ETSIT
Escuela Técnica Superior de
Ingenieros de **Telecomunicación**

International Courses Offered in E.T.S.I. Telecomunicación 2020/2021

Courses taught in English during 2020-21

Area	Acronym	Name	ECTS	Semester[1]	UVa subject code
Signal Theory & Communications	ICTA	Information and communications technology in automotive industry	6	1	46675
	WTS	Wireless Telecommunications Systems	6	2	45044
Mathematics	AM	Advanced Mathematics	6	2	75095
	NA	Numerical Algorithms	6	2	75101
Economy	ECO	Introduction to business economics and administration	6	2	75100
Signal Theory, Communications, Telematic Engineering and Electronics	PROJECT	PROJECT (Internship + TFG) or (Internship + TFM)	18 (6+12)	1 or 2	45035 + 45036 (TFG) or 45035 + 53817 (TFM)

[1] 1: Autumn (28th September 2020 to 12th February 2021)
2: Spring (15th February 2021 to 2nd July 2021)

Project

In each semester, we will offer different international projects. Each project comprises two UVa subjects: internship and TFG/TFM (depending on the study cycle of the student). **TFG/TFM can only be taken by students in their last year of their degree**. The project can be taken in any of the two semesters and it is also possible to take it during the full year.

Students will have to develop a project in the area of Telecommunications. Two departments will offer projects to international students: Signal Theory, Communications and Telematic Engineering and Electronics.

When a student wants to take a project, she/he must contact the ETSIT International Coordinator, CRI (subireccion.relaciones.tel@uva.es) and send her/him both a

Curriculum Vitae and areas of interest. If the CRI considers that she/he is eligible, the CRI will distribute the CV between the different research groups working in the areas suggested by the students. Research groups interested in the students will contact her/him directly and offer different topics for the project. When the student reaches an agreement with the research group, she/he will contact CRI and the research group to confirm the agreement. **This process has to be completed before signing any learning agreement.**

Maximum number of students in each course

The maximum number of admitted student in each course is 20.

English level for students

All students are required a B2 level of English.

Location

Classes will be planned in ETSITs rooms (classroom and laboratories). The project will be taken in the premises of each research group.

Classes schedule

Autumn Semester

	Monday	Tuesday	Wednesday	Thursday	Friday
9h		ICTA Sem13/1L014	ICTA Sem13/1L014		
10h		ICTA Sem13/1L014	ICTA Sem13/1L014		
11h			ICTA Sem13/1L014		
12h			ICTA Sem13/1L014		

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Spring Semester

	Monday	Tuesday	Wednesday	Thursday	Friday
9h	AM A108	NA A108	AM A108	NA 2L009	
10h	AM A108	NA A108	AM A108	NA 2L009	
11h	ECO A108		ECO A108		
12h	ECO A108		ECO A108		
16h					
17h					
18h		WTS (T/L) A10/2L004-5			
19h		WTS (T/L) A10/2L004-5		WTS (S/L) A10/2L004-5	
20h				WST (S/L) A10/2L004-5	

Contact

ETSIT International Coordinator (CRI) is Ramón J. Durán Barroso:
subireccion.relaciones.tel@uva.es

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Courses Syllabus:

Information and communications technology in automotive industry (ICTA)			
Code number:	46675	Number of ECTS:	6 ECTS
Semester:	Autumn	Language:	English

Lecturer(s) and contact:

- Dr. Juan Carlos Aguado Manzano (jaguado@tel.uva.es)
- Dr. Ignacio de Miguel Jiménez (Ignacio.miguel@tel.uva.es)

Learning goals:

At the end of this sections, the student should be able to:

- Use commercial software tools to analysis CAN messages from car devices and car applications.
- Enumerate and describe the most important CAN protocol parameters of physical and upper layers.
- Enumerate and describe the basic communication elements of intra-vehicular network communications under CAN protocol.
- Design and program very simple pieces of code to emulate intra-vehicle communications.
- Use carmakers documentation to analyze car devices and car applications.
- Describe vehicle-to-infrastructure and vehicle-to-vehicle communication services

Contents:

1. Introduction to Vehicle Telematics.
2. Intra-Vehicular communications. CAN Bus. CANoe.
3. Programming in CAPL.
4. Intra-vehicular communications. Other standards.
5. Design of ECUs.
6. ECU diagnosis.

