UNIVERSITAT DE VALÈNCIA - ESTUDI GENERAL

B. Eng. in TELECOMMUNICATION ENGINEERING
(Electronic Systems)

2003/04 SYLLABUS

Dpt. Electronics Engineering
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http://www.uv.es/~ingelec/visitors/index.html
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1.- General Description of the High School of Engineering.

The High School of Engineering of the University of Valencia has been created very recently. In fact it was officially established on the 24th of September of 2003.

This new High School of Engineering of the University of Valencia has its origins at the common needs and desires of three Departments of our University. These Departments are Chemical Engineering, Electronical Engineering and Informatics. All these departments are involved in lecturing in several engineering and technical degrees of our University at its Campus of Burjassot. These degrees are:

- M. Sc. in Electronic Engineering
- M. Sc. in Computer Engineering
- M. Sc. in Chemistry Engineering
- B. Eng. in Telecommunications Engineering specialising in Electronic Systems
- B. Eng. in Telecommunications Engineering specialising in Telematic Systems

The High School of Engineering is in charge of an approximate number of 2800 students from which 700 are enrolled in the M.Sc in Electronics Engineering and B. Eng. in Telecommunications specialising in Electronic Systems in a total of 56000 students from all the University of Valencia.

The Electronics Engineering Department is responsible for teaching M.Sc in Electronics Engineering and B. Eng. in Telecommunications specialising in Electronic Systems. Currently, there are 60 lecturers. The Department research covers the areas of Electronics, Digital Signal Processing and Electronic Technology. There are four research groups, namely, Industrial Electronics and Instrumentation Lab (LEII), Digital Signal Processing Group (GPDS), Communication and Electronic Digital Systems Group (DSDC), and Medical Imaging Acquisition and Processing Group (SATI).

The Computer Engineering Department is responsible for teaching M.Sc in Computer Engineering and B. Eng. in Telecommunications specialising in Telematic
Systems. Currently, there are around 70 lecturers. This Department covers the areas of Architecture and Technology of Computers, Computer Science and Engineering Systems. Research work concerns Image Processing, Robotics and Traffic Technology.

2.- Location of the High School of Engineering

The university centres are located in three campuses:

- Burjassot-Paterna, with the faculties of Biology, Physics, Chemistry, Mathematics, and Pharmacy.
- Blasco Ibáñez, with the centres of the Humanities area as well as the Medicine and Odontology College, the Nursing School, and the Psychology College.
- Tarongers, which encompasses the colleges of Social Sciences, Economics, and Law.

In each campus, there are different services and research institutes. As mentioned above, the Faculty of Physics is located in the Burjassot-Paterna Campus (Science Campus). There are two ways to arrive to the Burjassot-Paterna Campus by public transportation:

- Tramway: Company “FGV (metro-tranvia)” line 4 stopping down in “Campus de Burjassot” and “Vicent Andrés Estellés” stops.
- EMT (red buses from the municipality). The line arriving to the campus is number 63, only during weekday and lective periods.

3.- Professional Skills.

Electronics and communication systems are related areas of study concerned with technology that influences nearly every aspect of modern society. Electronics deals with the science and engineering of everyday items ranging from home appliances, entertainment systems, and telecommunications to city utilities, control systems for traffic, and transport. Communication systems deal with the technology of conveying information between people using computers and/or electronic equipment such as telephones. Both these areas of study play an important role in business and manufacturing, and are about building and using systems for productive and leisure activities.
The B. Eng. degree in Telecommunications (Electronic Systems) at the University of Valencia is intended to train Technical Engineers, well-qualified for the electronic industry market and R&D activities, ready to analyse and solve technological challenges, and able to get involved and develop projects. Students might become involved in communications, commercial or industrial control systems, consumer goods, entertainment products, computers and their peripheral devices, scientific and medical equipment, wireless applications or research and development. This degree is a professional program of studies in analogue and digital electronic circuit design, signal analysis and processing, communication systems, power electronics, measurements and tests, automation and computer architecture. Furthermore, the underlying goal is to foster an engineering attitude, that is, a justified confidence in one’s ability to solve technical problems.

