TELECOMMUNICATIONS SYSTEMS ENGINEERING B. Eng.

ELECTIVE COURSES TYPE B

Table of Contents

Course Name:	Digital Design I	Course Code:	595023027
Year:	3	Semester:	5
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Digital Electronics	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		Electronics II	
Coordinator:		Matías Garrido	
Bachelor Engineering Program:		Telecommunications Systems Engineering Sound and Image Engineering Telematics Engineering	

Course Contents

1. CAD+VHDL+Technology

2. Subsystems

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

(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

(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)

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 05   Ability for teamwork in multidisciplinary environments.

CE TEL10   Ability to analyze and design combinational and sequential circuits, synchronous and asynchronous, and to use microprocessors and integrated circuits.

CE TEL11   Knowledge and application of the fundamentals of hardware description languages

CE EC01   Ability to construct, take advantage and manage feedback systems, transport,

representation, processing, storage, management and presentation of multimedia information, from the point of view of the electronic systems.

CE CE05   Ability to design circuits of analogical and digital electronics, circuits of analogical-digital and digital-analogical conversion, radiofrequency circuits and conversion of electric power for applications of telecommunication and computing.

CE CE07   Ability to design interface devices, data capture and storage, and terminals for services and systems of telecommunication.

CE CE08   Ability to specify and use electronic instrumentation and measurement systems.

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

1.- Analysis, design, test and prototyping of simple digital subsystems (single-shot records, accumulators, frequency dividers, benches, counters BCD of several digits, counters programmable module, adding BCD and combinations of them) using VHDL.

2. - Apply CAD tools to capture, simulate and make digital systems.

3. - Search, select and use the relevant information provided by the manufacturers of configurable integrated circuits of average complexity.

4. - Perform analysis, design, test and prototyping of simple combinational and sequential systems using VHDL.

5. - Perform hierarchical descriptions of digital circuits using structural VHDL modeling.

6. - Know and use the configurable integrated circuits of different complexity for wired digital systems.

7. - Work in pairs with another student, planning weekly working hours and resolving small conflicts which may arise during the course.

8. - Use the oscilloscope to carry out and correctly interpret digital signal measures (logic levels, frequencies, indirect measures of current) in simple digital circuits.

Bibliography

Moodle Web Sources.

Course Name:	Microprocessor-based Systems	Course Code:	595023028
Year:	3	Semester:	5
Credits (ECTS):	6	Credit Hours:	4
Area:	Digital Electronics	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		Programming I Programming II Microprocessors	
Coordinator:		Fernando Pescador	
Bachelor Engineering Program:		Telecommunications Systems Engineering Sound and Image Engineering Telematics Engineering	

Course Contents

1. Block 0: Review
2. Block 1: External devices management
3. Block 2: Timers
4. Serial Communications
5. Medium complexity application design

ABET Student Outcomes

(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

(d)   An ability to function on multidisciplinary teams

(e)   An ability to identify, formulate, and solve engineering problems

(f)   An understanding of professional and ethical responsibility

(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

(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)

CG 03   Ability to express oneself in oral and written form, and to convey information through documents and public presentations.

CG 04	Ability to abstract, analyze, and synthesize, and to solve problems.
CG 05	Ability for teamwork in multidisciplinary environments.
CG 08	Ability to organize, plan and make decisions.
CG 11	Skills for the use of Information Technologies and Communications
CE TEL10	Ability to analyze and design combinational and sequential circuits, synchronous and asynchronous, and to use microprocessors and integrated circuits.
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 CE07	Ability to design interface devices, data capture and storage, and terminals for services and systems of telecommunication.
CE CE08	Ability to specify and use electronic instrumentation and measurement systems.
CE CE10	Being able to perform engineering projects of professional character in the field of specific technologies of telecommunication.