Lab:

1. Physical layer of the CAN bus.
2. CAN analysis: IGN signals, TeleAid Info-Call and Volume Control.
3. CAN analysis: Airbag signals.
4. CAN analysis: Real car trace.
5. Sending CAN messages using CANoe.
6. CAPL Program.
7. D2B Optical Bus Analyzer.
8. MOST Optical Bus Analyzer.
9. ECU simulation using CANister. Breathalyzer design and development.
10. Datalogger. Diagnostics.

Prerequisites:

This is an intermediate course, intended for learners with a background in computer and electrical engineering. To succeed in this course, you should have the following knowledge prerequisites:

- Intermediate programming experience, preferable in C.
- Familiarity with protocols, communications networks and telematic services.
- Basic use of laboratory equipment, mainly Oscilloscopes.

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Wireless Telecommunications Systems (WTS)			
Code number:	45044	Number of ECTS:	6 ECTS
Semester:	Spring	Language:	English

Lecturer(s) and contact:

- Dr. Ramón de la Rosa Steinz (ramros@tel.uva.es)

Learning goals:

At the end of this sections, the student should be able to:

- Know the options to experiment in the field of the radio amateur operation.
- Work with regulations related to the radio frequency spectrum management.
- Work with specifications related to radio telecommunication systems.
- Identify transmissions with spectrum analysis equipment.
- Connect the basic parameters that characterise a radio frequency system.
- Interpret the technology involved in the radio telecommunication systems.
- Estimate the radio coverage in point-to-point systems.
- Enumerate and describe the communication systems studied.
- Identify the planning requirements in terms of time and resources to develop projects

Contents:

1. AN INTRODUCTION TO RADIO:
   Concept revision. Logarithmic units. The radio frequency spectrum. Radio amateur operation as a way to experiment.
2. ANTENNA SYSTEMS TECHNOLOGY:
   Review of characteristics and parameters defining the antennas. Antenna feeders. Antennas applied to communication systems.
3. RECEIVERS AND TRANSMITTERS:
   Receivers technology. Transmitters technology. Interpreting transceiver wiring diagrams. The evolution of the radio. Software defined radio (SDR).
4. RADIO BROADCASTING:
   Amplitude modulation (AM) radio broadcasting. Frequency modulation (FM) and FM-stereo radio broadcasting. Digital broadcasting: RDS y DAB. Modulating in DAB. OFDM.
5. RADIO LINKS AND SATELLITE COMMUNICATIONS:
   Introduction and satellite orbits. Parameters that influence the communication: the link budget. Types of satellites. Satellites and radio amateur operation. Related modulating schemas: FSK and PSK. Radio links. Coverage estimation with software.
6. CELLULAR TELECOMMUNICATIONS:
   Basic standards. Second generation (2G): GSM, GPRS and EDGE. Modulations related to 2G. MSK, GMSK. Third generation (3G) and subsequent generations. UMTS, LTE, 5G. Modulations related to 3G and subsequent generations. Spread spectrum.
7. SHORT-RANGE WIRELESS DATA COMMUNICATIONS:
   Bluetooth. IEEE 802.11 – ISO/IEC 8802-11 (Wi-Fi). Other technologies.

Prerequisites:

It will be very helpful some basic knowledge about electronics to understand schemas, and ability to understand the concept of electromagnetic waves and its location in the radio frequency spectrum.

About the applied part of the subject, it will be helpful some basic knowledge of the laboratory of electronics instrumentation (oscilloscope, multimeter, function generator), reasonable manual skills and being resourceful to build small prototypes.

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Advanced Mathematics (AM)			
Code number:	75095	Number of ECTS:	6 ECTS
Semester:	Spring	Language:	English

Lecturer(s) and contact:

- Dr. Eduardo Cuesta Montero (eduardo@mat.uva.es)

Learning goals:

At the end of this sections, the student should be able to:

- Learning skills and expertise on complex variable and vectorial calculus technics.
- Learning skills on the basic analytical methods to solve partial differential equations.
- Posing and solving problems related to the subjects of the course.
- Discovering the relationship between the subjects of the course and other subjects in fact the ones related to Telecommunication and Electronic Engineering.
- Using recommended bibliography to assess ideas and results.
- Understanding mathematical models related to Telecommunication and Electronic Engineering.