After completing the degree, students are entitled to develop a professional activity according to the Institution of Technical Telecommunications Engineers and the attributions given by the Spanish Government. They are also able to access directly to the M.Sc. in Electronic Engineering Degree (two years).

4.- Teaching Contents.

The teaching content of the B. Eng. Degree in Telecommunications (Electronic Systems) (“ITT-SE” from now on) is organised into units called MODULES. A given number of credits are assigned to each module, so that one credit equals 10 teaching hours. There are four different types of modules:

- Core Modules: these correspond to disciplines determined by national General Guidelines imposed by the Government in order to provide uniformity of criteria along the country.
- Compulsory Modules: these correspond to disciplines determined by the University of Valencia, which are compulsory for each degree.
- Elective Modules: these correspond to disciplines determined by the University of Valencia for the Technical Engineering Degree in Telecommunications...
(Electronic Systems), the student must choose from a determined number of credits depending on the student’s preferences.

- Free Choice Modules: these correspond to modules which are chosen freely by the student from amongst the disciplines of various degrees offered at the University of Valencia and/or other specific degrees, of which a determined number of credits must be studied.

As regards the number of credits, the teaching content of the ITT-SE is distributed in the following way:

<table>
<thead>
<tr>
<th>Core Modules</th>
<th>Compulsory Modules</th>
<th>Elective Modules</th>
<th>Free Choice</th>
</tr>
</thead>
<tbody>
<tr>
<td>105 credits</td>
<td>40.5 credits</td>
<td>25.5 credits</td>
<td>21 credits</td>
</tr>
</tbody>
</table>

The teaching content is 207 credits in all, 192 of which correspond to theoretical or laboratory modules and 15 correspond to the End of Degree Project (Final Project). There are no incompatibilities between different modules but there are some hints for the better following of the modules.

The year is divided into two semesters. The first semester begins the last week of September and finishes in mid February. The second semesters starts in mid February and finishes at the end of June. The last three weeks of each semester are nor dedicated to lecturing but only to examinations. There are modules with annual and one-semester duration. There are three holiday periods during the academic year: the Christmas break, from 21st December to 8th January, the Fallas break, from 16th March to 20th March, and the Easter break, which covers one week in the end of March or beginning of April.

5.- Admission to the Studies

When students finish the secondary school they must pass an examination. The students are admitted depending on their results (marks obtained during the secondary school and final examination) until all the places, which are available annually, are filled. For the 2003/04 academic course there are 110 places.
After completing the Degree, students are allowed to have direct access to second cycle Degrees in:

- M.Sc. Control and Industrial Electronic Engineering.
- M.Sc. Telecommunications Engineering.

### 6.- Subjects Map.

#### I.T.T.-S.E. FIRST YEAR

<table>
<thead>
<tr>
<th>Code</th>
<th>Term</th>
<th>MODULE’s NAME</th>
<th>Type</th>
<th>Cred.</th>
<th>Theo</th>
<th>Lab</th>
</tr>
</thead>
<tbody>
<tr>
<td>13104</td>
<td>both</td>
<td>Mathematical Analysis for Engineering</td>
<td>CO</td>
<td>12</td>
<td>12</td>
<td>0</td>
</tr>
<tr>
<td>13100</td>
<td>both</td>
<td>Analogue electronics I</td>
<td>CO</td>
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<td>7.5</td>
<td>4.5</td>
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<tr>
<td>13095</td>
<td>both</td>
<td>Analysis of Circuits and Linear Systems</td>
<td>CO</td>
<td>9</td>
<td>7.5</td>
<td>1.5</td>
</tr>
<tr>
<td>13097</td>
<td>both</td>
<td>Digital Electronic Devices and Circuits</td>
<td>CO</td>
<td>10.5</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>12755</td>
<td>1st</td>
<td>Computing</td>
<td>CP</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>13103</td>
<td>2nd</td>
<td>Principles of Physic for Engineers</td>
<td>CO</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>13102</td>
<td>2nd</td>
<td>Electronic Devices</td>
<td>CO</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elective</td>
<td>EL</td>
<td>6</td>
<td></td>
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</tr>
<tr>
<td></td>
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<td><strong>TOTAL</strong></td>
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<td>67.5</td>
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#### I.T.T.-S.E. SECOND YEAR

<table>
<thead>
<tr>
<th>Code</th>
<th>Term</th>
<th>MODULE’s NAME</th>
<th>Type</th>
<th>Cred.</th>
<th>Theo</th>
<th>Lab</th>
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</thead>
<tbody>
<tr>
<td>13125</td>
<td>Both</td>
<td>Digital Electronic Systems</td>
<td>CO</td>
<td>12</td>
<td>7.5</td>
<td>4.5</td>
</tr>
<tr>
<td>13110</td>
<td>Both</td>
<td>Instrumentation and Electronic Equipment</td>
<td>CO</td>
<td>10.5</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>13127</td>
<td>Both</td>
<td>CAD</td>
<td>CP</td>
<td>6</td>
<td>0</td>
<td>6</td>
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<td>13105</td>
<td>1st</td>
<td>Fundamentals of Computers Architecture</td>
<td>CO</td>
<td>6</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>13114</td>
<td>1st</td>
<td>Introduction to Digital Signal Processing</td>
<td>CP</td>
<td>7.5</td>
<td>4.5</td>
<td>3</td>
</tr>
<tr>
<td>13116</td>
<td>2nd</td>
<td>Microelectronics</td>
<td>CO</td>
<td>6</td>
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<td>3</td>
</tr>
<tr>
<td>13101</td>
<td>2nd</td>
<td>Analogue electronics II</td>
<td>CP</td>
<td>6</td>
<td>4.5</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elective</td>
<td>EL</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Free Choice</td>
<td>FC</td>
<td>6</td>
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<tr>
<td></td>
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<td><strong>TOTAL</strong></td>
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<td>69</td>
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1 Legend: CO: Core subject  
CP: Compulsory subject  
EL: Elective subject  
FC: Free Choice
I.T.T.-S.E. THIRD YEAR

<table>
<thead>
<tr>
<th>Code</th>
<th>Term</th>
<th>MODULE’s NAME</th>
<th>Type</th>
<th>Cred.</th>
<th>Theo</th>
<th>Lab</th>
<th>Module Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>13124</td>
<td>Both</td>
<td>Electronic Control Systems</td>
<td>CO</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13111</td>
<td>Both</td>
<td>Introduction to Power Electronics</td>
<td>CP</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13106</td>
<td>1st</td>
<td>Fundamentals on communication electronics</td>
<td>CP</td>
<td>6</td>
<td>4.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13119</td>
<td>2nd</td>
<td>Projects</td>
<td>CO</td>
<td>6</td>
<td>4.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13118</td>
<td></td>
<td>Final Project</td>
<td>CP</td>
<td>15</td>
<td>0</td>
<td>15</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elective</td>
<td>EL</td>
<td>10.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Free Choice</td>
<td>FC</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>TOTAL</td>
<td></td>
<td>70.5</td>
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</tr>
</tbody>
</table>

ELECTIVE SUBJECTS (can also be chosen as free choice subjects)

<table>
<thead>
<tr>
<th>Code</th>
<th>MODULE’s NAME</th>
<th>Term</th>
<th>Year</th>
<th>Cred.</th>
<th>Theo</th>
<th>Lab</th>
<th>Module Type</th>
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</thead>
<tbody>
<tr>
<td>13112</td>
<td>Intro. to Programmable Logic Controllers</td>
<td>1st</td>
<td>2nd</td>
<td>7.5</td>
<td>4.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>12510</td>
<td>Economy and industrial organization</td>
<td>1st</td>
<td>2nd</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>13115</td>
<td>Mathematical methods for engineering</td>
<td>1st</td>
<td>2nd</td>
<td>6</td>
<td>4.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13123</td>
<td>Power supply electronic systems</td>
<td>2nd</td>
<td>2nd</td>
<td>7.5</td>
<td>4.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13029</td>
<td>Programming tools</td>
<td>2nd</td>
<td>2nd</td>
<td>4.5</td>
<td>1.5</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13129</td>
<td>Multimedia information processing</td>
<td>1st</td>
<td>3rd</td>
<td>4.5</td>
<td>3</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13113</td>
<td>Introduction to telecommunication systems</td>
<td>1st</td>
<td>3rd</td>
<td>4.5</td>
<td>4.5</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>13121</td>
<td>Remote Sensing Systems</td>
<td>1st</td>
<td>3rd</td>
<td>4.5</td>
<td>3</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13107</td>
<td>Assessment and Quality Control in Electr.</td>
<td>1st</td>
<td>3rd</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>13098</td>
<td>Optical communications</td>
<td>1st</td>
<td>3rd</td>
<td>4.5</td>
<td>3</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13126</td>
<td>Distributed industrial systems</td>
<td>2nd</td>
<td>3rd</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13122</td>
<td>Electronic systems with microprocessors</td>
<td>2nd</td>
<td>3rd</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13120</td>
<td>Data Transmission Networks</td>
<td>2nd</td>
<td>3rd</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>13096</td>
<td>Power electronic devices</td>
<td>2nd</td>
<td>3rd</td>
<td>6</td>
<td>4.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13117</td>
<td>Microwaves and antennas</td>
<td>2nd</td>
<td>3rd</td>
<td>6</td>
<td>4.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>13109</td>
<td>Virtual instrumentation</td>
<td>2nd</td>
<td>3rd</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

2 Legend: CO: Core subject  
CP: Compulsory subject  
EL: Elective subject  
FC: Free Choice
7.- Degree Modules

The purpose of the bachelor engineering in Telecommunications specialising in Electronic Systems is to prepare students for a variety of careers in electronics engineering. Specifically, this degree will prepare the student to

- Apply knowledge of digital number systems, logic gates, combination and sequential logic circuits.
- Describe the internal structure of a microprocessor and electrical signals.
- Interface external devices to a microprocessor system and write appropriate software to obtain desired interface performance.
- Apply working knowledge of AC and DC circuits and understand the physical principles of passive circuit devices.
- Demonstrate knowledge of the physical principles, theory and operation of solid state devices.
- Perform accurate and valid parameter measurements with industry standard test equipment while observing standard safety practices.
- Construct and troubleshoot electronic circuits from schematic diagrams.
- Demonstrate a cooperative and responsible attitude in the workplace.
- Demonstrate fundamental principles of physical phenomena.
- Design and construct analogue signal processing circuits and perform software verification through simulation.
- Solve mathematical problems relating to circuit analysis of linear and digital circuits.
- Design and construct digital electronic circuits employing microprocessors, including reduced instruction set processor and interrupt-driven systems.
- Design and construct prototype electronic circuits using schematic capture, circuit board layout software and printed circuit fabrication systems.
- Apply automated methods of signal sampling and testing, including real-time data acquisition and computer recording.
o Understand and apply methods to quantize and encode an analogue signal into a
digital signal.
o Use the z-transform to specify the parameters of digital signals.
o Synthesize digital signal processing systems to perform specified tasks.
o Design, program and commission automation systems and networked industrial
plants.
o Research, plan and prepare a comprehensive capstone project.
o Research, plan and prepare professional technical documents similar to
comprehensive manuals.

CORE MODULES

Laplace transform in the network theory. Network stability.

Analog Electronics I. (12 Credits). Annual.
Theory (7.5 credits)
Electronics analogue signals. Passive components: resistance, capacitors and
reels. Active components: tension and current sources. Semiconductor
substances. Solid devices: the diode and transistor. Other types of solid devices.
Signal amplifiers with transistors: polarisation, calculating input and output
gains and impedance in different configurations. Frequency response of
amplifiers with bipolar transistors. Amplifiers design. Amplifiers with field
Designing power amplifiers. Integrated power amplifiers. Feedback in
Feedback applications in oscillator design. Types of oscillators. Power sources.
Rectification. Filtering. Designing unregulated supplies. Regulators for power
supplies. Types. Designing regulated power supplies. Using integrated

Lab (4.5 Credits)

Mathematical Analysis for Engineering .(12 Credits). Annual
Digital Electronic Devices and Circuits (10.5 credits). Annual

Theory (6 credits)

Lab (4.5 credits)

Principles of Physic for Engineers (6 credits) 2nd semester

Microelectronics. (3 Credits). 2nd semester
Theory (3 credits)

Lab (3 credits)
Study of various semiconductor elements. Operating the ? -Electronics software, integrated circuit design. Logic circuit design.

**Electronic control systems. (9 Credits). Annual**

Theory (6 credits)

Lab (3 credits)
Electronic Devices (6 Credits). 2nd semester


Instrumentation and Electronic Equipment. (10.5 Credits). Annual.

Theory (6 credits)


Lab (4.5 credits)


Fundamentals of computer architecture. (6 credits) 1st semester.

Theory (3 credits)

Lab (3 credits)

Digital Electronic Systems (6 Credits). 3rd four-month period
Microcontroller systems. The CPU in a microcontroller. Input/output. 8-bit microcontrollers. 8-bit microprocessors. 16-bit microprocessors. Design of electronic systems based on microcontrollers and microprocessors. Introduction to advanced microprocessors.

Projects (6 Credits). 2nd semester

**COMPULSORY MODULES**

**Introduction to Digital Signal Processing (7.5 credits) 1st semester**


**Analogue electronics II (6 credits). 2nd semester**

Theory (4.5 credits)

Advanced audio power amplifiers. Types of amplifiers. Operational amplifiers for audio and feedback. Real cases. Impedance ratio. Foster and Cauer synthesis methods. Active impedance synthesis. Filters: Butterworth, Chebyshev and Bessel approximations. Frequency transforms. Low pass, high pass, stop band,

**Lab (1.5 credits)**


**CAD Techniques (6 Credits). Annual.**

Definition of basic concepts in printed circuits boards (PCB) elaboration process. EMI-related rules. Rules to avoid the heating. Practical advises. The scheme editor “schematics” by microsim? : Program structure e interrelation with the symbols and encapsulate libraries. Description of the menus of the program. Designs with multiples pages. Blocks and hierarchy symbols. Communication between blocks/hierarchy symbols. Creation and edition of encapsulated pinouts (plb library). Program structure and interrelation with the footprints libraries, encapsulates and pad stacks. Description of the program menus. Example pf creation of a footprint. Creation of the schemes with orcad sdt. Description of principal functions: Positioning of symbols, connection tracing, edition, etc. Assignation of encapsulating (file .stf) and creation of the netlist. Principal editor functions of the layout OrCAD PCB386 editor: positioning of footprints, visualising of ratsnest, manual and automatic rooters, DRC checking, etc. AutoCAD, 2D drawings for reference, 3-D drawings: creation of 3D objects for a sum and difference of solids.

**Introduction to Power Electronics. (9 Credits) Annual**

Theory (6 credits)

Introduction to the Power Electronics Systems. Line-Frequency Diode Rectifiers. Line-Frequency Phase-Controlled Rectifiers and Inverters. AC
Voltage Controllers. DC Choppers. Switch-mode DC-AC Inverters. PWM Inverters. Motor Drive Applications: AC and DC Drives.

Lab (3 credits)

Final Career Project. (15 Credits)
This is a project supervised by a lecturer from the Degree course, which is defended before a board of examiners consisting of three lecturers. The work can be developed in a company. The pupil can enrol for the project during either of the two four-month periods.

Fundamentals on communication electronics. (6 credits). 1st semester
Theory (4.5 credits)

Lab (1.5 credits)
Representation of signals in time and frequency domains. Concepts of linear signal modulation and demodulation. Assembling of several modulation, demodulation and AM receptors circuits. Verification of performance of some circuits for modulation and demodulation of FM. Applications of phased locked loop circuits. Study of coaxial cables as a transmission line when the input frequency is high, and the wavelength of the signal is comparable to the electric longitude of the cable. Build and check a complete system of communications formed for an infrared emitter and receptor.

