

## Course guide

### 270019 - IDI - Interaction and Interface Design

Last modified: 30/01/2024

**Unit in charge:** Barcelona School of Informatics  
**Teaching unit:** 723 - CS - Department of Computer Science.

**Degree:** BACHELOR'S DEGREE IN INFORMATICS ENGINEERING (Syllabus 2010). (Compulsory subject).

**Academic year:** 2023    **ECTS Credits:** 6.0    **Languages:** Catalan, Spanish

#### LECTURER

---

**Coordinating lecturer:** MARTA FAIREN GONZALEZ

**Others:**

Primer quadrimestre:

FRANCISCO JOSE ARIAS ARNEDO - 11, 21  
ALEJANDRO BEACCO PORRES - 11, 12, 22  
MARTA FAIREN GONZALEZ - 11, 12, 42  
JORGE LUQUE SERRANO - 41, 42  
NURIA PELECHANO GOMEZ - 21, 22, 23, 42  
EDUARD PUJOL PUIG - 23, 41

Segon quadrimestre:

FRANCISCO JOSE ARIAS ARNEDO - 13, 21, 33  
GENIS BAYONA JAUME - 11  
ALEJANDRO BEACCO PORRES - 11, 12, 13, 43, 51  
MARIA JOSE BLESAGUILERA - 23, 32, 53  
MARTA FAIREN GONZALEZ - 42, 51, 52, 53  
JOAN FONS SANCHEZ - 52  
JORGE LUQUE SERRANO - 12, 41, 42, 43  
IMANOL MUÑOZ PANDIELLA - 23, 31, 53  
NURIA PELECHANO GOMEZ - 21, 23, 31, 32, 33, 42

#### PRIOR SKILLS

---

EDA capabilities of the subjects (Data Structures and Algorithms) and M2 (Math 2).

In particular, it is expected that the student is able to:

- Program correctly by using Object-Oriented Programming in C + +.
- Understand and know how to implement basic data structures, lists, stacks, etc..
- Learn the basics of linear algebra, geometric transformations and changes of base.

#### REQUIREMENTS

---

- Prerequisite EDA
- Prerequisite M1

## DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

---

### Specific:

CT1.2A. To interpret, select and value concepts, theories, uses and technological developments related to computer science and its application derived from the needed fundamentals of mathematics, statistics and physics. Capacity to solve the mathematical problems presented in engineering. Talent to apply the knowledge about: algebra, differential and integral calculus and numeric methods; statistics and optimization.

CT2.5. To design and evaluate person-computer interfaces which guarantee the accessibility and usability of computer systems, services and applications.

CT4.1. To identify the most adequate algorithmic solutions to solve medium difficulty problems.

CT5.2. To know, design and use efficiently the most adequate data types and data structures to solve a problem.

CT5.3. To design, write, test, refine, document and maintain code in an high level programming language to solve programming problems applying algorithmic schemas and using data structures.

CT5.4. To design the programs' architecture using techniques of object orientation, modularization and specification and implementation of abstract data types.

CT5.5. To use the tools of a software development environment to create and develop applications.

### Generical:

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

## TEACHING METHODOLOGY

---

In theory sessions the teacher will introduce theoretical concepts and, where appropriate, exercises and problems. The theory is strongly tied to the developments proposed laboratory.

As support for the theory classes, especially for the interaction and design, notes or articles will be provided available via El Racó. These notes are designed for the students to have available during the classes.

Students are expected to prepare additional materials that will be provided in the form of notes or other documents in order to prepare for classes, exams and will serve as documentation practices to perform correctly. In the lab, introduced the software to use and pose a number of small practices that students must develop and eventually deliver. Much time will be devoted to laboratory students solve practices raised with the help of the teacher.

Laboratory exercises (deliverables) allow the use of code that students have developed independently. Sharing this code between students is considered copying.

## LEARNING OBJECTIVES OF THE SUBJECT

---

1. Learn to program interfaces in a high-level programming language and using a specific API. Design and implement interactive applications using APIs to interface design.

2. Learn the basics of Computer Graphics. Implementing simple applications that display data in OpenGL 3D.

3. Knowing the architecture of current GPUs.

4. Be able to design applications with different user interfaces for common as cell phones or tablets.

5. Getting a proactive attitude to quality and continuous improvement.

6. To be able to adapt to technological or organizational changes.

7. Ability to adapt in situations of time constraints and / or resources and / or lack of information.

9. Understand the concept of usability and knowledge to assess whether an interface of an application or a Web page is usable. Be able to assess the usability of a particular interface.



## STUDY LOAD

Type	Hours	Percentage
Hours small group	30,0	20.00
Hours large group	30,0	20.00
Guided activities	6,0	4.00
Self study	84,0	56.00

Total learning time: 150 h

## CONTENTS

### Introduction to interactive systems

**Description:**

Basics of interactive systems. Introduction to Human Computer Interaction.

### Ubiquitous computing and augmented reality

**Description:**

Definitions. Systems Virtual Reality and Augmented Reality.

### Design user interfaces

**Description:**

Introduction to Usability. Basic principles of designing user interfaces. Design Rules.

### Colour models

**Description:**

Representations of color. Translation between models.

### Programming Interface

**Description:**

Introduction to Qt. Advanced Programming with Qt interface.

### Processing and visualization of 2D and 3D geometry

**Description:**

Introduction to Computer Graphics. Visualization using OpenGL.



#### Developing user-centered

**Description:**

User-centered design. Evaluation of interface design. Evaluation of web pages. Usability studies.

#### Architecture and programming of graphics cards

**Description:**

Introduction to GLSL. Vertex shaders and fragment shaders.

## ACTIVITIES

#### Geometry Processing.

**Description:**

Studying the different forms of modeling scenes and objects. Learn the elements of the processing of 2D and 3D geometry: triangle meshes. Review data structures. Analysis of different data structures for geometry. Studying the elements of an interactive graphic system. Deploying simple OpenGL and 3D.

**Specific objectives:**

2

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

Theory classes: 2h

Self study: 6h

#### 3D visualization of data.

**Description:**

Studying the basics of 3D visualization. Learn the camera model. Doing exercises camera model and geometric transformations. To study the programmable visualization pipeline.

**Specific objectives:**

2, 3

**Full-or-part-time:** 20h

Theory classes: 10h

Self study: 10h

#### Programming graphical applications.

**Description:**

Program data structures that store meshes triangles. Program basically GPU by using GLSL. Understand and use lighting calculations OpenGL. Aprendre manage interaction Qt.

**Specific objectives:**

2, 3

**Full-or-part-time:** 33h

Laboratory classes: 18h

Self study: 15h

### Introduction to interactive systems.

**Description:**

Studying the Human-Computer Interaction notes. Usability study notes. Learn to design graphical interfaces. Learn to perform assessments of usability of applications and websites.

**Specific objectives:**

9

**Related competencies :**

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

**Full-or-part-time:** 7h

Theory classes: 2h

Self study: 5h

### Extension or exercises on an interface design theme.

**Description:**

Solve exercises or study an interface design theme autonomously.

**Specific objectives:**

1, 4, 5, 6, 7, 9

**Related competencies :**

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

**Full-or-part-time:** 10h

Self study: 10h

### Test Teo1: Control on graphics interaction and interface design.

**Description:**

Written exercise that assesses knowledge of graphics interaction and interface design.

**Specific objectives:**

2, 3, 5, 9

**Related competencies :**

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

**Full-or-part-time:** 12h

Guided activities: 2h

Self study: 10h



### Test Lab: Laboratory Practice Deployment graphics applications using OpenGL and designing the interface using Qt.

**Description:**

The lab test is deploying an application that uses OpenGL and Qt.

**Specific objectives:**

1, 2, 3

### Introduction to graphical interfaces.

**Description:**

Learn to design and implement graphical interfaces. Perform practical Qt.

**Specific objectives:**

1

**Full-or-part-time:** 12h

Laboratory classes: 6h

Self study: 6h

### Design user interfaces.

**Description:**

Study Model View Controller. Study notes on usability of applications and websites. Learn to design applications on mobile devices. Evaluating interfaces of mobile devices.

**Specific objectives:**

4, 9

**Related competencies :**

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

**Full-or-part-time:** 18h

Theory classes: 10h

Self study: 8h

### Introduction to AR, VR and UC

**Description:**

Studying the basics of 3D interaction, computer graphics, virtual reality and augmented reality and make the corresponding exercises. Studying the notes of the course.

**Specific objectives:**

2

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

Theory classes: 2h

### Advanced Programming Interface using OpenGL and Qt.

#### Description:

Learn advanced programming interfaces. Using Qt signals and slots. Integrating complex widgets advanced interfaces.

#### Specific objectives:

1, 2

#### Full-or-part-time: 14h

Laboratory classes: 6h

Self study: 8h

### Prova Teo2: Final Exam.

#### Description:

Review that will assess the knowledge acquired during the course. It will be a traditional written exam.

#### Specific objectives:

1, 2, 3, 4, 5, 6, 7, 9

#### Related competencies :

G8. APPROPRIATE ATTITUDE TOWARDS WORK: to have motivation to be professional and to face new challenges, have a width vision of the possibilities of the career in the field of informatics engineering. To feel motivated for the quality and the continuous improvement, and behave rigorously in the professional development. Capacity to adapt oneself to organizational or technological changes. Capacity to work in situations with information shortage and/or time and/or resources restrictions.

#### Full-or-part-time: 14h

Guided activities: 2h

Self study: 12h

## GRADING SYSTEM

The mark will consist of 3 parts:

- One lab note: ProvaLab in which students are asked to solve small problems. It will do more emphasis on graphic design but also including interaction and programming interfaces. The exam must be solved in lab and the student will start from an initial code given in the exam.

During the course, a set of laboratory exercises (n) will be specified that the student will have to complete and deliver. If all of these exercises are given, the student will opt for 1 extra point in the laboratory's note provided that in the test of a laboratory (ProvaLab) a score equal to or greater than 4.5 is achieved. If all of these exercises are not delivered and only x of these n are delivered, the formula to decide the portion of the point that can be reached is  $(x / n) ^ 2.2$ . For example, if n = 4, the values that would be obtained depending on the number x of deliveries is: 0 - 0; 1 - 0.05; 2 - 0.22; 3 - 0.53; 4 - 1.

- Two theory tests: Prova Teo1 and Prova Teo2. Do not use notes or calculators or calculators or mobile devices.

To calculate the final grade, using the following formula, where all the notes are on 10:

25% ProvaLab + 25% Prova Teo1 + 50% Prova Teo2

Rating generic competition: You will have values A, B, C or D (where A corresponds to an excellent standard, B corresponds to a desired level, C corresponds to a sufficient level and D corresponds to a level not exceeded). A good evaluation of this competition the students will have:

- Proactive attitude to quality and continuous improvement.
- Motivation. Students must work in terms of lack of information.
- Ability to adapt in situations of lack of information.

## BIBLIOGRAPHY

---

### Basic:

- Nielsen, J.; Loranger, H. Prioritizing web usability. Berkeley, CA: New Riders, 2006. ISBN 9780321350312.
- Nielsen, J.; Loranger, H. Prioritizing web usability. Berkeley, California, USA: New Riders, 2006. ISBN 9780321350312.
- Andújar, C.; Brunet, P.; Fairen, M.; Monclús, E.; Navazo, I.; Vázquez, P.P.; Vinacua, A. Informàtica gràfica: un enfocament multimèdia. CPET, 2008.
- Angel, E.; Shreiner, D. Interactive computer graphics : a top-down approach with WebGL. 7th ed., global ed. Harlow: Pearson, 2015. ISBN 9781292019345.
- Watt, A.H. 3D computer graphics. 3rd ed. Addison-Wesley, 2000. ISBN 0201398559.
- Shneiderman, B. [i 5 més]. Designing the user interface: strategies for effective human-computer interaction. 6th ed., global ed. Pearson Education Limited, 2017. ISBN 9781292153926.
- Shneiderman, B. [et al]. Designing the user interface: strategies for effective human-computer interaction. 6th ed., global ed. Pearson Education Limited, 2017. ISBN 9780124079144.
- Professorat assignatura. Transparències docents.

### Complementary:

- Lidwell, W.; Holden, K.; Butler, J. Universal principles of design: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rev. and updated. Beverly, Massachusetts: Rockport Publishers, 2010. ISBN 9781592535873.
- Lidwell, W.; Holden, K.; Butler, J. Universal principles of design: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rev. and updated. Rockport Publishers, 2010. ISBN 9781592535873.
- Stone, D.; Jarrett, C.; Woodroffe, M.; Minocha, S. User interface design and evaluation. Elsevier/Morgan Kaufmann, 2005. ISBN 0120884364.
- Stone, D.; Jarrett, C.; Woodroffe, M.; Minocha, S. User interface design and evaluation. Boston: Elsevier/Morgan Kaufmann, 2005. ISBN 0120884364.
- Rost, R.J.; Licea-Kane, B. OpenGL shading language. 3rd ed. Upper Saddle River, NJ: Addison-Wesley, 2010. ISBN 9780321637635.
- Rost, R.J.; Licea-Kane, B. OpenGL shading language. 3rd ed. Addison-Wesley, 2010. ISBN 9780321637635.

## RESOURCES

---

### Hyperlink:

- <http://www.nngroup.com/>- <https://developer.apple.com/devcenter/ios/index.action>- <http://www.smashingmagazine.com/>- <http://www.qt.io>- <http://www.opengl.org>