

SOUND AND IMAGE ENGINEERING

B. Eng.

SEMESTER 4

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Year 2015/16

Course Name:	Science, Technology and Society	Course Code:	595000117
Year:	2	Semester:	4
Credits (ECTS):	3	Credit Hours:	2
Area:	Common UPM Skills	Type:	Basic / Required
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		None	
Coordinator:		Eloy Portillo	
Bachelor Engineering Program:		Sound and Image Engineering Communications Electronics Engineering Telecommunications Systems Engineering Telematics Engineering	

Course Contents

1. Printing, Renaissance and first globalization
2. Scientific spirit and ingenuity Machinist
3. The scientific revolution
4. The revolutions of the 18th century
5. Progress and development capitalists
6. Technological determinism and ethics in engineering
7. Telecommunications economy
8. Environmental crisis and "grey ecology"
9. Sociology of telecommunications
10. Critical theory of postmodernism

ABET Student Outcomes

- (d) An ability to function on multidisciplinary teams
- (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
- (i) A recognition of the need for, and an ability to engage in life-long learning

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 05 Ability for teamwork in multidisciplinary environments..
- CG 06 Ability for adaptability, negotiation, conflict resolution and leadership
- CG 09 Ability to analyze and assess the social and environmental impact of technical solutions.
- 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 TEL 03 Ability to use computer tools of search of bibliographical resources or of information related to the telecommunications and the electronics.
- CE TEL 16 Knowledge of telecommunication legislation and regulations at the National, European and International levels.

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

- 1.- Locate the required information correctly.
- 2.- Analyze the information found and discard the irrelevant.
- 3.- Process the information from different sources and synthesize it properly.
- 4.- Contrast the ideas contributed by different sources.
- 5.- -Make an assessment about the rigor of the source of origin of information.
- 6.- Relate the scientific and technological aspects with a social environment of increasing complexity: social, economic, political, legal, ethical and environmental aspects.

Bibliography

“Ciencia, tecnología y sociedad. Una introducción al estudio social de la ciencia y la tecnología”, González, M. I.; López Cerezo, J. A. y Luján, J. L., 1996.

Year 2015/16

Course Name:	Wave Propagation	Course Code:	595000118
Year:	2	Semester:	4
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Physics	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:	Calculus I Lineal Algebra Calculus II Electromagnetism and Waves		
Coordinator:	Emma Acosta		
Bachelor Engineering Program:	Sound and Image Engineering Communications Electronics Engineering Telecommunications Systems Engineering Telematics Engineering		

Course Contents

1. Vector operators
2. Plane acoustic waves
3. Spherical acoustic waves
4. Stationary acoustic waves
5. Maxwell equations. Wave equation. Energy
6. Propagation of electromagnetic waves in a dielectric medium
7. Propagation of electromagnetic waves in conductive media
8. Reflection and refraction
9. Guided waves
10. Radiation of electromagnetic waves

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

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 13 Learning skills with a high degree of autonomy..

- 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 TEL 09 Ability to understand the mechanisms of electromagnetic and acoustic wave propagation and transmission, as well as corresponding transmitters and receivers.

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

1. Analyze fundamental characteristics of wave propagation.
2. Analyze the phenomenology associated with the electrostatic field.
3. Analyze the propagation of electromagnetic waves in media dielectrics and conductors.
4. Understand and analyze the meaning of Maxwell's equations and its consequences.
5. Understand the basic properties of materials that are based on devices.
6. Analyze the key characteristics of the magnetic field.
7. Analyze the phenomenology associated with oscillations.
8. Analyze fundamental characteristics of electromagnetic fields and electromagnetic waves.
9. Analyze the effect of boundary conditions, as well as the guided electromagnetic wave propagation.
10. Analyze the phenomena associated with radiation.
11. Analyze flat and spherical acoustic waves in media limited and unlimited.

Bibliography

“Elementos de electromagnetismo”, Matthew N. O., Sadiku Edición 3^a, Editorial Oxford University Press.

“Fundamentos de la teoría electromagnética”, Reitz, Milford y Christy, Editorial Pearson Educación.

