230667 - SCPD - System on Chip Physical Design

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)
DEGREE IN ELECTRONIC ENGINEERING (Syllabus 1992). (Teaching unit Optional)
MASTER'S DEGREE IN ELECTRONIC ENGINEERING (Syllabus 2013). (Teaching unit Optional)
ECTS credits: 5
Teaching languages: English

Teaching staff
Coordinator: Moll Echeto, Francesc De Borja
Rubio Sola, Jose Antonio
Others: Moll Echeto, Francesc De Borja
Rubio Sola, Jose Antonio

Opening hours
Timetable: 6 hours per week

Prior skills
Basic knowledge of CMOS technology and design.
Basic knowledge of digital design, combinational and sequential.

Requirements
Graduate studies in Electronic Engineering or equivalent

Degree competences to which the subject contributes
Specific:
CEE18. Ability to design CMOS digital and analog integrated circuits of medium complexity.

CEE19. Ability to apply low-power techniques to integrated circuits (ICs).

Transversal:
1. TEAMWORK: Being able to work in an interdisciplinary team, whether as a member or as a leader, with the aim of contributing to projects pragmatically and responsibly and making commitments in view of the resources that are available.
2. 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.
3. 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.
Learning objectives of the subject:

The aim of this course is to train students in methods of design of CMOS integrated circuits from a high level description to a layout in an efficient way using computers so that the resulting layout satisfies topological, geometric, timing and power-consumption constraints of the design.

Learning results of the subject:

- Ability to understand and apply timing and power constraints to a complex integrated circuit.
- Ability to perform the physical implementation of a complex integrated circuit.
- Ability to apply low power design techniques to integrated circuit design.
- Ability to develop techniques for the design, analysis and evaluation of electronic systems in applications such as automation, aerospace, energy distribution and generation, consumer electronics, biomedicine, etc.
- Ability to analyze, design and evaluate microelectronic integrated circuits.
- Ability to implement advanced design techniques of microelectronic integrated circuits.
- Ability to use state of the art computer aided design (CAD) tools for the design of integrated circuits.

Study load

<table>
<thead>
<tr>
<th>Total learning time: 125h</th>
<th>Hours large group:</th>
<th>Hours medium group:</th>
<th>Hours small group:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13h</td>
<td>0h</td>
<td>26h</td>
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<tr>
<td></td>
<td>10.40%</td>
<td>0.00%</td>
<td>20.80%</td>
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<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>86h</td>
<td>68.80%</td>
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</tbody>
</table>
## Content

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Learning time</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Nanometer chip design overview</td>
<td>25h</td>
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</tbody>
</table>
Theory classes: 3h  
Laboratory classes: 6h  
Self study : 16h  

Description:  
- Challenges in nanometer chip design  
- Digital design flows  
- Design and verification  
- Physical implementation  
- Low power design techniques  
- Test techniques  
- Signoff  
- Lab1 |
| 2       | RTL synthesis for low power | 25h |  
Theory classes: 3h  
Laboratory classes: 4h  
Self study : 18h  

Description:  
- Power problem  
- Low power techniques  
- Power-aware synthesis (Lab2) |
| 3       | Design planning/ floorplanning | 24h |  
Theory classes: 2h  
Laboratory classes: 4h  
Self study : 18h  

Description:  
- Low power design flow  
- Floorplan  
- Power distribution plan  
- Lab3 |
### 4. Physical design

**Learning time:** 27h  
Theory classes: 3h  
Laboratory classes: 6h  
Self study: 18h  

**Description:**  
- Placement and optimization  
- Clock tree synthesis  
- Routing  
- Lab4

### 5. Sign-off

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

**Description:**  
- IR drop analysis  
- Design finishing and layout verification  
- Tapeout  
- Lab: project

### 6. Design project

**Learning time:** 18h  
Laboratory classes: 6h  
Self study: 12h

**Description:**  
Implement an IP using low power flow.

### Qualification system

Continuous evaluation (CE):  
Partial exams: 25%  
Individual assessments: 25%  
Laboratory experiences: 50%

Final score: maximum (CE, Final exam)

### Regulations for carrying out activities

Final exam: individual  
Individual works: Individual  
Research presentation: groups of two students  
Laboratory: groups of two students
Bibliography

Complementary:


Others resources:

Slides of the course