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

1. - Handle specific electronic instrumentation for the development of systems based on microprocessor, such as the Logic Analyzer.
2. - Development of applications in working groups
3. - Interpret the specifications of a system based on microcontroller of medium complexity...
4. - Write the code needed to develop an application based on microcontroller.
5. - Connect a peripheral to a microcontroller using interfaces based on standard protocols.
6. - Manage the initialization (reset) and clock sources in a microcontroller.
7. - Establish and manage a serial asynchronous communication between two systems.
8. - Learn how to handle any peripheral of medium complexity of a microcontroller from the documentation provided by the manufacturer.
9. - Send and receive data between two devices using serial synchronous communications
10. - Generate tensions and analogue wave forms, with sufficient accuracy, using a microcontroller´s analogue converters.
11. - Design the logic necessary to control a peripheral not included in the microcontroller through accesses to specific memory map addresses.
12. - Produce a report which justifies and describes the taking of decisions on the development of a project and defending it orally with accuracy and detail.
13. - Manage timers and counters, along with the modules of capture and comparison to develop applications based on the precise control of timing between events.
14. - Discuss software and hardware architecture of medium complexity microcontroller-based systems.
15. - Handle CAD environments for the coding, compilation, and debugging of applications based on microcontroller.
16. - Develop systems based on microprocessors from different fields of application

Bibliography

Moodle Web Resources

Course Name:	Analog Electronics I	Course Code:	595023023
Year:	2	**Semester:**	4
Credits (ECTS):	6	**Credit Hours:**	4
Area:	Analog Electronics	**Type:**	Elective / Type B
Term:	Spring	**Language:**	Spanish
Prerequisites / Co-requisites:		Circuit Analysis I Electronics I Circuit Analysis II	
Coordinator:		Sergio López	
Bachelor Engineering Program:		Telecommunications Systems Engineering Sound and Image Engineering Telematics Engineering	

Course Contents

1. Circuits with diodes
2. Circuits with transistors
3. Circuits with operational amplifiers

ABET Student Outcomes

(b)   An ability to design and conduct experiments, as well as to analyze and interpret data

(d)   An ability to function on multidisciplinary teams

(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

(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)

CG 02   Skilled to searching and selecting information, critical reasoning and writing and defending the reasonings within the defined area.

CG 03   Ability to express oneself in oral and written form, and to convey information through documents and public presentations.

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

CG 11   Skills for the use of Information and Communication Technologies.

CE CE05   Ability to design circuits of analogical and digital electronics, circuits of analogical-digital and digital-analogical conversion, radiofrequency circuits and

conversion of electric power for applications of telecommunication and computing.

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

1.- Use basic circuit analysis techniques to analyze the operation of linear and nonlinear circuits based on operational amplifiers.

2.- Design, from specifications, circuits of low complexity based on diodes, transistors (bipolar and unipolar) and operational amplifiers.

3.- Implement circuits of low complexity based on diodes, transistors (bipolar and unipolar) and operational amplifiers.

4.- Interpret the basic information in the datasheets of the diodes, transistors (bipolar and unipolar) and operational amplifiers.

5.- Use of analog circuit simulation programs to analyze and design circuits based on diodes, transistors (bipolar and unipolar) and operational amplifiers.

6.- Understand the behavior, at the level of model, diodes, transistors, bipolar and unipolar in working conditions of small-signal.

7.- Graphical and analytical understanding of bipolar and unipolar transistors.

8.- Use the techniques of analysis of circuits to analyze the functioning of basic circuits with diodes.

9.- Use the techniques of analysis of circuits to analyze the functioning of basic circuits with bipolar and unipolar transistors.

Bibliography

HAMBLEY, Allan R. Electrónica. 2ª Edición

FRANCO, Sergio. Design with Operational Amplifiers and Analog Integrated Circuits. 3ª Edición

PLEITE, J., VERGAZ, B y RUIZ, J.M. Electrónica Analógica para Ingenieros. Madrid: McGraw Hill, 2009

Course Name:	Production Technologies of Electronics Systems	Course Code:	595023033
Year:	3	Semester:	6
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Systems Engineering and Electronic Products	Type:	Elective / Type B
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Electronics I Electronics II Microprocessors	
Coordinator:		Eduardo Nogueira Díaz	
Bachelor Engineering Program:		Telecommunications Systems Engineering Sound and Image Engineering Telematics Engineering	

Course Contents

1. Introduction to the technologies of production of electronic systems.
2. Design of printed circuit boards and design rules.
3. Materials, manufacturing processes and types of printed circuit board.
4. Improvement of noise and electromagnetic compatibility, CE marking.
5. Thermal analysis of printed circuit board's power.
6. Evaluation of quality and reliability of circuits.