“Campos y ondas electromagnéticos”, P. Lorrain y D:R: Corson, Editorial Selecciones Científicas.

“Fundamentos de Acústica”, L.E. Kinsler, A.R. Frey, A.B. Coppens y J.V., Sanders. Editorial Limusa.

Year 2015/16

Course Name:	Microprocessors	Course Code:	595000120
Year:	2	Semester:	4
Credits (ECTS):	6	Credit Hours:	4
Area:	Fundamentals of Electronics	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:		Programming I Electronics I	
Coordinator:		Juan Manuel López	
Bachelor Engineering Program:		Sound and Image Engineering Communications Electronics Engineering Telecommunications Systems Engineering Telematics Engineering	

Course Contents

1. Introduction to microprocessor systems
2. Processor Cortex M0
3. Programming 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
- (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
- (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 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 to solve engineering problems.
CE TEL10	Ability to analyze and design combinational and sequential circuits, synchronous and asynchronous, and to use microprocessors and integrated circuits.

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

1. Use the microprocessor peripherals to develop applications which solve problems of medium complexity.
2. Design the logic necessary to connect memory and peripherals for input/output in a digital system based on microprocessor, respecting the timing established in their machine cycles.
3. Perform simple programs in Assembly language and high level for a commercial microprocessor Language:.
4. Understand the functionality and interface subsystems combinational, sequential, and memories.
5. Understand the principles of operation of some basic peripherals: serial port, parallel port, timers, etc.
6. Learn about the architecture, features, and operation of a commercial microprocessor.
7. Understand the different techniques of input/output for the exchange of data between a microprocessor-based system and other systems.
8. Understand the principles of operation of a microprocessor, the basic elements that make up its architecture, and digital circuits comprising a microprocessor-based system.

Bibliography

"Manual del procesador Cortex-M0"

Year 2015/16

Course Name:	Communication Theory	Course Code:	595000121
Year:	2	Semester:	4
Credits (ECTS):	6	Credit Hours:	4
Area:	Communication Systems	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:		Signals and Systems	
Coordinator:		Pedro García	
Bachelor Engineering Program:		Sound and Image Engineering Communications Electronics Engineering Telecommunications Systems Engineering Telematics Engineering	

Course Contents

1. Model of a communication system
2. Signals
3. Noise
4. Distortion
5. Analog Modulation
6. A/D Conversion. MIC System
7. Filtered Base-band digital transmission
8. Base band Digital transmission with noise
9. Digital Modulation

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
- (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
- (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.
- CG 05 Ability for teamwork in multidisciplinary environments..
- CG 09 Ability to analyze and assess the social and environmental impact of technical solutions.
- CG 11 Skills for the use of Information and Communication Technologies.
- CE TEL 01 Capacidad para aprender de manera autónoma nuevos conocimientos y técnicas adecuados para la concepción, el desarrollo o la explotación de sistemas y servicios de telecomunicación.
- CE TEL 03 Ability to use computer tools of search of bibliographical resources or of information related to the telecommunications and the electronics.
- CE TEL 04 Ability to analyze and specify the fundamental parameters of a communication system.
- CE TEL 05 Ability to weigh up the advantages and disadvantages of different technological alternatives to deploy or implement communication systems, from the point of view of signal space, perturbations and noise, and analog and digital modulation systems.
- CE TEL10 Ability to analyze and design combinational and sequential circuits, synchronous and asynchronous, and to use microprocessors and integrated circuits.
- CE TEL 16 Knowledge of telecommunication legislation and regulations at the National, European and International levels.

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

- 1.- Relate the technical aspects with the social environment. Aspects of market, regulatory environment.
- 2.- Analyze the process of modulation and demodulation, analog and digital.
- 3.- Interpret and characterize the signal parameters in terms of power, wide bandwidth and quality of telecommunication systems (relations signal to noise or interference, distortion and error probability).
- 4.- Analyze the structure, performance and applications of telecommunication systems.
- 5.- Characterizing elements and technologies of transit, distribution, access and user networks.
- 6.- Understand and manage base-band and modulated signals.

