Course guides
270150 - TGA - Graphic Cards and Accelerators

Unit in charge: Barcelona School of Informatics
Teaching unit: 701 - DAC - Department of Computer Architecture.

Degree: BACHELOR’S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Optional subject).

Academic year: 2021 ECTS Credits: 6.0 Languages: Spanish

LECTURER

Coordinating lecturer: AGUSTÍN FERNÁNDEZ JIMÉNEZ

Others:
Segon quadrimestre:
AGUSTÍN FERNÁNDEZ JIMÉNEZ - 11
DANIEL JIMENEZ GONZALEZ - 11
BEATRIZ OTERO CALVIÑO - 11

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CCO2.6. To design and implement graphic, virtual reality, augmented reality and video-games applications.
CCO3.1. To implement critical code following criteria like execution time, efficiency and security.
CCO3.2. To program taking into account the hardware architecture, using assembly language as well as high-level programming languages.
CEC2.1. To analyse, evaluate, select and configure hardware platforms for the development and execution of computer applications and services.
CEC2.2. To program taking into account the hardware architecture, using assembly language as well as high-level programming languages.
CEC3.1. To analyse, evaluate and select the most adequate hardware and software platform to support embedded and real-time applications.
CT1.1B. To demonstrate knowledge and comprehension about the fundamentals of computer usage and programming. Knowledge about the structure, operation and interconnection of computer systems, and about the fundamentals of its programming.
CT6.2. To demonstrate knowledge, comprehension and capacity to evaluate the structure and architecture of computers, and the basic components that compound them.
CT6.3. To demonstrate knowledge about the characteristics, functionalities and structure of the Operating Systems allowing an adequate use, management and design, as well as the implementation of applications based on its services.
CT7.1. To demonstrate knowledge about metrics of quality and be able to use them.
CT7.2. To evaluate hardware/software systems in function of a determined criteria of quality.

General:
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.
G6. SOLVENT USE OF THE INFORMATION RESOURCES: To manage the acquisition, structuring, analysis and visualization of data and information of the field of the informatics engineering, and value in a critical way the results of this management.
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

TEACHING METHODOLOGY

Teaching methodology is described in Activities
LEARNING OBJECTIVES OF THE SUBJECT

STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided activities</td>
<td>6,0</td>
<td>4.00</td>
</tr>
<tr>
<td>Self study</td>
<td>84,0</td>
<td>56.00</td>
</tr>
<tr>
<td>Theory classes</td>
<td>30,0</td>
<td>20.00</td>
</tr>
<tr>
<td>Laboratory classes</td>
<td>30,0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 150 h

CONTENTS

(ENG) Tema 1: Introducción

Description:
(ENG) - Història de les Targetes gràfiques
- El pipeline gràfic

Specific objectives:
(ENG)

Related activities:
(ENG)

(ENG) TEMA 2: Components fonamentals d'una targeta gràfica

Description:
(ENG) - Shaders
- Rasterització
- Textures
- Antialiasing
- Z-Buffer

Specific objectives:
(ENG)

Related activities:
(ENG)

(ENG) TEMA 3: Exemples Comercials

Description:
(ENG) - Evolució Històrica del hardware gràfic
- Exemples Clàssics
- Exemples Actuals

Specific objectives:
(ENG)

Related activities:
(ENG)
### (ENG) TEMA 4: Computació d'Altes Prestacions

**Description:**
- CPU vs GPU
- Supercomputació i GPUs
- Paradigmes de computació / paral·lelisme
- Sistemes MultiGPU
- Acceleradors

**Specific objectives:**
(ENG)

**Related activities:**
(ENG)

### (ENG) TEMA 5: Aspectes Software

**Description:**
- GPGPU
- CUDA
- OpenGL
- DirectX
- Shader Assembly and Shading Languages

**Specific objectives:**
(ENG)

**Related activities:**
(ENG)

### (ENG) TEMA 6: Aspectes Tecnològics

**Description:**
- Refrigeració
- Overclocking
- Benchmarking
- Busos
- Connectors

**Specific objectives:**
(ENG)

**Related activities:**
(ENG)
ACTIVITIES

(ENG) Examen Final

Description:
(ENG) És un examen no presencial. Al voltant de la setmana 13 es lliurà l'examen en horari de classe. Els estudiants tenen 2 setmanes per realitzar l'examen. Cada pregunta d'examen té un espai limitat per respondre. Les respostes han de ser concises, clares i correctes.

Specific objectives:
(ENG) 1, 2, 3, 4, 5

Material:
(ENG)

Delivery:
(ENG)

Related competencies:
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.
G6. SOLVENT USE OF THE INFORMATION RESOURCES: To manage the acquisition, structuring, analysis and visualization of data and information of the field of the informatics engineering, and value in a critical way the results of this management.

Full-or-part-time: 15h
Guided activities: 3h
Self study: 12h

(ENG) CUDA

Description:
(ENG) Es presentaran les eines bàsiques que ofereix CUDA per a la programació de targetes gràfiques.