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

(d)   An ability to function on multidisciplinary teams

(i)   A recognition of the need for, and an ability to engage in life-long learning

(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)

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.
CG 13	Learning skills with a high degree of autonomy.
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 CE09	Ability to analyze and solve interference problems and electromagnetic compatibility.

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

1.- Knowing the rules of design and analysis for a circuit of high frequency or high power density.
2.- Know the properties, capabilities and limitations of each interconnect technology.
3.- Learn about the encapsulated and parameters selection of the components.
4.- Understand the application of the physical and electrical design rules depending on the application.
5.- Perform CAD-CAM (Computer Aided Design - Manufacturing) design of a circuit.
6.- Understand the processes for the realization of a printed circuit board and apply them in a printed circuit board manufacturing laboratory.

Bibliography

Tecnología Microelectrónica Vol 2: Circuitos Impresos. Ramiro Álvarez Santos. Editorial Ciencia.

Printed Circuits Handbook. C.F. Coombs. McGraw Hill Handbooks

Complete PCB Design Using OrCAD® Capture and PCB Editor. Kraig Mitzner. Ed Newnes

Course Name:	Audio Engineering I	Course Code:	595023126
Year:	3	Semester:	5
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		Sound and Image Fundamentals Signals and Systems Communication Theory	
Coordinator:		Francisco Javier Tabernero	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Telematics Engineering	

Course Contents

1. Psychoacoustic basis for Audio Engineering

2. Multichannel sound techniques

3. Audio Engineering equipment

4. Mixing consoles

ABET Student Outcomes

(b) An ability to design and conduct experiments, as well as to analyze and interpret data

(d) An ability to function on multidisciplinary teams

(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 recognition of the need for, and an ability to engage in life-long learning

(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 TEL 01   Ability to independently learn new knowledge and skills adequate for the design, development or utilization of telecommunication systems and services.

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

1.- Ability to understand and analyze the characteristics of the different equipment and processors used in audio engineering.

2.- Ability to understand and analyze the characteristics of different mixing consoles used in

audio systems.

Bibliography

Moodle Web Resources

Course Name:	Image and Video Technologies	Course Code:	595023128
Year:	3	Semester:	5
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		Signals and Systems Sound and Image Fundamentals Communication Theory Digital Signal Processing	
Coordinator:		Martina Eckert	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Telematics Engineering	

Course Contents

1. Basic features of Sound and Image signals

2. Digitalization and Encoding

3. Image and Video Compression

4. Advanced Video Encoding

ABET Student Outcomes

(b)   An ability to design and conduct experiments, as well as to analyze and interpret data

(d)   An ability to function on multidisciplinary teams

(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 recognition of the need for, and an ability to engage in life-long learning

(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)

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

CG 03   Ability to express oneself in oral and written form, and to convey information through documents and public presentations.

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

CG 05	Ability for teamwork in multidisciplinary environments.
CG 11	Skills for the use of Information and Communication Technologies.
CG 13	Learning skills with a high degree of autonomy.
CE SI01	Ability to construct, take advantage and manage services and telecom applications, understood these as systems of recording, analogical and digital treatment, codification, transmission, representation, processing, storage, reproduction, management and presentation of audiovisual services and multimedia information.
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 TEL01	Ability to independently learn new knowledge and skills adequate for the design, development or utilization of telecommunication systems and services.

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

1.- Ability to understand some advanced video encoding processes.
2.- Ability to understand the process of compressing video signals and auxiliary signals.
3.- Ability to understand the processes of digitization and encoding of images.
4.- Ability to understand the different formats of the video signal, for the various resolutions used in initial format, uncompressed.

Bibliography

Moodle Web Resources.

Course Name:	Sound and Image Fundamentals	Course Code:	595023122
Year:	2	Semester:	4
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		None	
Coordinator:		Danilo Simón	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Telematics Engineering	

Course Contents

1. Signals, systems, and Acoustic measurements. Review of concepts

2. Voice and hearing

3. Plane and spherical waves

4. Standing Waves

5. Features of the light and the human eye

6. Colorimetry applied to the presentation of images

7. Signals which are used for the representation of images

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

(d)   An ability to function on multidisciplinary teams

(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 SI 01   Ability to construct, take advantage and manage services and telecom applications, understood these as systems of captation, analogical and digital treatment, codification, transmission, representation, processing, storage, reproduction, management and presentation of audiovisual services and multimedia information.

