3rd/4th Year

Track 1: Automatic Controls and Electronics

1	55000051	Applied Mathematics
2	55000101	Systems Programming
3	55000103	Analog Electronics
4	55000104	Digital Electronics
5	55000105	Robotics
6	55000106	Power Electronics
7	50000107	Microprocessors Systems
8	55000108	Computer Control
9	55000204	Electrotechnics II

INDUSTRIALES
ETSII | UPM

55000051 - APPLIED MATHEMATICS

CREDITS:	4.5 ECTS
DEPARTMENT:	Industrial and Applied Mathematics (MAT)
COURSE COORDINATOR:	María Elena Domínguez Jiménez
TYPE:	Common
YEAR AND SEMESTER:	3rd Year / Spring

LIST OF TOPICS

MODULE 1. Numerical linear algebra.

- 1.1. Direct methods for solving linear systems: Gaussian elimination and LU factorization.
- 1.2. Badly conditioned problems. Condition number
- 1.3. Iterative methods of solving linear systems: Jacobi, Gauss-Seidel and conjugate gradients.
- 1.4. Iterative methods for calculating eigenvalues: power method and QR method.

MODULE 2. Least squares approximation.

- 2.1. The least squares problem. Least squares solutions.
- 2.2. Calculation of the QR factorization by means of: Gram-Schmidt method, and Householder matrices.

MODULE 3. Polynomial interpolation.

- 3.1. The Vandermonde Matrix Conditioning Problem
- 3.2. Lagrange and Newton interpolation formulas.
- 3.3. Runge phenomenon. Optimal choice of interpolation nodes: Chebychev nodes.

MODULE 4. Numerical integration

- 4.1. Rectangle, trapezoid and Simpson formulas.
- 4.2. Gaussian quadrature formulas: Legendre nodes.

MODULE 5. Fourier's analysis

- 5.1) Trigonometric approximation of periodic functions. Fourier series. Fourier coefficients. Gibbs phenomenon.
- 5.2) Discrete Fourier Transform (DFT). Roots of the unity. Fourier matrix and DFT. Trigonometric interpoliation and DFT.
- 5.3). Fourier transform. Definition and properties. Inversion formula.
- 5.4) Fourier analysis applications: filter design, spectral analysis, noise extraction and signal compression.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Algebra

TOPICS: Linear systems, least squares, eigenvalues, condition number.

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Basic math. Skill for the management of the concepts of calculus, algebra and differential equations.
- Familiarity with the basics of programming (best in Matlab)

SPECIFIC OUTCOMES FOR THE COURSE

Course Syllabi. Elective (Profile I)

At the end of the course, the student will be able to (or will have ability for):

- Modelling of problems using mathematical tools.
- Knowledge of the numerical problems in engineering, and the advantages and limitations of resolution methods studied in the course
- Ability to use media computations to implement, adjust and validate mathematical models of reality.

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_6. An ability to develop and conduct appropriate experimentation, analyse and interpret data, and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

OTHER MATERIALS

- Notebook written by the Professor, containing the required theory and exercises, available for the students at Moodle.
- Exams of other years, also available in Moodle.

55000101 - SYSTEMS PROGRAMMING

CREDITS:	6 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Fernando Matía
TYPE:	Track (Automatic Controls and Electronics)
YEAR AND SEMESTER:	3rd Year / Spring

LIST OF TOPICS

MODULE 1. Computer Basics

- 1) Computer Architecture
- 2) Operating systems

MODULE 2. Sequential programming

- 3) Programming languages and compilers
- 4) C Language review

MODULE 3. Algorithms and Data Structures

- 5) Recursion algorithms
- 6) Array's algorithms
- 7) Dynamic structures

MODULE 4. Object Orientation

- 8) Introduction to C++ Language
- 9) Inheritance and Polymorphism
- 10) Overloading
- 11) Input / Output and STL

MODULE 5. Working Classroom

- 12) Practices and Workgroups

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC: Fundamentals of microprocessors (55000025-Fundamentals of Electronics)

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Fundamentals of sequential programming
- C language

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Ability to program in C and C++ languages
- Ability to understand the functioning of a computer
- Ability to understand the operation of an operating system
- Ability to design and implement algorithms
- Ability to design a program philosophy OOP

