

## 230669 - MEMS - Mems. Microelectromechanical Systems

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 2009). (Teaching unit Optional) MASTER'S DEGREE IN INFORMATION AND COMMUNICATION TECHNOLOGIES (Syllabus 2009). (Teaching unit Optional) MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional) DEGREE IN ELECTRONIC ENGINEERING (Syllabus 1992). (Teaching unit Optional) DEGREE IN TELECOMMUNICATIONS ENGINEERING (Syllabus 1992). (Teaching unit Optional)
ECTS credits:	5
Teaching languages:	English

### Teaching staff

Coordinator:	LUIS CASTAÑER MUÑOZ, ANGEL RODRIGUEZ
Others:	SANDRA BERMEJO

### 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
- Individual work (distance)
- Exercises
- Extended answer test (Final Exam)

### Learning objectives of the subject

#### Learning objectives of the subject:

Understanding the general principles and tools of the microelectromechanical systems and devices and its applications.

#### Learning results of the subject:

- Independent ability to propose, plan and develop MEMS devices and applications
- Ability to understand multidomain problems: thermal, fluidic, mechanical and electrical
- Ability to design a fabrication process of a MEMS device



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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. Introduction to MEMS</p>	<p>Learning time: 6h Theory classes: 1h Self study : 5h</p>
<p>Description: - Scaling of forces to the microworld. - MEMS design and fabrication process outline.</p>	
<p>2. Elasticity</p>	<p>Learning time: 17h Theory classes: 5h Self study : 12h</p>
<p>Description: - Stress and strain - Elastic properties of main materials - Beam equation - Membranes - Flexures</p>	
<p>3. Piezoresistance and piezoelectricity</p>	<p>Learning time: 18h Theory classes: 6h Self study : 12h</p>
<p>Description: - Piezoresistance and piezoelectric coefficients - Pressure sensors based on piezoresistors</p>	
<p>4. Electrostatic actuation and sensing</p>	<p>Learning time: 17h Theory classes: 5h Self study : 12h</p>
<p>Description: - Electrostatic force - Pull-in and pull-out - Comb actuators and differential capacitance</p>	

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<p>5. Inertial sensors</p>	<p>Learning time: 16h Theory classes: 5h Self study : 11h</p>
<p>Description: - accelerometers - gyroscopes</p>	
<p>6. Resonators</p>	<p>Learning time: 15h Theory classes: 5h Self study : 10h</p>
<p>Description: - Resonator model - Equivalent circuit - Applications</p>	
<p>7. Microfluidics and electrokinetics</p>	<p>Learning time: 18h Theory classes: 6h Self study : 12h</p>
<p>Description: - Pressure driven flow - Electrokinetic flow - Nanoparticle selfassembly - Dielectrophoresis - Liquid lenses and displays</p>	
<p>8. Fabrication processes</p>	<p>Learning time: 18h Theory classes: 6h Self study : 12h</p>
<p>Description: - Bulk micromachining - Surface micromachining - Foundry services</p>	

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### Planning of activities

#### EXERCISES

Description:  
Exercises to strengthen the theoretical knowledge.

#### EXTENDED ANSWER TEST

Description:  
Final examination.

### Qualification system

Final examination: from 50% to 60%  
Individual assessments: from 40% to 50%

### Bibliography

#### Basic:

Senturia, S.D. Microsystem design [on line]. Boston: Kluwer Academic, 2001 [Consultation: 10/03/2015]. Available on: <<http://link.springer.com/book/10.1007/b117574>>. ISBN 0-7923-7246-8.

Liu, C. Foundations of MEMS. 2nd rev. ed. int. Pearson Education Limited, 2011. ISBN 9780273752240.