TELEMATICS ENGINEERING B. Eng.

SEMESTER 3

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Course Name:	Electromagnetism and Waves	Course Code:	595000212
Year:	2	Semester:	3
Credits (ECTS):	6	Credit Hours:	4
Area:	Physics	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:		Calculus I Lineal Algebra Calculus II	
Coordinator:		Marta Sánchez	
Bachelor Engineering Program:		Telematics Engineering Communications Electronics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. Oscillations

2. Waves in elastic media

3. Electrostatics

4. Magnetostatics

5. Electro-magnetic fields

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   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 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 propagation and transmission of electromagnetic and acoustic waves, and their transmitters and receivers.

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

1. Ability to calculate work and energy and use the principles of conservation.
2. Understand and analyze the harmonic oscillations.
3. Know and use the function and the equation of waves.
4. Understand the mechanisms associated with the propagation of waves in elastic media.
5. Understand and analyze the process of interference and standing waves.
6. Know and apply Gauss's law for electric field in vacuum and material means.
7. Understand and use the relationship between field and electric potential.
8. Understand and use the concepts of density and current and the continuity equation.
9. Know and estimate the effects of magnetic fields on electrical currents and material means.
10. Know and apply the theorem of Ampere in vacuum and material means.
11. Know and use the Faraday law of electro-magnetic induction and calculate the magnetic energy.
12. Know and apply the Ampère-Maxwell law.
13. Understand Maxwell's equations in integral form**.**

Bibliography

"Física Universitaria",Young-Freedman. Edición 12ª. Editorial Addison-Wesley. Vol. I y II

"Problemas de Física resueltos", Departamento de Física Aplicada.

Course Name:	Statistics and Stochastic Processes	Course Code:	595000213
Year:	2	Semester:	3
Credits (ECTS):	6	Credit Hours:	4
Area:	Mathematics	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:		Calculus I; Lineal Algebra Calculus II	
Coordinator:		Carmen Cousido	
Bachelor Engineering Program:		Telematics Engineering Communications Electronics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. Probability
2. Random Variables
3. Random vectors
4. Statistic inference
5. Stochastic processes
6. Practices with statistic software

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 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.

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 algorithmic, statistics and optimization.

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

1.- Calculate the distribution of a function of one or more independent random variable.

2.- Handle numerical and graphical statistical data analysis tools.

3.- Know and apply processes Poisson and normal.

4.- Calculate marginal and conditional distributions. Calculate odds and moments of multi-dimensional random variables.

5.- Understand the concepts of random variable and associated probability distribution.

6.- Calculate odds and moments of discrete random variables. Know and apply the Poisson and negative binomial, geometric, binomial models.

7.- Know and apply the normal multidimensional models and multinomial.

8.- Understand the concept of probability. Know their properties. Apply the fundamental theorems of calculus of probabilities.

9.- Know the main statistical sample and the sampling distribution.

10.- -Calculate odds and moments of continuous random variables. Know and apply uniform, normal and exponential models.

11. Understand the concepts of multi-dimensional random variable and associated probability distribution.

12. Understand and apply the independence of random variables.

13.- Information about the law of probabilities governing a random phenomenon based on observations of the same.

14.- Learn the basics of stochastic processes. Characterize stationary processes. Calculate the average, autocorrelation and spectral density of a process.

15.- Apply the techniques and probabilistic models to solve problems in telecommunications.

16.- Apply the tools which can treat systems where signs in the presence of uncertainty.

Bibliography

"Estadística Aplicada". J. De la Horra, Ed. Díaz de Santos.

"Cálculo de Probabilidades y Estadística", Fernández Abascal, Ed. Ariel.

"Probability, Statistics and Random Processes for Electrical Engineering", A León-García, Ed. Mc Graw Hill.

"Estadística, modelos y métodos", D. Peña, Ed. Alianza Universidad.

"Random Signals", Shanmugan, Ed. Wiley.

"Introduction to Probability Models", S. M. Ross, Ed. Academic Press

Course Name:	Electronics II	Course Code:	595000214
Year:	2	Semester:	3
Credits (ECTS):	6	Credit Hours:	4
Area:	Fundamentals of Electronics	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:		Electronics I Lineal Algebra Calculus II	
Coordinator:		Manuel César Rodríguez	
Bachelor Engineering Program:		Telematics Engineering Communications Electronics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. Coding, Boole Algebra, logic circuits

2. Digital Circuits Technology

3. Combinational 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

(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 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 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 TEL 10   Ability to analyze and design combinational and sequential circuits, synchronous and asynchronous, and to use microprocessors and integrated circuits.

CE TEL 11   Knowledge and application of the fundamentals of hardware description languages.

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

1. Understand the functionality and interface of the sequential subsystems.
2. Understand HDL of combinational circuits and sequential simple synchronous modeling.
3. Apply CAD tools for capturing and simulation of simple digital circuits.
4. Understand the mechanisms associated with the propagation of waves in elastic media.
5. Apply CAD tools for the technological realization of electronic circuits.
6. Apply the mathematical tools used for analysis and design of digital circuits.
7. Understand the functionality and interface of the combinational subsystems.
8. Design and verify sequential circuits.
9. Design and verify combinational circuits.
10. Understand the technological foundations for the realization of digital circuits.