Contents:

1. CURVES AND SURFACES:
   Parametric curves, geometric curves, and orientation. Parametric surfaces, tangent plane, and orientation. Implicit's and Inverse's Theorem. Implicit curves and surfaces.
2. SCALAR AND VECTOR FIELDS:
   Gradient, equipotential varieties, curl, divergence, and Laplacian. Conservative fileds, solenoidal fields, and potentials.
3. LINE INTEGRALS:
   Line integrals for scalar functions. Parametrizing with respect to arc lenght. Fields along curves. Green's Formula. Simply connected domains, and potentials.
4. SURFACE INTEGRALS:
   Integral in several variables. Surface integration of scalar functions. Parametric surface area. Field flux throughout a surface. Surfaces with oriented border. Stoke's Theorem. Gauss Theorem.
5. INTRODUCTION TO COMPLEX VARIABLE FUNCTIONS:
   Basic properties of complex numbers. Complex variable functions. Geometric representation of elementary functions.
6. HOLOMORPHIC FUNCTIONS:
   Limits and continuity. Holomorphic functions. Cauchy-Riemann's conditions. Geometrical meaning. Elementary holomophic functions.
7. COMPLEX INTEGRATION:
   Definitions and properties. Relationship with the line integral. Cauchy's Integral Formula. Taylor expansions.
8. POWER EXPANSIONS:
   Sequences and series of complex numbers. Convergence of sequences and series of functions. Integration term by term. Power expansions. Convergence radius. Zero order. Taylor's expansions. Properties of functions defined by power expansions. Analytic functions.

9. LAURENT'S EXPANSIONS:
   Singularity classification. Development of Laurent's expansions.
10. FOURIER EXPANSIONS:
    Representation of functions in terms of Fourier expansions. Convergence and applications.
11. INTRODUCTION TO PARTIAL DIFFERENTIAL EQUATIONS:
    Background in partial differential equations. Eigenvalue Problems and Fourier expansions.
12. SEPARATED VARIABLE METHOD FOR PARTIAL DIFFERENTIAL EQUATIONS:
    General problema statement. Applications to equations of physic mathematic.

Prerequisites:

Some background on Calculus and Linear Algebra is strongly recommended.

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Numerical Algorithms (NA)			
Code number:	75101	Number of ECTS:	6 ECTS
Semester:	Spring	Language:	English

Lecturer(s) and contact:

- Dr. Óscar Angulo Torga (oscar@mat.uva.es)

Learning goals:

At the end of this sections, the student should be able to:

- Understand limitations of analytical methods and the need for numerical algorithms.
- Understand how computers represent numbers and how these impact mathematical computations on computers.
- Understand how we describe errors and approximations that result from using computers to solve mathematical equations and approximate mathematical functions.
- Learn how to solve a system of linear equations numerically using direct and iterative methods.
- Learn how to solve least-squares problems.
- Understand how to approximate the functions using interpolating polynomials.
- Learn how to solve definite integrals and initial value problems numerically.
- Learn the application of the FFT .
- Know how to solve complex differential problems.
- Demonstrate the applications of numerical techniques to simple problems drawn from telecommunications and electronic engineering fields.

Contents:

1. MATLAB programming.
2. Direct methods for solving of linear systems.
3. Least squares approximation.
4. Iteration: linear and nonlinear.
5. The matrix eigenvalue problem.
6. Lagrangian interpolation.
7. Numerical integration and differentiation.
8. Trigonometric interpolation.
9. Numerical solution to ordinary differential equations.
10. Numerical solution to partial differential equations.

Prerequisites:

Skills on Linear Algebra and Advanced Calculus.

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Introduction to business economics and administration (ECO)			
Code number:	75100	Number of ECTS:	6 ECTS
Semester:	Spring	Language:	English

Lecturer(s) and contact:

- Dr. Guillermo Aleixandre Mendizabal (galeixam@eco.uva.es)

Learning goals:

At the end of this sections, the student should be able to:

- Apply the basic principles of the economy and the company to the telecommunications sector.
- Identify the different types of companies, market structures, being able to calculate prices and quantities of equilibrium in each one of them.
- Distinguish the types of costs of the companies and their sources of financing.
- Interpret the economic, legal and institutional framework of the company.

Contents:

1. Preliminary concepts in economy.
2. The enterprise and the entrepreneur.
3. Competitive markets in the short term: demand and supply.
4. Production, costs, revenues and business benefits.
5. Firms in the perfect competition market.
6. Firms in non-competitive markets.
7. Project appraisal decisions in the company.
8. Financial statement analysis of the company and business financing.

Prerequisites:

There are no academic preconditions to take this course.