Computing (6 credits) 1st semester

Theory (3 credits)

Lab (3 credits)
**ELECTIVE MODULES**

**Introduction to Programmable Logic Controllers (7.5 credits) 2\textsuperscript{nd} semester**

The goal of this subject is introducing the student in the use and applications of one of the devices most used in factories. OMRON was chosen as the PLC (Programmable Logic Controller) provider to make the practices, because it is the most extended manufacturer in the Comunidad Valenciana. An introduction to nano-PLCs will be given using Mitsubishi PLCs as a base. Also, big PLCs will be studied using SIMATIC S7 Siemens series. In addition, the student will learn about control elements and automatisms which are normally used and are not studied in other subjects of the engineering, for example frequency variators, inductive detectors, encoders, etc.

For the laboratory work, OMRON CPM1A series PLC’s are used for the sessions.

**Introduction to telecommunication systems (4.5 credits) 1\textsuperscript{st} semester**


**Programming tools (4.5 credits) 2\textsuperscript{nd} semester**

Theory (1.5 credits)

Deeper knowledge of the C programming language C. Knowledge and use of simple dynamic data structures. Knowledge of the object oriented programming to operative level. User interfaces. Internet-oriented programming languages.

Lab (3 credits)

**Multimedia Information processing (4,5 credits) 1st semester**

Theory (3 credits) + Lab (1,5 credits)

**Virtual instrumentation (6 credits) 2nd semester**

Theory (3 credits)

Lab (3 credits)


Power Electronic Devices (6 credits) 2nd semester

Theory (4.5 credits)


Lab (1.5 credits)
Demo board for power electronic devices, simple and double trigger. Maximum values. Static characteristics. Dynamic characteristics. Static characteristics of MOSFETS, IGBT’s and diodes. Dynamic characteristics of power IGBT’s. Calculation of the commutation loses at ON and OFF. Variation of loses with the different parameters. Dynamic characteristics of power MOSFET. Commutation loses. Loses variation with different parameters. Dynamic characteristics of power diodes. Commutation loses. Variation with different parameters. Characteristics of capacitors, coils and power resistors.

Electronic systems with microprocessors (6 credits) 2nd semester

Theory (3 credits)

Laboratory (3 credits)
Student project: embedded system design based on advanced microcontroller. Application study. Hardware and software design. Development, verification and test of a prototype. Written and oral reports.

Mathematical methods for engineering (6 credits).

Optical Communications (4.5 credits).

Distributed Industrial Systems. (6 credits). 2nd Semester.
Theory (3 credits)
Laboratory (3 credits)
Lab sessions are developed using PC’s and Omron PLC’s, deploying some PLC network using RS232, RS485, PROFIBUS protocols, and programming touch panles and SCADA systems using SIEMENS systems.

8.- Qualification System
The results are expressed as numerical marks from 0 to 10. The students are graded according to the following scale: 0-5 SUSPENSO (fail), 5-7 APROBADO (pass), 7- 8.5 NOTABLE (second class), over 8.5 SOBRESALIENTE (first class). Amongst the students with a first class grade, a MATRÍCULA DE HONOR (first class grade with distinction) is awarded, at a rate of one first class grade with distinction for each group of 20 pupils. Despite this, final marks of the Degree are computed with a different numerical value, i.e.: APROBADO=1, NOTABLE=2, SOBRESALIENTE=3, MATRÍCULA DE HONOR=4.

9.- Evaluation Methods

These can change for each subject from one academic year to another. Nevertheless, the most usual form of assessment for tutorial credits is a final examination. The laboratory credits are assessed according to the criteria of laboratory attendance, dissertations presented after the lab. sessions and, optionally, course work, continual assessment, or a final examination.

10.- ECTS-ERASMUS Coordinators

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