CE SI 02   Ability to analyze, specify, implement and support systems, equipment, heads and facilities of television, Sound and Image, both fixed and mobile environments.

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

1.- Ability to analyze the phenomenology associated with oscillations.

2.- Ability to analyze fundamental characteristics of wave propagation.

3.- Ability to analyze plane and spherical acoustic waves in limited and unlimited surroundings.

4.- Identify, characterize, and use capture and playback devices of Sound and Image: (microphones, speakers, cameras, monitors and projectors).

Bibliography

Moodle Web Resources

Course Name:	Audio Engineering II	Course Code:	595023131
Year:	3	Semester:	6
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Audio Engineering I Sound and Image Fundamentals	
Coordinator:		Antonio Mínguez	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Telematics Engineering	

Course Contents

1. Digitalization of the audio signal

2. Interconnection

3. Digital Audio Workstations (DAW)

4. Digital storage of audio signal

5. Optical audio storage media

6. Audio coding. Binary system reduction techniques

ABET Student Outcomes

(b)   An ability to design and conduct experiments, as well as to analyze and interpret data

(d)   An ability to function on multidisciplinary teams

(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 recognition of the need for, and an ability to engage in life-long learning

(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)

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.

CE SI01   Ability to construct, take advantage and manage services and telecom applications, understood these as systems of recording, analogical and digital

treatment, codification, transmission, representation, processing, storage, reproduction, management and presentation of audiovisual services and multimedia information.

CE SI02   Ability to analyze, specify, implement and support systems, equipment, heads and facilities of television, Sound and Image, both fixed and mobile environments.

CE SI03   Ability to perform projects of places and facilities destined to the production and recording of Sound and Image signals.

CE SI05   Ability to create, encode, manage, transmit and distribute multimedia contents, according to usability and accessibility criteria of audiovisual, transmitting and interactive services.

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

1.-   Recognize devices and terminals of communication, data capture and playback of Sound and Image, and its main parameters.

2.-   Understand and analyze the characteristics of the different environments in audio installations.

3.-   Know and understand in detail the audio coding techniques that reduce the bit rate.

4.-   Understanding the techniques used in the storage of the audio signal and the most important optical systems.

5.-   Ability to understand and analyze the characteristics of different mixing consoles used in audio systems

6.-   Understand and analyze the characteristics of different mixing consoles used in audio systems.

7.-   Know the specific aspects in the digitalization of the audio signal.

8.-   Analyze the characteristics and design of interconnection between audio equipment.

9.-   Ability to understand and analyze the characteristics of the different equipment and processors used in audio engineering.

10.-   Understanding and handling of Sound and Image signals (digitization, formats and coding systems).

11.-   Understand and analyze the characteristics of the different equipment used in audio engineering for a specific use.

Bibliography

Pohlmann, Ken C. Principios de audio digital. McGraw Hill, 2002.

Watkinson, J. The Art of Digital Audio. Focal Press, 2001.

Bogh Brixen, Eddy. Audio Metering. Focal Press, 2011.

Course Name:	Transmission Systems	Course Code:	595023228
Year:	3	Semester:	5
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		Communication Theory	
Coordinator:		Antonio Da Silva	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Sound and Image Engineering	

Course Contents

1. Introduction to Transmission Systems

2. 2 Mb/s Multiplex Systems

3. Digital Plesiochronous Hierarchy

4. Synchronous Digital Hierarchy (SDH): multiplexing structure

5. Fiber optic based Line Systems

6. Synchronous digital hierarchy: network structure

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

(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)

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

CG 10   Ability to handle specifications, rules and regulations and applying them in the development of the profession

CE TE01   Ability to build, take advantage and manage networks, services, processes and telecom applications, understood these as systems of captation, transport, representation, processing, storage, management and presentation of multimedia

information, from the point of view of telematic services.

CE TE02   Ability to apply techniques in which nets, services and telematic aplications are based, like systems of management, signalisation and commutation, routing, security (cryptographic protocols, tunnelling, firewall, mechanisms to collect, authenticate and protect contents), traffic engineering (graphs theory, queuing theory, teletraffic), tarification and reliability and service quality, in environments fixed, mobile, personal, local or long-distanced, with different bandwidths, including telephony and data.