Bibliography

Moodle Resources

Course Name:	Telecommunication Networks and Services	Course Code:	595000215
Year:	2	**Semester:**	3
Credits (ECTS):	6	**Credit Hours:**	4
Area:	Computer Networks	**Type:**	Basic / Required
Term:	Fall / Spring	**Language:**	Spanish
Prerequisites / Co-requisites:		Programing II	
Coordinator:		Oscar Ortiz	
Bachelor Engineering Program:		Telematics Engineering Communications Electronics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. INTRODUCTION TO TELECOMMUNICATIONS NETWORKS

2. STRATIFIED INTO LEVELS COMMUNICATION ARCHITECTURES

3. ARCHITECTURE CENTRES OF SWITCHING AND SIGNALING IN TELECOMMUNICATIONS NETWORKS

4. INTRODUCTION TO THE PROTOCOLS AND SECURITY SERVICES

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

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 applicati

CE TEL 06   Knowledge and use of the principles of programming in telecommunication networks, systems and services.ntinuous improvement, as well as knowing their economic and social impact.

CE TEL 13   Knowledge and use of the concepts of network architecture, protocols and communication interfaces.

CE TEL 14   Ability to differentiate the concepts of access and transport network, packet and circuit switching network, fixed and mobile network, as well as distributed systems and networked applications, voice, data, audio, video, interactive and multimedia services.

CE TEL 15   Knowledge of methods of interconnecting networks and routing, fundamentals of planning and networks dimensioning basing on traffic parameters.

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

1.   Describe the functionality of each level of a tiered architecture.
2.   Classify telecommunications networks according to the geographical area.
3.   Recognize the need for stratified models of communication architectures.
4.   Develop a protocol for communication with basic flow control and control of errors, segmentation and reassembly procedures.
5.   Describe the operation of a packet-switched network.
6.   Explain the main threats and attacks on the security of telecommunication networks.
7.   Classify telecommunications networks based on topology.
8.   Describe the basic architecture of a circuit switching Center.
9.   Explain the types of control associated with each circuit switching Center architecture.
10.   Classify telecommunications networks based on switching techniques.
11.   Describe the functionality of signaling networks.
12.   Identify the elements of telecommunications networks.
13.   Explain the need and the different types of signs.
14.   Describe the services, security protocols and mechanisms used in telecommunication networks

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"Redes de computadoras: un enfoque descendente", James F., Pearson Addison Wesley, 2010

"Comunicaciones y Redes de Ordenadores", Stallings, W., Séptima Edición, Prentice-Hall International, 2004.

"Redes de computadores e Internet", Halsall, F., Pearson Addison-Wesley, 2006

"Digital Telephony", J.C. Bellamy, Tercera edición, Ed. Willey-Interscience Publications John Willeyand sons, 2000

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

"Network security essentials: applications and standards", Stallings, W., Pearson Prentice Hall, 2007

Course Name:	Signals and Systems	Course Code:	595000216
Year:	2	Semester:	3
Credits (ECTS):	6	Credit Hours:	4
Area:	Mathematics	Type:	Basic / Required
Term:	Fall / Spring	Language:	Spanish
Prerequisites / Co-requisites:		Calculus I Lineal Algebra Calculus II Circuit Analysis II	
Coordinator:		Juan Carlos González de Sande	
Bachelor Engineering Program:		Telematics Engineering Communications Electronics Engineering Telecommunications Systems Engineering Sound and Image Engineering	

Course Contents

1. Introduction to the signals analysis in the time domain

2. Systems analysis of in the time domain

3. Fourier analysis for continuous-time systems and signals

4. Fourier analysis for discrete-time systems and signals

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 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.

CE B3   Knowledge and command of basic concepts on the general laws of Mechanics, Thermodynamics, electromagnetic fields and waves, and its application to solve engineering problems.

CE B4   Knowledge and command of basic concepts on linear systems and related functions and transforms, theory of electrical circuits, electronic circuits, physical principles of semiconductors and logic families, electronic and photonic devices, materials technology and its application for solving problems of engineering.

CE 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.-   Characterize and analyze mathematically in the time domain signals and of continuous time and discrete time LTI systems.

2.-   Characterize and analyze signals and continuous time LTI systems, in the domino frequency and in the transformed domain.

3.-   Characterize and analyze signals and discrete time LTI systems, in the domino frequency and in the transformed domain.

4.-   Determination of the most suitable method to be applied in the analysis of basic problems with signals and systems.

5.-   Analysis and characterization of discrete time signals.

6.-   Performing basic operations with signals and functions.

7.-   Perform the convolution of signals.

8.-   Determine the relationship between the different ways of characterizing LTI systems.

9.-   An analysis on frequency of continuous time signals.

10.- An analysis on frequency of discrete time signals.

11.- Characterize mathematically the operation of sampling of continuous-time signals.

12.- Calculate the ideally sampled signal spectrum.

13.- Characterize LTI discrete time systems in the time domain (impulse response and constant coefficients linear difference equation) and transformed domains (frequency response and stem function).

14.- Characterize LTI systems in continuous time in the frequency and in the Laplace domain.

15.- Represent the poles and zeros diagram of the continuous-time and discrete time systems.

16.- Characterize different types of systems depending on their frequency discrimination.

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"Señales y Sistemas", 2ª Edición. A.V. Oppenheim, A. S., Willsky y S. H. Nawab. Prentice Hall. 1998.

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"Señales y Sistemas: análisis mediante métodos de transformada y MATLAB" M.J. Roberts, McGraw-Hill Interamericana. 2005.