Specific objectives:
(ENG) 3

Material:
(ENG)

Delivery:
(ENG)

Related competencies:
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 28h
Theory classes: 4h
Laboratory classes: 10h
Self study: 14h
(ENG) Pipeline gràfic

**Description:**
(ENG) Descripció exhaustiva del pipeline gràfic.

**Specific objectives:**
(ENG) 1, 2

**Material:**
(ENG)

**Delivery:**
(ENG)

**Full-or-part-time:** 8h
Theory classes: 2h
Laboratory classes: 2h
Self study: 4h

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(ENG) Exemples Comercials

**Description:**
(ENG) Es presentaran diversos exemples de targetes gràfiques comercials, amb l'objectiu d'entendre el disseny actual de les mateixes.

**Specific objectives:**
(ENG) 1, 2, 5

**Material:**
(ENG)

**Delivery:**
(ENG)

**Full-or-part-time:** 8h
Theory classes: 2h
Laboratory classes: 2h
Self study: 4h
(ENG) GPGPU

Description:
(ENG) Descriure les tècniques clàssiques de GPGPU i com les seves limitacions han influït en el disseny de les noves arquitectures i llenguatges de programació.

Specific objectives:
(ENG) 2, 3

Material:
(ENG)

Delivery:
(ENG)

Related competencies:
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 4h
Theory classes: 2h
Self study: 2h

(ENG) OpenCL

Description:
(ENG) Descripció del llenguatge.

Specific objectives:
(ENG) 3

Material:
(ENG)

Delivery:
(ENG)

Related competencies:
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

Full-or-part-time: 8h
Theory classes: 4h
Laboratory classes: 2h
Self study: 2h
**Project Description**

(ENG) Implementació d’un projecte software.

**Specific Objectives:**
(ENG) 1, 2, 3, 4, 5

**Material:**
(ENG)

**Delivery:**
(ENG)

**Related Competencies:**
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

G6. SOLVENT USE OF THE INFORMATION RESOURCES: To manage the acquisition, structuring, analysis and visualization of data and information of the field of the informatics engineering, and value in a critical way the results of this management.

**Full-or-part-time:** 30h

Laboratory classes: 10h
Self study: 20h

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**Components Fonamentals d’una Targeta Gràfica**

**Description:**
(ENG) Es presentaran alguns elements fonamentals d’una targeta gràfica: unitat de textures, memòria, z buffer, ...

**Specific Objectives:**
(ENG) 1, 2, 3, 4

**Material:**
(ENG)

**Delivery:**
(ENG)

**Related Competencies:**
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.

G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.

G6. SOLVENT USE OF THE INFORMATION RESOURCES: To manage the acquisition, structuring, analysis and visualization of data and information of the field of the informatics engineering, and value in a critical way the results of this management.

**Full-or-part-time:** 8h

Theory classes: 4h
Self study: 4h
**(ENG) CPUs vs GPUs**

**Description:**
(ENG) Es presentaran les diferències essencials entre una CPU i una GPU.

**Specific objectives:**
(ENG) 1, 5

**Material:**
(ENG)

**Delivery:**
(ENG)

**Full-or-part-time:** 4h
Theory classes: 2h
Self study: 2h

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**(ENG) Shading Languages**

**Description:**
(ENG) Descripció de les característiques bàsiques dels Llenguatges de programació dels shaders, en alt i baix nivell.

**Specific objectives:**
(ENG) 1, 3, 4

**Material:**
(ENG)

**Delivery:**
(ENG)

**Related competencies:**
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.
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**Full-or-part-time:** 4h
Theory classes: 2h
Self study: 2h
(ENG) Història

**Description:**
(ENG) Visió històrica de l’evolució de les targetes gràfiques, des del primer PC fins avui.

**Specific objectives:**
(ENG) 1

**Material:**
(ENG)

**Delivery:**
(ENG)

**Full-or-part-time:** 2h
Theory classes: 2h

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(ENG) Xerrades

**Description:**
(ENG) Durant el curs, i depenent de la disponibilitat, s’impartiran xerrades de temes afins.

**Specific objectives:**
(ENG) 1, 2, 3, 4, 5

**Material:**
(ENG)

**Delivery:**
(ENG)

**Related competencies:**
G4. EFFECTIVE ORAL AND WRITTEN communication: To communicate with other people knowledge, procedures, results and ideas orally and in a written way. To participate in discussions about topics related to the activity of a technical informatics engineer.
G7. AUTONOMOUS LEARNING: to detect deficiencies in the own knowledge and overcome them through critical reflection and choosing the best actuation to extend this knowledge. Capacity for learning new methods and technologies, and versatility to adapt oneself to new situations.
G6. SOLVENT USE OF THE INFORMATION RESOURCES: To manage the acquisition, structuring, analysis and visualization of data and information of the field of the informatics engineering, and value in a critical way the results of this management.

**Full-or-part-time:** 8h
Theory classes: 4h
Self study: 4h

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**GRADING SYSTEM**

Not yet translated
BIBLIOGRAPHY

Basic: