TELEMATICS ENGINEERING B. Eng.

ELECTIVE COURSES TYPE B

Table of Contents

Course Name:	Analog Electronics I	Course Code:	59502223
Year:	3	Semester:	6
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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   Skilled for public speaking and in written and communicating information throughout documents and public speeches.

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

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

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 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:	Digital Design I	Course Code:	595022027
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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   Skilled to searching and selecting information, critical reasoning and writing and defending the reasonings within the defined 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 languagesCE 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 EC05	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 EC07	Ability to design interface devices, data capture and storage, and terminals for services and systems of telecommunication.
CE EC08	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:	595022028
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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   Skilled for public speaking and in written and communicating information throughout documents and public speeches.

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 EC04	Ability to apply electronic as support technology in other fields and activities, not only in the field of Information Technologies and Communications.
CE EC07	Ability to design interface devices, data capture and storage, and terminals for services and systems of telecommunication.
CE EC08	Ability to specify and use electronic instrumentation and measurement systems.
CE EC10	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:	Production Technologies of Electronics Systems	Course Code:	595022033
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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 EC04	Ability to apply electronic as support technology in other fields and activities, not only in the field of Information Technologies and Communications.
CE EC09	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:	Wave Transmission and Propagation	Course Code:	595022327
Year:	3	Semester:	5
Credits (ECTS):	6	Credit Hours:	3
Area:	Applied Electromagnetism	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		Calculus I Calculus II Linear Algebra Electromagnetism Waves Propagation	
Coordinator:		Jose María Rodríguez	
Bachelor Engineering Program:		Telematics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. Transmission Lines

2. S Parameters

3. Conductive guides

4. Dielectric guides and fiber optic

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

(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 ST03   Capacity of analysing components and their specifications for communications systems, guided and non-guided.

CE ST05	Capacity for the selection of aerials, equipments 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 TEL03	Ability to use computer tools of search of bibliographical resources or of information related to the telecommunications and the electronics.
CE TEL09	Ability to understand the mechanisms of propagation and transmission of electromagnetic and acoustic waves, and their transmitters and receivers.
CG 02	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 13	Learning skills with a high degree of autonomy.

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

1.-   Characterize a transmission line by its electromagnetic parameters.

2.-   Understand and handle impedance matching techniques.

3.-   Interpret the mechanisms of propagation of electromagnetic waves in confined media: conductive guides and fiber optics.

4.-   Interpret the techniques used in high frequency circuits and subsystems.

5.-   Design and characterize high frequency circuits and subsystems.

6.-   Handling of the instrumentation used in microwave and high frequency technologies.

Bibliography

D.M. Pozar. Microwave Engineering. 4th edition. Ed. Wiley. 2011

S. Ramo, J.R. Whinnery and T. Van Duzer. Fields and Waves in Comunication Electronics. Ed. John Wiley & Sons. New York, 1984.

D.K. Cheng. Fundamentos de Electromagnetismo para Ingeniería. Ed. Addison-Wesley Iberoamericana. Washington, Delaware, 1996.

C.T.A. Johnk. Teoría electromagnética. Principios y aplicaciones.Ed. John Wiley & Sons. 1994.

F.T. Ulaby, E. Michielsen and U. Ravaioli. Fundamentals of Applied Electromagnetics 6th edition Ed. Pearson. 2010.

C.A. Balanis. Advanced Engineering Electromagnetics Ed. John Wiley & Sons. New York, 1989.

J. M. Senior. Optical Fiber Communications.Principles and Practice.2nd edition. Ed. Prentice-Hall. 1992.

Course Name:	Communications Electronics I	Course Code:	595022328
Year:	3	Semester:	5
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Elective	Type:	Elective / Type B
Term:	Fall	Language:	Spanish
Prerequisites / Co-requisites:		None	
Coordinator:		Miguel Ángel del Casar	
Bachelor Engineering Program:		Telematics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1.- Introduction to the study of the oscillators.
2.- LC Autocontrolled Oscillators
3.- Crystal Oscillators
4.- Analogue direct frequency synthesizers
5.- Indirect frequency synthesizers
6.- Direct Digital Synthesizers

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

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

CG 03   Skilled for public speaking and in written and communicating information throughout documents and public speeches.

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

CG 05	Ability for teamwork in multidisciplinary environments.
CG 09	Ability to analyze and assess the social and environmental impact of technical solutions.
CG 10	Ability to handle specifications, rules and regulations and to apply them in the practice of the profession.
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 ST03	Capacity of analysing components and their specifications for communications systems, guided and non-guided.
CE ST04	Capacity for the selection of circuits, subsystems and systems of radiofrecuency, microwave, broadcasting, radiolinks and radiolocalization.
CE ST07	Ability to design and development of telecommunications networks for industrial applications
CE TEL01	Ability to use communication and computer applications (office automation, databases, advanced calculus, project management, visualization...) to support the development and utilization of networks, services and telecommunication and electronics applicati
CE TEL02	Ability to use applications of communication and computer (office automation, databases, advanced calculus, management of projects, visualization...) to support the development and utilization of nets, services and applications of telecommunication and electronics.
CE TEL03	Ability to use computer tools of search of bibliographical resources or of information related to the telecommunications and the electronics.

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

1. Analyze the characteristics of transistors by means of models.

2. Analyzing and designing basic electronic circuits.

3. Analyze, design, build and measure radio frequency oscillator circuits.

4. Analyze, design, build and measure indirect frequency synthesizers circuits.

5. Select components, circuits and commercial subsystems in the field of radio frequency generators.

6. Analyze and design electronic communications circuits.

7. Analyze and design electronic communications subsystems.

8. Manage electronic automated design tools.

9. Select the most appropriate signal generator circuit for each application.

10. Select the most appropriate oscillator technology for each application of communications

Bibliography

M. Sierra Pérez y otros, Electrónica de Comunicaciones, Pearson Education, 2003

G. González, Foundations of Oscillators Circuit Design, Artech House, 2006

R. Rhea, Oscillator Design and Computer Simulation, McGraw- Hill, 1995

J. Smith, Modern Communication Circuits, McGraw-Hill, 1998

F.M. Gardner, Phaselock Techniques, Wiley, 2005

R. Best, Phase Locked Loop ? Design, Simulation and Applications, McGraw-Hill, 2007

Rohde, Microwave and Wireless Synthesizers ? Analysis and Design, Wiley, 1997

A. Chenakin, Frequency Synthesizers: Concept to Product, Artech House, 2010

B.G. Goldberg, Digital Frequency Synthesis Demystified, Ed. Newmes, 1999

Course Name:	Analog Electronics	Course Code:	595022322
Year:	2	Semester:	4
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Circuits Analysis I Electronics I	
Coordinator:		Francisco José Arqués	
Bachelor Engineering Program:		Telematics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. Introduction to electronic components

2. Polarizing techniques

3. Equivalent models of transistors

4. Middle frequency and small signal amplifiers

5. Frequency Response

6. Introduction to feedback 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   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 B1   Capacity of solving mathematic problems that can appear in engineering. Aptitude for applying knowledges about: linear algebra, geometry, differential geometry, differential and integral calculus, differential equations, partial-

differential equations, numeric methods, numeric algorithmics, statistics and optimization.

CE B2   Basic knowledge on using and programming computers, operating systems, databases and software used in engineering.

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 EC04   Ability to apply electronic as support technology in other fields and activities, not only in the field of Information Technologies and Communications.

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 power for applications of telecommunication and computing.

CE EC08   Ability to specify and use electronic instrumentation and measurement systems.

CE ST03   Capacity of analyzing components and their specifications for communications systems, guided and non-guided.

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

1.-   Understand the characteristics of the diodes, bipolar and unipolar transistors used in electronic circuits.

2.-   Understand the usefulness of the simulation of analog circuits based on diodes, transistors and operational amplifiers.

3.-   Applying basic circuit analysis techniques to analyze the functioning of basic circuits with transistors.

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

5.-   Understanding bipolar and unipolar transistors graphically and analytical in continuous.

6.-   Meet the Thevenin and Norton theorems, the simplifications which they give place and know to determine the equivalent which they generate.

Bibliography

"Electrónica" ALLAN R. HAMBLEY , PEARSON EDUCACION, 2001.

ELECTRONICA DE POTENCIA: CIRCUITOS, DISPOSITIVOS Y APLICACIONES". MUHAMMAD H. RASHID , PRENTICE HALL MEXICO, 2005

"Principles of Transistor Circuits". S W Amos. ELSEVIER.

"Intuitive Analog Circuit Design", Marc Thompson. ELSEVIER.

Electrónica Básica para Ingenieros. Gustavo A. Ruiz Robredo. Servicio de Publicaciones de la Universidad de Cantabria

Course Name:	Communications Electronics II	Course Code:	595022331
Year:	3	Semester:	6
Credits (ECTS):	6	Credit Hours:	4
Area:	Elective	Type:	Elective / Type B
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		Communication Electronics I	
Coordinator:		Federico Javier Ortega	
Bachelor Engineering Program:		Telematics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. Transmitters and receivers

2. Small signal amplifiers

3. Conventional power amplifiers

4. Switched power amplifiers

5. Amplifier Design

6. Linearization

7. Frequency Mixers

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

(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 ST01   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 ST05   Ability to create, encode, manage, transmit and distribute multimedia contents, according to usability and accesibility criteria of audiovisual, transmitting and interactive services.

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

1.-   Handling of the instrumentation and procedures for a basic laboratory of communication systems, (generator/oscilloscope and Spectrum Analyzer RF modulator).

Bibliography

Herbert L. Krauss, Charles W. Bostian, Frederick H. Raab, Solid state Radio Engineering, Wiley, 1980, ISBN: 978-0-471-03018-8

Andrei Grebennikov, Nathan O. Sokal, Marc J. Franco, Switchmode RF and Microwave Power Amplifiers, 2nd edition, Academic Press (Eselvier) 2012, ISBN: 978-0-12-415907-5

Guillermo González, Microwave Transistor Amplifiers: Analysis and Design, 2nd edition, Prentice Hall, 1996, ISBN: 978-0132543354

Francisco Javier Ortega González, Análisis y Diseño de Amplificadores de Potencia en Alta Frecuencia, Departamento de Publicaciones de la EUIT de Telecomunicación, UPM

Course Name:	Audio Engineering I	Course Code:	595022126
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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

(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

(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 use communication and computer applications (office automation, databases, advanced calculus, project management, visualization...) to support the development and utilization of networks, services and telecommunication and electronics applications.

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:	595022128
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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

(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

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

CG 03   Skilled for public speaking and in written and communicating information throughout documents and public speeches.

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 captation, 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 accesibility criteria of audiovisual, transmitting and interactive services.
CE TEL01	Ability to use communication and computer applications (office automation, databases, advanced calculus, project management, visualization...) to support the development and utilization of networks, services and telecommunication and electronics applicati

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:	595022122
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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 SO 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 SO 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:	595022131
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:		Telematics Engineering Telecommunications Systems Engineering Sound and Image 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

(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 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 SI01   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 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 accesibility 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.