Course guide
240330 - 240NR029 - Virtual Reality and Serious Games

Last modified: 19/06/2026

Unit in charge: Barcelona School of Industrial Engineering
Teaching unit: 749 - MAT - Department of Mathematics.

Degree: MASTER'S DEGREE IN NEUROENGINEERING AND REHABILITATION (Syllabus 2020). (Compulsory subject).
MASTER'S DEGREE IN INDUSTRIAL ENGINEERING (Syllabus 2025). (Optional subject).

Academic year: 2026 **ECTS Credits:** 4.5 **Languages:** English

LECTURER

Coordinating lecturer: Susín, Antoni

Others: Monclús Lahoya, Eva

PRIOR SKILLS

Knowledge of programmaing in C# o C++

TEACHING METHODOLOGY

The course will have a very practical approach: it will alternate theory sessions in which concepts will be explained and exercises will be carried out with laboratory sessions in which students will use 2D and 3D graphic modeling and visualization software, game engines and libraries. of creating interactive applications. Throughout the course, in groups of two people, they will carry out a project to create a gamified application or a serious game for neurorehabilitation.

LEARNING OBJECTIVES OF THE SUBJECT

The aim of the course is to introduce students to graphic applications, virtual reality, augmented and mixed reality, serious games and gamification in neurorehabilitation. The goal of the course is that students know the use, structure, design and validation process of these applications for the collection of data through questionnaires, for the diagnosis or early detection of pathologies and for the rehabilitation of patients with functional or cognitive impairment. Students will learn the basics of graphic applications: geometric modeling, visualization and animation both 2D and 3D and will learn how to use them. They will also learn the basics of programming interactive applications and games. They will specify, design, program and plan the validation of a serious game or gamification.

STUDY LOAD

Type	Hours	Percentage
Hours large group	20,3	18.03
Hours small group	20,3	18.03
Self study	72,0	63.94

Total learning time: 112.6 h

CONTENTS

title english

Description:
- 2D and 3D graphics: definitions and technology
- From tangible reality to virtual reality, the continuum of mixed reality
- Games and gamifications: definitions and applications in the field of neurorehabilitation

Related activities:
- Theory lesson
- Practice 1: Report on the state-of-the-art on gamified applications or serious game for a specific area of â□□â□□neurorehabilitation

Full-or-part-time: 14h
Theory classes: 4h
Practical classes: 2h
Self study : 8h

2D Graphics

Description:
Introduction to 2D graphics.
Basic concepts: raster versus vector model; coordinate systems; geometry and topology; color models
Window-viewport transformation
Layer concept
Animation. Key-frame, inbetweening- Kinematic and dynamic models. Behavioral models.
Graphic interaction
Games: state machine, scene graph, scoring, messaging

Specific objectives:
- To understand the basics of 2D graphics
- To know how to use a graphic library or a 2D framework for object animation and game creation (for example pygame, Unity, Blender)
- To know how to use a graphics library or a 2D framework for creating interactive applications (for example kivy, Unity or android studio)

Related activities:
- Practice of using a vector graphics application (inkscape), raster (gimp)
- Practice programming with pygame and/or Kivy
- Demo of use of Unity and/or Android Studio

Full-or-part-time: 19h
Theory classes: 4h
Practical classes: 4h
Self study : 11h

3D Graphics

Description:
Concept of 3D graphic model. Geometric models
Camera, lighting. Visualization process
Realistic lighting.
Animation of rigid solid and deformation of surfaces
3D interaction
3D game

Specific objectives:
- To know the principles of geometric modeling and know how to create simple objects with Blender
- To understand the stages of the visualization process
- To understand and know how to model materials and define the lighting of an environment
- To be able to create an animation objects with Blender
- Be able to program a simple game dynamic objects with Blender or Unity 3D

Related activities:
- Practice using Blender
- Demonstration of the use of Unity and/or Android Studio

Full-or-part-time: 21h
Theory classes: 4h
Practical classes: 6h
Self study : 11h

Project of gamification or serious game

Description:
This topic will consist of the development of a gamification project or a serious game for a proposed application in the field of neurorehabilitation.
Students in groups of 3 people will have to analyze the problem, if necessary with interviews with clinical professionals and / or patients, analyze the state of the art and evaluate existing similar applications, specify the model of requirements, implement and define the validation plan.

Specific objectives:
Deepen and expand the theoretical and practical knowledge acquired by applying it to a specific use case

Related activities:
- Study of the state of the art
- Problem analysis: specification of the requirements model
- Implementation
- Validation
- Writing a report
- Oral presentation

Full-or-part-time: 21h
Practical classes: 3h
Self study : 18h

GRADING SYSTEM

Throughout the course there will be 2 evaluable lab works (Pi i = 1 ... 2) and a two theory works. The course is designed to be highly practical, with assessment based on coursework rather than a final exam.
The grade of the subject will be calculated as: 0.1 P1 + 0.5 P2 + 0.2 NT1 + 0.2 NT2

EXAMINATION RULES.

The lab work and the theory work will be done in groups of two persons.