Bibliography

- “Apuntes de Teoría”, Dpto. Publicaciones.
- “Manual de Practicas”, Dpto. Publicaciones.
- “Libro de Problemas”, Dpto. Publicaciones.

Year 2015/16

Course Name:	Sound and Image Fundamentals	Course Code:	595000122
Year:	2	Semester:	4
Credits (ECTS):	6	Credit Hours:	4
Area:	Audio Engineering	Type:	Basic / Required
Term:	Spring	Language:	Spanish
Prerequisites / Co-requisites:		None	
Coordinator:		Danilo Simón	
Bachelor Engineering Program:		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 SI01 Ability to build, utilize and manage telecommunication services and applications for the purpose of acquiring, treating analogically and digitally, encoding, transporting, representing, processing, storing, reproducing, managing and presenting audiovisual services and multimedia information.
- CE SI02 Ability to analyze, specify, implement and support television, audio and video systems, equipment, headers and facilities, both in 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 audio and video: (microphones, speakers, cameras, monitors and projectors).

Bibliography

Moodle Web Resources

Year 2015/16

Course Name:	Digital Signal Processing	Course Code:	595000124
Year:	2	Semester:	4
Credits (ECTS):	4,5	Credit Hours:	3
Area:	Communication Systems	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:		Calculus I, Lineal Algebra Calculus II, Signals and Systems	
Coordinator:		Juan Carlos Gonzalez de Sande	
Bachelor Engineering Program:		Sound and Image Engineering Communications Electronics Engineering Telecommunications Systems Engineering Telematics Engineering	

Course Contents

1. Continuous digital signal processing
2. Design of digital filters
3. The transform discrete Fourier transform (DFT)

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
- (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

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.
- 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 to solve engineering problems.

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

CE TEL08 Ability to apply signal analysis and treatment and system modeling tools.

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

- 1.- Perform the convolution of signals.
- 2.- An analysis on frequency of discrete time signals.
- 3.- Linking continuous time systems and systems of discrete time in the time domain.
- 4.- Performing basic operations with signals and functions.
- 5.- Be able to characterize LTI systems of discrete time in the time domain (response to the impulse and constant coefficients linear difference equation) and processed domains (frequency and function of system response).
- 6.- Describe the characteristics of the spectral estimation of sequences with the spectrum of the continuous-time signal from which they come.
- 7.- Characterize and describe mathematically FIR and IIR filters.
- 8.- Designing IIR filters using the bilinear transformation method.
- 9.- Apply the rational change of the sample rate to the solution of problems.
- 10.- Mathematical tools of analysis and design for discrete time systems .
- 11.- Represent the flowchart of digital filters in their basic forms.
- 12.- Determine the parameters of an interpolator.
- 13.- Characterize mathematically the operation of sampling of continuous-time signals.
- 14.- Analysis and characterization of discrete time signals.
- 15.- Calculate the ideally sampled signal spectrum.
- 16.- Relate time continuous signals and time discrete time-domain signals.
- 17.- Relate the linear convolution with the DFT.
- 18.- Differentiate digital according to the characteristics of its impulse response filter types: FIR and IIR filters.
- 19.- Be able to describe the block diagram of a digital signal processing system in real time enumerating the significant parameters of each block.
- 20.- Describe the basic methods for the design of FIR filters.
- 21.- Describe linear phase FIR filters.
- 22.- Describe the principles of the method of sampling in frequency of FIR filter design and relate it to the DFT.
- 23.- Designing IIR filters by using the method of the invariant transformation of impulse.
- 24.- Determine the parameters of a decimator.
- 25.- Consider the solution to problems of sampling rate change.
- 26.- Relate the circular convolution with the DFT.

Bibliography

"Señales y Sistemas", 2ª Edición. A.V. Oppenheim, A. S., Willsky y S. H. Nawab. Prentice Hall. 2000.

"Tratamiento de Señales en Tiempo Discreto", Oppenheim, Schaffer, Buck., Prentice Hall, 2000.

"Tratamiento digital de señales. Principios, algoritmos y aplicaciones", J.G. Proakis, D.G. Manolakis, , Prentice Hall, 1997.