Universidad de Granada
Departamento de Electrónica y Tecnología de Computadores

Module 0
Academic Year 13-14

Printed Circuits Technologies

Prof. Andrés Roldán Aranda

7th Semester

Telecommunication Technology Engineering Grade

Printed Circuits Technologies

Proffesor's Office

Andrés Roldán Aranda

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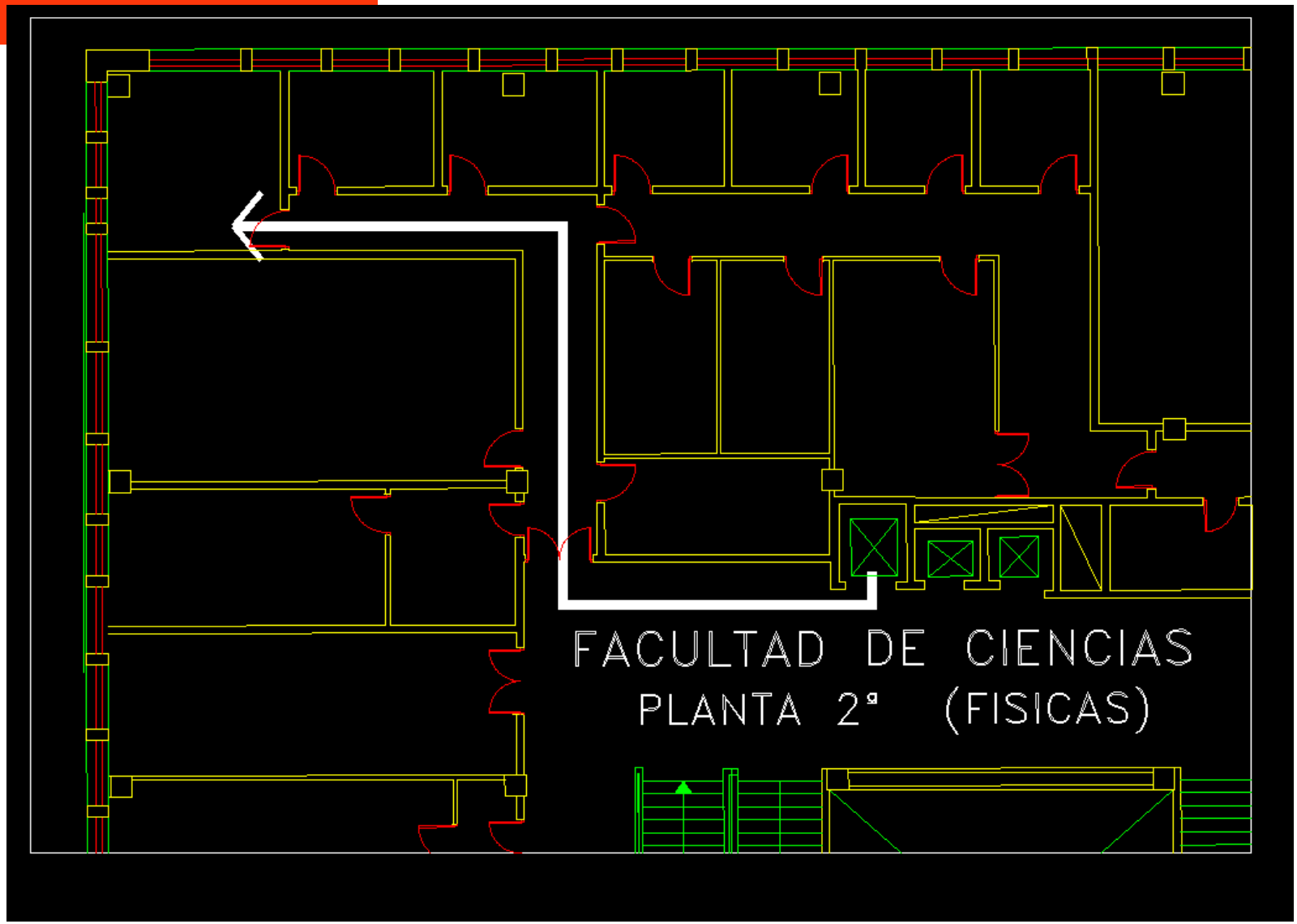
Proffesor's Office – Sciences Faculty



Theory - Class 0.7

- ✓ **Wednesday 08:30-09:30 (1H)**
- ✓ **Friday 11:30-12:30 (1H)**

Lab classes

- ✓ **Friday 12:30-14:30 (2H)**

Where ? Lab 3.11 and Class 0.7

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
- Use your personal laptop for all technical activities

BRIEF DESCRIPTION OF CONTENTS

- Printed circuit boards (PCB).
- CAD/CAM tools for the development of electronic circuits and products. Manufacture processes in the industry.
  - ✓ **CAD** (Computer-Aided-Design)
  - ✓ **CAM** (Computer-Aided-Manufacturing)
  - ✓ **CAE** (Computer-Aided-Engineering)
- Quality criteria and cost estimation.
- Fabrication process and Microfabrication
- Electronic Product Integration.

GENERAL 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 1/2

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.

GOALS 2/2

The student should be able ALSO :

- ✓ 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.

➢ 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: MicroFabrication

- ❍ UNIT 5. Micro manufacturing
- ❍ UNIT 6. Documentation

PRACTICAL AGENDA:

- Seminars
  - Multilayer PCB Design
  - Heat Dissipation
  - Exhibition of student designs → **INTEGRATED PROJECT**
- Laboratory Practice
  - Lab. 1: Design in CAD / CAE / CAM environment
  - Lab. 2: Design and fabrication of an electronic prototype.
  - Lab. 3: Post-processing of PCBs
  - Lab. 4: Collection and management of documentation for PCB manufacturing

PRACTICAL AGENDA:

- 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
- Mark Madou, Fundamentals of Microfabrication, CRC
- 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

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%**

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

- Theoretical part: exams, review sessions and exercises will be carried out. Percentage of final qualification: **60%**.

- Practical part: labs activities, problem solving and project development (individual or group). Percentage of final qualification: **30%**.

- Seminars will be evaluated considering the problems that have been delivered and solved by students. Percentage of final qualification: **10%**.

EVALUATION SYSTEM

Learning Activities	Percentage
Theory	60.00%
Lab.	30.00%
Others (seminars, ...)	10.00%

Don't forget this !!

To pass the course, you need to PASS the Exam and Lab parts

REASONS TO ATTEND CLASS

Do you Know that we remember
10% of what we **read**,
20% of what we **hear**,
30% of what we **see**, and
50% of what we hear and see?

TUTORIAL ASSISTANCE

- **The dumbest question is the one that does not arise.**
- In class you have to answer any questions you have !! "No charge apart $!"
- For non-academic concerns or private issues uses the TUTORIALS !

REMEMBER: Email before going to my office. Some times I am in the LABs.

***IMPORTANT**: in the beggining of your email use [TCI] to avoid SPAM filtering error and don't forget your full name.*