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.- Analyze the structure and quality of standardized at 2 MB/s systems.

2.- Use the appropriate laboratory equipment for measurement of defects, abnormalities, and quality of the signal transmission in normalized structures according to the European synchronous digital hierarchy.

3.- Calculate the bandwidths used in telephony and data communications.

4.- Understand the operation of the transmitter and receiver at different levels of the European plesiochronous digital hierarchy .

5.- Understand the rules used in the multiplexes of plesiochronous digital hierarchy.

6.- Learn about other international standards equivalent to the European ones, relating to the plesiochronous digital hierarchy. .

7.- Distinguish the elements that constitute a wide area network .

8.- Know the parameters that define the quality of line systems by optical fiber.

9.- Understand the problems arising in the integration of plesiochronous digital hierarchy networks with synchronous digital hierarchy networks. .

10.- Contextualise a transmission system model applied to a network at a great distance .

11.- Use the appropriate laboratory equipment to verify the proper functioning of the European plesiochronous digital hierarchy standard operating systems.

12.- Understand the rules used in the multiplex of synchronous digital hierarchy.

Bibliography

Connection-oriented networks : SONET/SDH, ATM, MPLS and optical networks, Perros, Harry G. John Wiley & Sons, 2005

SISTEMAS DE TRANSMISIÓN, ETSIST Publicaciones

Course Name:	Mobile Communications Networks	Course Code:	595023234
Year:	4	Semester:	7
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		Telecommunication Networks and Services Computer Networks Signaling and Switching Advanced Networks and Services	
Coordinator:		Carlos Ramos Nespereira	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Sound and Image Engineering	

Course Contents

1. Introduction to cellular mobile systems

2. GSM Systems: GSM, GPRS, EDGE

3. 3G Systems: UMTS, HSDPA, HSUPA

4. Introduction to 4G mobile systems

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

(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

(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)

CG 03   Ability to express oneself in oral and written form, and to convey information through documents and public presentations.

CG 05   Ability for teamwork in multidisciplinary environments.

CG 10   Ability to handle specifications, rules and regulations and applying them in the

development of the profession

| CE TE01 | Ability to build, take advantage and manage networks, services, processes and telecom applications, understood these as systems of recording, transport, representation, processing, storage, management and presentation of multimedia information, from the point of view of telematic services. |

| CE TE02 | Ability to apply techniques in which nets, services and telematic applications are based, like systems of management, signalization and commutation, routing, security (cryptographic protocols, tunneling, firewall, mechanisms to collect, authenticate and protect contents), traffic engineering (graphs theory, queuing theory, teletraffic), tarification and reliability and service quality, in environments fixed, mobile, personal, local or long-distanced, with different bandwidths, including telephony and data. |

| 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.- Ability to describe the basic characteristics of cellular mobile systems.

2.- Ability to identify emerging technological alternatives in 4G.

3.- Ability to explain the structures of protocols on GSM/GPRS/EDGE interfaces.

4.- Ability to justify functional improvements between 2G technologies.

5.- Ability to detail the functionality of the elements of architecture in the 3G network: UMTS/HSDPA/HSUPA.

6.- Ability to establish a chronological classification comparison of mobile communications systems.

7.- Ability to relate messages signaling with the services of the level of link and the logical channels defined in the networks GSM/GPRS/EDGE radio interface.

8.- Ability to explain technical and functional improvements among the 3G technologies.

9.- Ability to identify the functionality of control messages exchanged in the networks GSM/GPRS/EDGE radio interface

Bibliography

Hernando Rábanos, José M. Comunicaciones móviles (2ª edición). Ed. Centro de Estudios Ramón Areces, 2004.

Cox, Christopher. Essentials of UMTS. Ed. Cambridge University Press, New York, 2008.

Kreher, Ralf. UMTS signaling: UMTS interfaces, protocols, message flows and procedures analyzed and explained? (2nd Ed.). Ed. John Wiley & Sons, 2007.

Huidobro Moya, José Manuel. Comunicaciones móviles: GSM, UMTS, LTE?. Ed. Ra-Ma Madrid, 2012.

