230658 - IMT - Introduction to Microelectronic Technologies

Coordinating unit: 230 - ETSETB - Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering
Academic year: 2018
Degree: MASTER'S DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 2013). (Teaching unit Optional)
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: English

Teaching staff
Coordinator: I. MARTIN
Others: M. GARIN

Degree competences to which the subject contributes

Transversal:
1. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.
2. FOREIGN LANGUAGE: Achieving a level of spoken and written proficiency in a foreign language, preferably English, that meets the needs of the profession and the labour market.

Teaching methodology

- Lectures
- Application classes
- Problem deliveries
- Exams with short questions and problems
- Short oral presentations

Learning objectives of the subject

Learning objectives of the subject:

The aim of this course is to teach students at an introductory level about the physical principles of semiconductor devices and offer them an overview about the reasons why semiconductor devices are the basis of the electronics industry, which it appears to be the largest industry in the world.
In particular we go in depth in the physical foundations, then we will present in detail diodes, MOS and bipolar transistors. Additionally, a brief description and analysis of fundamental properties of optoelectronic devices and MEMS (Micro Electro Mechanical Systems) will be given.

Learning results of the subject:

- Ability to analyse and predict the general behaviour of semiconductor devices.
- Ability to quantify the electrical properties.
- Ability to obtain the different electrical models to be applied in circuit analysis and design.
### Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group: 39h 31.20%</th>
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<tbody>
<tr>
<td></td>
<td>Hours medium group: 0h 0.00%</td>
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<td>Hours small group: 0h 0.00%</td>
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<td>Guided activities: 0h 0.00%</td>
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<td>Self study: 86h 68.80%</td>
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# Content

## 1. Fundamentals

**Description:**
- Crystal structure
- Atomic structure and wave properties
- Energy bands
- Carrier concentrations
- Currents in semiconductors

**Learning time:** 30h
- Theory classes: 10h
- Self study: 20h

## 2. P/N junctions

**Description:**
- Band diagram in thermal equilibrium
- Electrostatics
- Steady state I-V characteristics
- Small signal model
- Junction breakdown

**Learning time:** 31h
- Theory classes: 9h
- Self study: 22h

## 3. Bipolar junction transistor.

**Description:**
- The transistor effect
- Band diagram
- Common-base I-V characteristics
- Ebers-Moll model
- Small signal model
- Non idealities

**Learning time:** 26h
- Theory classes: 8h
- Self study: 18h
### Planning of activities

**SHORT ANSWER TEST (CONTROL)**

**Description:**
Mid term control.

**EXTENDED ANSWER TEST (FINAL EXAMINATION)**

**Description:**
Final examination.

### Qualification system

Final examination: 45%
Partial examinations and controls: 45%
Oral presentation: 10%

### MOS transistor

**Description:**
- MOS transistor structure
- MOS capacitor
- I-V characteristics
- Small signal model
- Non idealities

**Learning time:** 32h
- Theory classes: 10h
- Self study: 22h

### MEMS and optoelectronic devices

**Description:**
- Description and analysis of basic MEMS devices: piezoelectrics, accelerometers and MEMS gyroscopes.
- Description and analysis of basic optoelectronic devices: photoconductors, photodiodes, solar cellsm LED's and lasers.

**Learning time:** 6h
- Theory classes: 2h
- Self study: 4h
Bibliography

Basic:
