## BASIC DETAILS:

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|---|---|---|---|
| **Subject:** | ARQUITECTURAS AVANZADAS DE COMPUTACIÓN | | |
| **Id.:** | 30565 | | |
| **Programme:** | GRADUADO EN INGENIERÍA INFORMÁTICA (SEMIPRESENCIAL). 2008 (BOE 15/12/2008) | | |
| **Module:** | TECNOLOGÍAS HARDWARE | | |
| **Subject type:** | OPTATIVA | | |
| **Year:** | 3 | **Teaching period:** | Segundo Cuatrimestre |
| **Credits:** | 3 | **Total hours:** | 75 |
| **Classroom activities:** | 9 | **Individual study:** | 66 |
| **Main teaching language:** | Inglés | **Secondary teaching language:** | Castellano |
| **Lecturer:** | | **Email:** | |

## PRESENTATION:

In this subject, the students will learn how work comples computational systems. When the clock frequency of a processor can not be increased it is necessary to look for other ways to increase the computational capacity. During this subject the students will learn how this can be solved using pipelining, several processors, or other techniques, like using the GPU.

## PROFESSIONAL COMPETENCES ACQUIRED IN THE SUBJECT:

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| **General programme competences** | G02 | Innovative capacity to propose and find new and efficient ways to undertake any task and/ or function within the professional environment - highly motivated by quality. |
| | G04 | Capacity to always commit to working responsibly - creating a strong sense of duty and fulfilment of obligations. |
| | G05 | Capacity to adapt to different environments while being positive and optimistic, orienting your behaviour towards the achievement of goals. |
| | G06 | Capacity to analyse and find a solution to complex problems or unforeseen situations which may arise while working in any type of socio-economic organisation. |
| | G09 | Capacity to make decisions impartially and rationally. |
| | G11 | Ability to get on in a multicultural or international environment, interacting with people of different nationalities, languages and cultures. |
| | G12 | Capacity to undertake professional activities with integrity, respecting social, organisational and ethical norms. |
| | G14 | Capacity for abstraction to handle various complex knowledge models and apply them to examining and solving problems. |
| **Specific programme competences** | E01 | Capacity to understand the engineering profession and commitment to serve society under the corresponding professional code of conduct. |
| | E02 | Capacity to apply the intrinsic engineering principles based on mathematics and a combination of scientific disciplines. |
| | E03 | Capacity to recognise the technical principles and apply the appropriate practical methods satisfactorily to analyse and solve engineering problems. |
| | E04 | Capacity to maintain an open mind to innovation and creativity within the framework of the engineering profession. |
| | E08 | Capacity to communicate productively with clients, users and colleagues both orally and in writing, so as to pass on ideas, solve conflicts and achieve agreements. |
| | E10 | Capacity to understand and assess the impact of technology on individuals, organisations, society and the environment, including ethical, legal and political factors, recognising and applying the pertinent standards and regulations. |
| | E11 | Capacity to remain up-to-date in the technological and business worlds in the area of information and communication technologies. |
| | E13 | Capacity to identify, assess and use current and emerging technologies, considering how they apply in terms of individual or organisational needs. |
| | E20 | Capacity to undertake the detailed design of the components of a project (procedures, user interface, equipment characteristics, communications system parameters, etc.). |
| | E21 | Capacity to perform tests that verify the validity of the project (functional, data integrity, performance of the computer applications, equipment, communications, etc.). |
| | E27 | Capacity to write and maintain descriptive documentation of the origin, production and operability of IT systems. |

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| **Learning outcomes** | R01 | Understand the architecture of multiprocessor systems. |
| | R02 | Understand grid computing. |
| | R03 | Develop programs which optimise the use of resources, making use of GPGPU techniques. |
| | R04 | Understand and assess memory systems in complex computing systems. |

**PRE-REQUISITES:**

Arquitectura de Ordenadores

**SUBJECT PROGRAMME:**

**Subject contents:**

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|---|
| **1 - Introduction** |
| 1.1 - The necessity of computation |
| 1.2 - Moore ' s Law |
| 1.3 - Processors Evolution |
| 1.4 - Pipelining |
| **2 - Multiprocessors** |
| 2.1 - Introduction |
| 2.2 - SMachine Simulator |
| 2.3 - Real Multi-core Processors |
| **3 - Grid Computing** |
| 3.1 - Introduction |
| 3.2 - Classification |
| 3.3 - Cluster Architecture |
| 3.4 - Volunteer Computing |
| **4 - GPGPU** |
| 4.1 - Introduction to Heterogeneous Computing |
| 4.2 - OpenCL: The open standard for parallel programming of heterogeneous systems |
| 4.3 - CUDA |

Subject planning could be modified due unforeseen circumstances (group performance, availability of resources, changes to academic calendar etc.) and should not, therefore, be considered to be definitive.

**TEACHING AND LEARNING METHODOLOGIES AND ACTIVITIES:**

**Teaching and learning methodologies and activities applied:**

Classes are conducted exclusively in English. Students are expected to participate in class and in all class-related activities in English. Classes are practical and communicative. Many class activities will be conducted in pairs and groups in the format of infomation gaps, debates, project preparation, problem solving, simulations, presentations etc.

This methodology enables maximum student participation and talking time in class. It also encourages cooperate learning and meaningful interaction between students and the development of professional competences.

Students are expected to complete all independent study tasks, which will be uploaded on the PDU.

**Theory Sessions**: Lectures will be used to explain the basis of the different chapters. Wherever possible, explanations will be accompained by images, text or sounds to be used as practical examples and discussion topics. During the sessions, the lecturer will propouse activities or to look for information out of the class and he will resolve doubts.

**Practical Sessions**: There are individual labs and a practice in gropus. For this practice, students will

be grouped into groups of 2 or 3. Practice will be the goal of the whole group. During practice,students will use problem-based learning methodological strategy

**Student work load:**

| Teaching mode | Teaching methods | Estimated hours |
|---|---|---|
| **Classroom activities** | Master classes | 3 |
| | Practical exercises | 1,5 |
| | Laboratory practice | 1,5 |
| | Assessment activities | 3 |
| **Individual study** | Tutorials | 5 |
| | Individual study | 18 |
| | Individual coursework preparation | 15 |
| | Group cousework preparation | 16 |
| | Project work | 8 |
| | Compulsory reading | 3 |
| | Recommended reading | 1 |
| | **Total hours:** | 75 |

**ASSESSMENT SCHEME:**

**Calculation of final mark:**

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|---|---|---|
| Written tests: | 50 | % |
| Individual coursework: | 25 | % |
| Group coursework: | 25 | % |
| **TOTAL** | 100 | % |

*Las observaciones específicas sobre el sistema de evaluación serán comunicadas por escrito a los alumnos al inicio de la materia.

**BIBLIOGRAPHY AND DOCUMENTATION:**

**Basic bibliography:**

HENNESSY, John L. and PATTERSON, David A. Computer Architecture: A Quantitative Approach. Morgan Kaufmann, 3a Edición, 2003.
CUDA C Programming Guide

**Recommended bibliography:**

BUYYA, R. Hig Performance Cluster Computing: Architectures and Systems. Upper Saddle River, NJ. Pretince Hall, 1999
BUYYA, R. Hig Performance Cluster Computing: Programming and Applications. Upper Saddle River, NJ. Pretince Hall, 1999
HWANG, K. Advanced Computer ARchitectura. New York: McGraw-Hill, 1993.
STALLINGS, William. Organización y arquitectura de computadores. Pretince Hall, 2006.

**Recommended websites:**

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| CUDA | http://www.nvidia.com/object/cuda_home_new.html |
| BOINC | http://boinc.berkeley.edu/ |
| HTCondor | https://research.cs.wisc.edu/htcondor/ |

* Guía Docente sujeta a modificaciones