Course guides
230669 - MEMS - Mems. Microelectromechanical Systems

Unit in charge: Barcelona School of Telecommunications Engineering
Teaching unit: 710 - EEL - Department of Electronic Engineering.
Degree: MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Optional subject).
MASTER'S DEGREE IN ADVANCED TELECOMMUNICATION TECHNOLOGIES (Syllabus 2019). (Optional subject).
Academic year: 2019   ECTS Credits: 5.0   Languages: English

LECTURER
Coordinating lecturer: 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
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hours large group</td>
<td>39,0</td>
<td>31.20</td>
</tr>
<tr>
<td>Self study</td>
<td>86,0</td>
<td>68.80</td>
</tr>
</tbody>
</table>

Total learning time: 125 h

CONTENTS

1. Introduction to MEMS
Description:
- Scaling of forces to the microworld.
- MEMS design and fabrication process outline.

2. Elasticity
Description:
- Stress and strain
- Elastic properties of main materials
- Beam equation
- Membranes
- Flexures

3. Piezoresistance and piezoelectricity
Description:
- Piezoresistance and piezoelectric coefficients
- Pressure sensors based on piezoresistors

4. Electrostatic actuation and sensing
Description:
- Electrostatic force
- Pull-in and pull-out
- Comb actuators and differential capacitance

5. Inertial sensors
Description:
- accelerometers
- gyroscopes
6. Resonators

Description:
- Resonator model
- Equivalent circuit
- Applications

7. Microfluidics and electrokinetics

Description:
- Pressure driven flow
- Electrokinetic flow
- Nanoparticle selfassembly
- Dielectrophoresis
- Liquid lenses and displays

8. Fabrication processes

Description:
- Bulk micromachining
- Surface micromachining
- Foundry services

ACTIVITIES

EXERCISES

Description:
Exercises to strengthen the theoretical knowledge.

EXTENDED ANSWER TEST

Description:
Final examination.

GRADING SYSTEM

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

BIBLIOGRAPHY

Basic: