

## 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:	2017		
Degree:	MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional) MASTER'S DEGREE IN TELECOMMUNICATIONS 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.



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### Study load

Total learning time: 125h	Hours large group:	39h	31.20%
	Hours medium group:	0h	0.00%
	Hours small group:	0h	0.00%
	Guided activities:	0h	0.00%
	Self study:	86h	68.80%

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### Content

<p>1. Fundamentals</p>	<p>Learning time: 30h Theory classes: 10h Self study : 20h</p>
<p>Description:</p> <ul style="list-style-type: none"> <li>- Crystal structure</li> <li>- Atomic structure and wave properties</li> <li>- Energy bands</li> <li>- Carrier concentrations</li> <li>- Currents in semiconductors</li> </ul>	
<p>2. P/N junctions</p>	<p>Learning time: 31h Theory classes: 9h Self study : 22h</p>
<p>Description:</p> <ul style="list-style-type: none"> <li>- Band diagram in thermal equilibrium</li> <li>- Electrostatics</li> <li>- Steady state I-V characteristics</li> <li>- Small signal model</li> <li>- Junction breakdown</li> </ul>	
<p>3. Bipolar junction transistor.</p>	<p>Learning time: 26h Theory classes: 8h Self study : 18h</p>
<p>Description:</p> <ul style="list-style-type: none"> <li>- The transistor effect</li> <li>- Band diagram</li> <li>- Common-base I-V characteristics</li> <li>- Ebers-Moll model</li> <li>- Small signal model</li> <li>- Non idealities</li> </ul>	

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4. MOS transistor	Learning time: 32h Theory classes: 10h Self study : 22h
Description: - MOS transistor structure - MOS capacitor - I-V characteristics - Small signal model - Non idealities	
5. MEMS and optoelectronic devices	Learning time: 6h Theory classes: 2h Self study : 4h
Description: - Description and analysis of basic MEMS devices: piezoelectrics, accelerometers and MEMS gyroscopes. - Description and analysis of basic optoelectronic devices: photoconductors, photodiodes, solar cells, LED's and lasers.	

### 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%

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### Bibliography

#### Basic:

Sze, S.M.; Lee, M.K. Semiconductor devices: physics and technology: international student version. 3rd ed. Singapore: John Wiley & Sons Singapore, 2013. ISBN 9780470873670.

Prat Viñas, L.; Calderer Cardona, J. Dispositivos electrónicos y fotónicos : fundamentos [on line]. 2a ed. Barcelona: Edicions UPC, 2006 [Consultation: 20/06/2016]. Available on: <<http://hdl.handle.net/2099.3/36596>>. ISBN 8483018543.