GUIDE OF THE COURSE

# Printed Circuit Technology

Academic year 2015-2016

| MODULE | AREA | YEAR | SEMESTER | ECTS CREDITs | COURSE |
|---|---|---|---|---|---|
| Electronic Systems | Electronic Systems Complements | 4th | 7º | 6 | Elective |

| LECTURER | ADDRESS |
|---|---|
| Prof. Andrés Roldán Aranda | Dpto. Electrónica y Tecnología de Computadores. Faculty of Sciences.<br>Office nº 11. Telephone. 958-24-40-10.<br>Email: amroldan@ugr.es |
| | **TUTORIAL ASSISTANCE** |
| | Wed/Thur/Fri. from 12:00-14:00.<br>Email before reach the office |

| GRADE | OTHER MASTER |
|---|---|
| Telecommunication Technology Engineering Grade | Telecommunication Engineering Master |

**RECOMMENDATIONS**

- Fluent reading of scientific English.
- Knowledge of fundamental electronic design
- Basic knowledge of experimental techniques in the electronic lab
- Foundations of electromagnetic fields and transmission lines
- Basic computer skills

**BRIEF DESCRIPTION OF CONTENTS**

Printed circuit boards (PCB). CAD/CAM tools for the development of electronic circuits and products. Manufacture processes in the industry. Quality criteria and cost estimation. Electronic product design & development.

## GENERAL AND SPECIFIC SKILLS

**Skills training common to the industry Telecommunication:**

C3 - Ability to use search tools for library resources or information related to telecommunications and electronics.

**Specific skills module:**

O6 - Ability to recognize and design printed circuit boards, to know tools, technologies and quality standards.

**Transversal skills:**

G1 - Capacity for analysis and synthesis: Find, analyze, critique (critical thinking), relate, structure and synthesize information from various sources and integrate ideas and knowledge.

G2 – Organization, planning and management of production information.

G3 - Oral and written communication in academic and professional fields with special emphasis on writing technical documentation.

G4 - Ability to solve problems.

G5 - Ability to make decisions based on objective criteria (experimental data or scientific simulation) and ability to argue or logically justify those decisions.

G6 - Ability to use and application of ICT in the academic and professional field.

G7 - Ability to communicate in a foreign language, particularly English.

G8 - Ability to work in team.

G9 - Capacity for independent learning and initiative and entrepreneurship

G10 - Motivation for quality and continuous improvement, acting with rigor, responsibility and ethics professional.

## GOALS

The student should be able:

- To read and understand datasheets and articles from the main PCB technological papers.
- To make a public presentation of one among the themes of the course and be able to answer the questions emerged in the discussion.
- To relate mechanical and electronic results with product manufacturing procedures.
- Understand the concepts and nomenclature of the design and manufacturing soldering technology in micrometer and millimetre scale.
- Find the conditioning elements of the technology in order to make the PCB designs for general and specific applications.
- To choose the different electronic components in a circuit depending on the technique used for

industrial manufacturing.

• Satisfy the standards and quality criteria in the design of printed circuits.

• Achieve introductory knowledge for different manufacturing technologies and industrial production PCBs.

• To know and manage CAD tools for obtaining lithography masks and chemical processes required during manufacturing.

• Learn and design easy CAD models of 3D printing oriented electronic products.

• Read into technical specifications of electronic equipment and write technical documentation.

• Apply the technological concepts needed to optimize production times depending on the available processes in the manufacturing line.

• Ability to apply mathematical concepts to optimize the costs of manufacture and assembly of printed circuit boards during industrialization in outside plant.

**SYLLABUS**

**THEME CONTENT**:

MODULE 1: Printed Circuit Boards

UNIT 1. Historical Review

UNIT 2. Component packages

UNIT 3. Design Rules

UNIT 4. Electrical and Mechanical Design

MODULE 2: Electronic Product Fabrication

UNIT 5. PCB and Fabrication Technology

UNIT 6. PCB Documentation

**PRACTICAL AGENDA:**

• Seminars

Multilayer PCB Design

Heat Dissipation

Exhibition of works

• Laboratory Practice

Integrated Project: A complex design using CAD/CAE/CAM tools, including design and fabrication of an electronic prototype from the cradle to the grave. Post-processing of PCBs and collection and management of documentation for Electronic Product manufacturing in a Web Site

• Field tour:

Visit a PCB Assembly Factory. Depending on the existing workload in business on the date of travel, will opt for the Technological Park of Andalucía (Málaga) or any of the existing in the province of Jaén (to perform according to availability of budget to finance the tour)

## REFERENCES

### BASIC BIBLIOGRAPHY


- Jon Varteresian, Fabricating Printed Circuit Boards, Newnes, 2002
- R. Tummala, Fundamentals of Microsystems Packaging, McGraw-Hill 2001
- Mark Madou, Fundamentals of Microfabrication, , CRC Press, ISBN: 0-8493-9451-1
- Elaine Rhodes, Developing Printed Circuit Assemblies: From Specifications to Mass Production, 2008
- C. Robertson. PCB Designer´s Reference. Prentice Hall, 2003
- C. Coombs, Printed Circuits Handbook, McGraw-Hill Professional, 6 edition, 2007


### COMPLEMENTARY BIBLIOGRAPHY:


- V. Shukla, Signal Integrity for PCB Designers, Reference Designer, 2009
- D. Brooks, Signal Integrity Issues and Printed Circuit Board Design, Prentice Hall, 2003
- B. Archambeault, J. Dreuiawniak, PCB Design for Real-World EMI Control, Springer, 2002


## LINKS

http://electronica.ugr.es/~amroldan/printed_circuit_technology/

## WORKLOAD ESTIMATION

| Modality | Names | Hours | ECTS | % |
|---|---|---|---|---|
| **In-class work activities** | | **60** | **2.4** | **40%** |
| Theoretical classes | Theory | 30 | 1.2 | 20% |
| Practical classes | Professional skills practice | 22 | 0.88 | 15% |
| ECTS tutorials | Group tutorials | 5 | 0.2 | 3% |
| Assessment | Assessment | 3 | 0.12 | 2% |
| **Distance education work activities** | | **90** | **3.6** | **60%** |
| Individual self-study | Progress assessment tasks | 45 | 1.8 | 30% |
| Individual self-study | Working on theory contents | 40 | 1.6 | 27% |
| Group self-study | Preparatory work for practical sessions | 5 | 0.2 | 3% |
| | **Total** | **150** | **6** | **100%** |

**Distance education work activities**

| Modality | Name | Description |
|---|---|---|
| Individual self-study | Progress assessment tasks | Essays and exercises will be assigned as homework to be assessed and corrected in class. |
| Individual self-study | Working on theory contents | Learning and revising theory and prototype. Completing assignments related to the theory items taught in class. |
| Group self-study | Preparatory work for practice sessions | Preparing the activities to be carried out before the class. |

## ATTENDANCE SYSTEM

Attendance at large group lectures is mandatory.
Attendance at small group classes is mandatory.
Attendance at seminars and realization of autonomous work will be mandatory for those students wishing this part to be assessed.

## EVALUATION SYSTEM

In order to assess the acquisition of contents and skills, a diversified evaluation system will be used, selecting the most appropriate assessment technique for the subjects at all times, which allows to highlight the different knowledge and skills acquired by students when taking each course.
One or more of the following evaluation techniques shall apply:

- Theoretical part: exams. Percentage of final qualification: **60%**.
- Practical part: labs activities, integrated project. Percentage of final qualification: **30%**.
- Seminars or individual practical activities will be evaluated considering the extra work carried out by students and advised by the professor. Percentage of final qualification: **10%**.

***To pass the course will be necessary to pass both the theoretical, practical and seminar parts.***

• For students qualifying for the final single assessment. This type of assessment will consist of all the evidence to prove that the student has acquired all of the general and specific skills described in the corresponding section of this Course Guide, including at least a theory and a practical laboratory production test. The final numerical grade will be obtained by the weighted sum of the ratings corresponding to a theoretical, the practical test.

All matters relating to the assessment will be governed by the Student Evaluation and Qualification Policy

at the University of Granada, which is available at this WEB URL. All matters relating to the assessment will be governed by the rules on teacher planning and organization of existing tests at the University of Granada.

The grading system is expressed by numerical rating according to the provisions of art. 5 of R.D. 1125/2003 of 5 September, establishing the European credit system and grading system of official university degrees and valid national territory is established.

**ADITIONAL INFORMATION**