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_5. An ability to function effectively on a team whose members together provide leadership,create a collaborative and inclusive environment,establish goals,plan tasks,and meet objectives
- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Computer Architecture and Management
W. Stallings Prentice Hall, 7th Edition, 2006

Algorithms + Data Structures = Programs
N. Wirth Prentice Hall, 1987

C++: A Beginners Guide
H. Schildt McGraw-Hill, 2nd Edition, 2010

Operating Systems: an Applied Vision
J. Carretero et. al. Mc-Graw Hill, 2nd Edition, 2007

How to Program C++
Deytel & Deytel Prentice Hall, 7th Edition, 2010

OTHER MATERIALS

55000103 - ANALOG ELECTRONICS

CREDITS:	4.5 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronic Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Javier Uceda
TYPE:	Track (Automatic Control and Electronics)
YEAR AND SEMESTER:	4tYear / Fall

LIST OF TOPICS

MODULE 1. Introduction

1) Introduction to analog electronics

MODULE 2. Electronic components

2) Introduction to the physics of semiconductors

3) The PN junction. The diodes

4) The bipolar transistor

5) The field-effect transistor

MODULE 3. Amplification

6) The amplification. Introduction and basic concepts

7) A single stage amplifier. DC models and AC small-signal models.

8) Multi-stage amplifiers

9) Feedback amplifiers. General characteristics. Stability. Nyquist criterion. Gain margin. Phase margin

10) The operational amplifier. Structure and basic features. Analysis on DC. Analysis on AC. Stability

11) Amplifiers using operational amplifiers as building blocks.

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSES: Circuit Theory and Fundamentals of Control Theory

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Ability to analyze electrical circuits

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for:

- CE22A - knowledge of the fundamentals and applications of analog electronics.
- CE24A - capacity to design both analog, digital, and power electronic systems
- RA13 - ability to design analog circuits.
- RA14 - skills to solve real problems in analog electronics.
- RA15 - ability to design linear power supplies.

STUDENT OUTCOMES

- ABET_1. An ability to identify, formulate and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration for public health, safety and welfare, as well as global, cultural, social, environmental and economic factors.
- ABET_3. An ability to communicate effectively with a range of audiences.
- ABET_5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks and meet objectives.
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies.
- ABET_6. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgment to draw conclusions.

BIBLIOGRAPHY

TEXT BOOKS

Electrónica. Miguel Ángel Pérez García. IBERGARCETA PUBLICACIONES. 2017. ISBN: 978-84-1622-875-1

OTHER MATERIALS

Lecture presentations, exams in previous academic years, documents for practical experiments in lab, etc.

55000104 - DIGITAL ELECTRONICS

CREDITS:	3 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Eduardo de la Torre
TYPE:	Track (Automatic Controls and Electronics)
YEAR AND SEMESTER:	4th Year / Fall

LIST OF TOPICS

MODULE 1. VHDL

- 1) Introduction to the VHDL. Review of circuits

MODULE 2. Synthesis of sequential circuits

- 2) Methodology for synchronous synchronous sequential circuits design
- 3) Methodology for synthesis of asynchronous sequential circuits

MODULE 3. Digital technologies

- 4) Logic families. Compatibility
- 5) Special inputs/outputs. Memories
- 6) Programmable devices. PALs, PLDs and FPGAs
- 7) FPGA architectures

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

Knowledge about FET transistors and circuit theory are recommended

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Designing circuits of low to medium complexity using HDLs (VHDL in particular)
- Model, describe, simulate, synthesize and implement a circuit on an FOGA
- Knowledge about circuit technologies and real characteristics of components (logic values, current drive, fanin and fanout, delays, power, etc.)
- To understand the concept of ‘programmability’ or ‘reconfigurability’ of reconfigurable devices
- To develop a medium complexity work that requires teamworking and design planning
- To use commercial tools (in this case, Xilinx Vivado)

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_5. An ability to function effectively on a team whose members together provide leadership,create a collaborative and inclusive environment,establish goals,plan tasks,and meet objectives
- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

- Digital Design and Computer Architecture, Harris & Harris. Ed. Morgan Kauffmann, 2015

OTHER MATERIALS

- Xilinx Vivado Programming Suite, Xilinx.
- Pynq Board documentation, Digilent.

55000105 - ROBOTICS

CREDITS:	6 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	A. Barrientos
TYPE:	Track (Automatic Controls and Electronics)
YEAR AND SEMESTER:	4th Year / Fall

LIST OF TOPICS

MODULE 1. Introduction (4 h)

- 1) Development, current status and trends in the Robotics (2 h)
- 2) Definitions and classification of robots (2 h)

MODULE 2. Robot morphology (12h)

- 3) Morphology mechanical robot (4 h)
- 4) Actuators and sensors of the robot (6 h)
- 5) Control system. HW and Sw (0,5 h)
- 6) End Effectors (1,5 h)

MODULE 3. Mathematical tools for Robot modeling (4 h)

- 7) 3D Point position representation (0, 5 h)
- 8) Representation of the spatial attitude. Rotation matrix and quaternion (1, 5 h)
- 9) Homogenous transformation matrices (MTH) (1h)
- 10) Relationship and comparison between different methods for spatial pose definition (0, 5 h)
- 11) Use of Matlab for the modeling and simulation of robots (0.5 h)

MODULE 4. Kinematic modeling (10h)

- 12) The direct kinematic problem. Geometric methods and method based in base transformation (1 h) . The Denavit Hartenberg method(3 h). Method of displacement matrices (1 h)
- 13) The inverse kinematic problem. Geometric methods and methods based in MTH. The Pieper solution method (2 h)
- 14) Differential model. Jacobian matrix. Singular configurations (1 h)

MODULE 5. Dynamic modeling (2h)

- 15) Dynamic model of a rigid robot. Newton-Euler formulation, Lagrange Formulation. Computational algorithms (1 h)
- 16) Modeling in the task-space (0.5 h)
- 17) Modeling of actuators (0, 5 h)

MODULE 6. Kinematic Control (2 h)

- 18) Kinematic control objetives (0.5 h)
- 19) Types of trajectories . Selection and sampling of Cartesian trajectories (0, 5 h)
- 20) Trajectory Interpolation (1 h)

MODULE 7. Dynamic control (2 h)

- 21) Joint Space Control (1h)
- 22) Multi-joint Control (0.5 h)
- 23) Practical issues of controller design (0.5 h)

MODULE 8. Robot Programming (3h)

- 24) Robot programming methods. Classification (1 h)
- 25) System requirements of robot programming system (1 h)
- 26) Example of Programming an industrial robot (1 h)

MODULE 9. Implementation of the industrial robot (3 h)

- 27) Design and control of a robotic cell (0,5h)
- 28) Features to consider in the selection of a robot (1 h)
- 29) Security in robotic installations (1 h)
- 30) Industrial Robotics Market (0,5 h)

MODULE 10. Robot applications (3h)

- 31) Applications of Industrial Robots. Classification and characteristics (1 h)
- 32) Service Robots for personal use. Classification (1h)
- 33) Service robots for professional use (1h)

MODULE 11. Mobile robots (11h)

- 34) Mobile Robots Overview (0, 5 h)
- 35) Kinematics of the mobile robot(1h)
- 36) Navigation Sensors(2h)
- 37) Sensor fusion (2,5h)
- 38) Guidance of Mobile robot (2 h)
- 39) A ROS Introduction (3h)

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Ability to perform mathematical calculations
- Ability to understand spatial figures
- Skill in managing MATLAB
- Scheduling algorithms ability
- Ability to conceive and design systems
- Skill in C programming
- Basic knowledge in Linux

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Capacity to select and use correctly an industrial robot manipulator
- Capacity for modeling and control of robot manipulators and mobile robots.
- Ability to conceive and design robots for use in non-industrial applications (service robots)
- Capacity to address automation projects that used industrial robots
- Ability to develop robots both in terms of its subsystems and in terms of its control algorithms

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors
- ABET_5. An ability to function effectively on a team whose members together provide leadership,create a collaborative and inclusive

environment,establish goals,plan tasks,and meet objectives

- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Fundamentos de Robótica (McgrawHill,2007)

OTHER MATERIALS

Licencias Universitarias de Labview y Matlab. Licencias gratuitas de SW de simulación de Robots.

55000106 - POWER ELECTRONICS

CREDITS:	4.5 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	José A. Cobos
TYPE:	Track (Automatic Controls and Electronics)
YEAR AND SEMESTER:	4th Year / Spring

LIST OF TOPICS

MODULE 1. Basics of power electronics.

- 1) Introduction
- 2) Fundamentals Concepts in Power Electronics

MODULE 2. Simulation

- 3) Review of basic concepts for Simulation of power electronics circuits

MODULE 3. Review of Power Semiconductors

- 4) Power Diode
- 5) MOSFET
- 6) IGBT
- 7) Thyristor
- 8) Other semi-conductors: DIAC, TRIAC, IGBT, GTO
- 9) Series and parallel connection

MODULE 4. Power Converters

- 10) AC-DC
- 11) DC-DC
- 12) DC-AC
- 13) AC-AC

MODULE 5. Thermal management

- 17) Static and dynamic thermal resistance

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Differential Equations; Basic Electronics; Circuit Theory, Analog electronics;

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

Knowledge on power ele ctronics circuits and components as well as the fundamental concepts that drive their performance.

At the end of th course, the student will be able to (or will have ability for):

Analyze and design power electronics converters

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

Power Electronics:Converters, Applications and Design. Mohan, Undeland and Robbins

Fundamentals of Power Electronics. Erickson and Maksimovic

Problemas de Electrónica de Potencia. Barrado y Lázaro

Principles of Power Electronic. Kassakian

OTHER MATERIALS

55000107 - MICROPROCESSORS SYSTEMS

CREDITS:	3 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Y. Torroja
TYPE:	Track (Automatic Controls and Electronics)
YEAR AND SEMESTER:	4th Year / Spring

LIST OF TOPICS

MODULE 1. Introduction

- 1) Introduction
- 2) Minimum Microprocessor System

MODULE 2. Microprocessor Architecture

- 3) Internal Architecture
- 4) Programmer's Model
- 5) Instruction Set

MODULE 3. Input /Output Techniques

- 6) Developing Tools
- 7) Methods and devices for Input /Output
- 8) Interrupts
- 9) Time Related Input/Output
- 10) Serial communication
- 11) A/D and D/A

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE:

TOPIC:

- Electronics Fundamentals
- Digital Electronics
- Analog Electronics
- Programming Fundamentals

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Ability to understand the architecture of a microprocessor system.
- Ability to program in high and low level languages and understand their relationship.
- Ability to analyze and design embedded systems based on microprocessors and microcontrollers.

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_5. An ability to function effectively on a team whose members together provide leadership,create a collaborative and inclusive environment,establish goals,plan tasks,and meet objectives
- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

Microcontrollers and microcomputers : principles of software and hardware engineering (Cady, Frederick M.)
The microprocessor : a biography (Malone, Michael S.)
Microprocesadores : diseño práctico de sistemas (Angulo Usategui, José María)
Digital Design and Computer Architecture (David Money Harris & Sarah L. Harris)

OTHER MATERIALS

Equipos de prácticas y maquetas a escala para la realización de trabajos basados en proyectos

55000108 - COMPUTER CONTROL

CREDITS:	4.5 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	José María Sebastián
TYPE:	Track (Automatic Controls and Electronics)
YEAR AND SEMESTER:	4th Year / Spring

LIST OF TOPICS

MODULE 1. Modeling of discrete systems

- 1) Sequences and discrete systems
- 2) Transformed from a sequence. Models of discrete systems
- 3) Sampling and signal reconstruction
- 4) Sampled systems

MODULE 2. Discrete systems analysis

- 5) Stability of discrete systems
- 6) Dynamic analysis of discrete systems

MODULE 3. System identification

- 7) System identification

MODULE 4. Discrete control systems with controllers

- 8) Discrete feedback systems
- 9) Discretization of continuous regulators. Discrete PID
- 10) Discrete design of regulators by LDR

MODULE 5. Control to shocks

- 11) Control to shocks

MODULE 6. Practical work

- 1) TP1: Introduction to discrete systems
- 2) TP2: Sampling and reconstruction
- 3) TP3: Hybrid systems
- 4) TP4: Dynamic analysis
- 5) TP5: Designing regulators
- 6) TP6: Implementation of regulators to shocks

MODULE 7. Laboratory practice

- 1) P1: Implementation of continuous regulators
- 2) P2: System identification
- 3) P3: Implementation of discrete regulators

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Systems Dynamics
TOPIC: Systems modelling, Systems analysis
COURSE: Control Fundamentals
TOPIC: Design of control systems, Automation systems

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Algorithms in computer programming skills
- Skill in performing mathematical calculations
- Ability to design systems using PID control
- Skill in managing MATLAB
- Ability to model physical systems by its transfer function
- Ability to perform static and dynamic analysis of a continuous system

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Ability to perform static and dynamic analysis of discrete systems and sampled both open loop with feedback.
- Ability to perform real monovariable implanted control both conventional regulatory processes and industrial
- Ability to model discrete systems via their transfer function Z.
- ability to model sampled systems through its transfer function Z
- Ability to design, program and implement a control using discrete control system.
- Ability to identify a real system from its temporal evolution both from sequences of inputs and outputs

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_5. An ability to function effectively on a team whose members together provide leadership,create a collaborative and inclusive environment,establish goals,plan tasks,and meet objectives
- ABET_6. An ability to develop and conduct appropriate experimentation,analyse and interpret data,and use engineering judgment to draw conclusions

BIBLIOGRAPHY

TEXT BOOKS

Sistemas discretos de control
R. Aracil, A. Jiménez Editorial Publicaciones ETSII

Control de sistemas discretos
O. Reinoso, J. M. Sebastián, F. Torres, R. Aracil Editorial McGraw Hill

Fundamentos de control con MATLAB
E. Pinto, F. Matía Editorial Pearson-Prentice Hall, 2010

OTHER MATERIALS

All de information about this subject including additional material and exams is available at the Moodle site.

55000204 - ELECTROTECHNICS II

CREDITS:	4.5 ECTS
DEPARTMENT:	Automatic Control, Electrical and Electronics Engineering and Industrial Informatics (AUT)
COURSE COORDINATOR:	Rafael Asensi
TYPE:	Track (Automatic Controls and Electronics) / Track (Electrical Engineering)
YEAR AND SEMESTER:	4th Year / Fall

LIST OF TOPICS

MODULE 1. Transients in circuits

MODULE 2. Quadripole and multipole

MODULE 3. Inductive coupling

MODULE 4. Nonlinear circuits

MODULE 5. Circuit frequency response

RECOMMENDED COURSES OR KNOWLEDGE

RECOMMENDED PREVIOUS COURSES:

COURSE: Electrotecnia, Ecuaciones diferenciales, Electromagnetismo

TOPIC:

RECOMMENDED PREVIOUS KNOWLEDGE OR ABILITIES:

- Know the principles of circuit theory.
- Ability to analyze electrical circuits using systematic methods.
- Know the particular characteristics of the most common schemes in Electrical Engineering: DC, AC, and transient operation.
- Knowledge of the fundamentals of linear algebra and differential equations.
- Basic electromagnetism.

SPECIFIC OUTCOMES FOR THE COURSE

At the end of the course, the student will be able to (or will have ability for):

- Knowing the particular characteristics of complex systems operating in Electrical Engineering.
- Systematically analyze the behavior of electric circuits, using advanced techniques.
- Recognize more technological applications of electricity and use the knowledge gained in solving common problems.

STUDENT OUTCOMES

- ABET_1. An ability to identify,formulate,and solve complex engineering problems by applying principles of engineering,science,and mathematics
- ABET_2. An ability to apply engineering design to produce solutions that meet specified needs with consideration fo public health,safety,and welfare,as well as global,cultural,social,environmental,and economic factors
- ABET_3. An ability to communicate effectively with a range of audiences
- ABET_7. An ability to acquire and apply new knowledge as needed using appropriate learning strategies

BIBLIOGRAPHY

TEXT BOOKS

Circuitos eléctricos. Vol. I y II. A. Pastor, J. Ortega, V. M. Parra, A. Pérez. UNED, 2003.

OTHER MATERIALS

Class documentation (Powerpoint presentations, documents, Matlab programs, collection of class exercises…) elaborated by the professor.