Holma, Harri. WCDMA for UMTS: HSPA Evolution and LTE. 5ª Ed. Ed. Wiley, 2010

Course Name:	Advanced Application Programming	Course Code:	595023222
Year:	2	Semester:	4
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Programming I Programming II	
Coordinator:		Pablo Ramírez	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Sound and Image Engineering	

Course Contents

1. Multilayer Architectures

2. Graphic User Applications Development

3. Java Server Applications for Web

ABET Student Outcomes

(b)   An ability to design and conduct experiments, as well as to analyze and interpret data

(d)   An ability to function on multidisciplinary teams

(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)

CG 03   Ability to express oneself in oral and written form, and to convey information through documents and public presentations.

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

CE TE04   Ability to describe, programme, validate and optimize protocols and interfaces of communication in the different levels of networks' architecture.

CE TEL07   Knowledge and use of the principles of programming in telecommunication networks, systems and services.

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

1.-   Indicate and describe the existing regulation regarding the approval of cryptographic systems.

2.-   Establish a comparison between public key and symmetric key cryptosystems.

3.-   Set the advanced capabilities of the X509 certification.

4.- Describe the basic security services in telematic networks.

5.- Describe algorithms commonly used in secret-key and public-key cryptosystems.

6.- Describe the mathematical foundations of modern cryptology.

7.- Describe the elements, structure and capacities of key distribution infrastructure.

Bibliography

Ken Arnold, James Gosling y David Holmes. El lenguaje de programación Java. Addison Wesley. 2001. 3ª Edición.

Bruce Eckel. "Thinking in Java". Ed. Prentice Hall.

Course Name:	Networks and Services Security	Course Code:	595023231
Year:	3	Semester:	6
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Programming II Computer Networks Telecommunication Networks and Services	
Coordinator:		Ana Gómez	
Bachelor Engineering Program:		Telecommunication Systems Engineering Communications Electronics Engineering Sound and Image Engineering	

Course Contents

1. General approaches on the security of networks and services

2. Security Infrastructures

3. Spanish legislation on information security. Recommendations and safety audits

4. Cybersecurity Applications

ABET Student Outcomes

(a)   An ability to apply knowledge of mathematics, science, and engineering

(e)   An ability to identify, formulate, and solve engineering problems

(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

(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)

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

CG 05   Skilled for teamwork in multidisciplinary environments

CE TE01   Ability to build, take advantage and manage networks, services, processes and telecom applications, understood these as systems of recording, transport, representation, processing, storage, management and presentation of multimedia information, from the point of view of telematic services.

| CE TE02 | Ability to apply techniques in which nets, services and telematic aplications are based, like systems of management, signalisation and commutation, routing, security (cryptographic protocols, tunnelling, firewall, mechanisms to collect, authenticate and protect contents), traffic engineering (graphs theory, queuing theory, teletraffic), tarification and reliability and service quality, in environments fixed, mobile, personal, local or long-distanced, with different bandwidths, including telephony and data. |
| CE TE05 | Ability to follow the technologic progress of transmission, commutation and process to improve the networks and telematic services. |

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

1.- Set the advanced capabilities of the X 509 certification.

2.- Designing and defining the most optimal solution for a specific telematics system that meets its security requirements.

3.- Indicate and describe the existing regulation regarding the approval of cryptographic systems.

4.- Describe the elements, structure and capabilities of the cryptographic tokens.

5.- Analyze the risks and vulnerabilities of networks and their systems.

6.- Describe the most commonly used security mechanisms for protecting networks and systems-level transport.

7.- Describe traditional security services used in telematics mechanisms such as email and Web service.

8.- Indicate the most significant aspects in relation to the standards for smart cards.

9.- Describe the most commonly used security mechanisms for the protection of networks and network-level systems.

10.- Define the protocols of action for efficient management of the security of networks and systems in accordance with standards and recommendations in force.

11.- Describe the basic security services in telematics networks.

12.- Describe the mathematical foundations of modern cryptology.

13.- Describe algorithms commonly used in secret-key and public-key cryptosystems.

14.- Establish a comparison between public-key and symmetric-key cryptosystems.

15.- Describe the elements, structure and capacities of key distribution infrastructure.

Bibliography

Carracedo, J. Seguridad en Redes Telemáticas. Mc Graw Hill. 2004

Stallings, William Network security essentials : applications and standards Pearson Prentice Hall, 2007