2015/16

Course Name:	High Frequency Microelectronic Design	Course Code:	595010348
Year:	4	Semester:	7
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type A
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:			
Coordinator:		José Luis Jiménez	
Bachelor Engineering Program:		Telecommunication Systems Engineering	

Course Contents

1. Introduction to the MMIC with III-v materials
2. Passive elements in MMIC and its modeling .
3. Active elements in MMIC and its modeling.
4. Introduction to the harmonic balance method and the method of moments.
5. The MMIC circuit design
6. Obtaining the Layout and LVS, DRC

ABET Student Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (c) An ability to identify, formulate, and solve engineering problems
- (d) An ability to communicate effectively
- (e) An ability to communicate effectively
- (f) An ability to communicate effectively
- (g) An ability to communicate effectively
- (h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) A knowledge of contemporary issues
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Study Outcomes (according to the Spanish program definition)

- CE EC05 Ability to design circuits of analogical and digital electronics, circuits of analogical-digital and digital-analogical conversion, radiofrequency circuits and conversion of electric
- CE ST04 Capacity for the selection of circuits, subsystems and systems of radiofrequency, microwave, broadcasting, radiolinks and radiolocalization.

Specific outcomes of instruction (according to the Spanish program definition)

- 1.- The acquisition of theoretical and practical knowledge enough to deal with the initial design of a monolithic integrated circuit of microwave and millimeter-wave using III-V materials .
- 2.- The acquisition of theoretical and practical knowledge enough to use the techniques of simulation and tools associated to allow the study and design of monolithic microwave integrated circuits and millimeter using III-v materials.

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Year 2015/16

Course Name:	Mobile Communication	Course Code:	595010342
Year:	4	Semester:	8
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type A
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:	Radiocommunication Systems Telecommunication Systems		
Coordinator:	Rafael Herradón		
Bachelor Engineering Program:	Telecommunication Systems Engineering		

Course Contents

1. Mobile Communications Systems
2. 2nd Generation GSM Cellular Systems
3. 3rd Generation GSM Cellular Systems: UMTS
4. 4th Generation GSM. LTE
5. Wireless Local Area Networks

ABET Student Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (c) An ability to identify, formulate, and solve engineering problems
- (d) A broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (e) A knowledge of contemporary issues
- (f) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Study Outcomes (according to the Spanish program definition)

- CE ST02 Ability to apply techniques on which telecommunication networks, services and applications are based, whether in fixed or mobile environments, personal, local or long distance areas, with different bandwidths, including telephony, radio broadcasting, television and data, from the point of view of transmission systems.
- CE ST05 Capacity for the selection of aerials, equipment and systems of transmission, wave propagation guided and non-guided by electromagnetic, radiofrequency or optical ways and related radioelectric space management and assignment of frequencies.

- CE TEL01 Ability to independently learn new knowledge and skills adequate for the design, development or utilization of telecommunication systems and services.
- CE TEL16 Knowledge of telecommunication legislation and regulations at the National, European and International levels.
- CG 02 Ability to search and select information, develop critical thinking and produce and defend arguments within the area.
- CG 04 Ability to abstract, analyze, and synthesize, and to solve problems.
- CG 10 Ability to handle specifications, rules and regulations and to apply them in the practice of the profession.

Specific outcomes of instruction (according to the Spanish program definition)

- 1.- Design and planning of mobile communication systems and networks.
- 2.- Use of the procedures and techniques of measurement and characterization of these systems and the elements of communications involved.
- 3.- Description and comparison of the major European digital mobile communications systems (TETRA, GSM/GPRS, UMTS, LTE), including architecture, services, interfaces, the different layers, and especially for the radio interface.
- 4.- Analysis of structure of bursts and plots and used procedures for coding and modulation.
- 5.- Analysis and simulation of the mobile channel and propagation models.
- 6.- Calculation of the balance sheets of link and the quality of mobile communications systems.

Bibliography

Comunicaciones móviles digitales. Rafael Herradón, EUITT, 2007.

Comunicaciones Móviles José M. Hernando., 2ª ed. C.E. Ramón Areces, 2004

Wireless and cellular telecommunications, Lee, William. McGraw Hill 2006

Essentials of LTE and LTE-A A. Ghosh, R Ratasuk. Cambridge University Press. 2011

Year 2015/16

Course Name:	Radar Technology	Course Code:	595010345
Year:	4	Semester:	8
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type A
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:			
Coordinator:		José Luis Jiménez	
Bachelor Engineering Program:		Telecommunication Systems Engineering	

Course Contents

1. Introduction to Radar Technologies
2. Radar Equation
3. Signal Processing and Treating. Radar Data
4. Technologic Aspects

ABET Student Outcomes

- (a) An ability to apply knowledge of mathematics, science, and engineering
- (b) An ability to design and conduct experiments, as well as to analyze and interpret data
- (e) An ability to identify, formulate, and solve engineering problems
- (j) A knowledge of contemporary issues
- (k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Study Outcomes (according to the Spanish program definition)

- CE ST04 Ability to select radiofrequency, microwave, radio broadcasting, radio link and radio localization circuits, subsystems and systems.
- CE ST05 Ability to select aerials, equipment and transmission systems for guided and non-guided wave propagation, through electromagnetic, radiofrequency or optical channels. Ability to manage the associated radio electric space and frequency allocation.
- CE TEL04 Ability to analyze and specify the fundamental parameters of a communication system.

Specific outcomes of instruction (according to the Spanish program definition)

- 1.- Design, simulate and plan a Radar System.

Bibliography

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