



# Course guide

## 804246 - MVJ - Game Engines

**Last modified:** 22/09/2024

**Unit in charge:** Image Processing and Multimedia Technology Centre  
**Teaching unit:** 804 - CITM - Image Processing and Multimedia Technology Centre.

**Degree:** BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Compulsory subject).

**Academic year:** 2024    **ECTS Credits:** 6.0    **Languages:** Catalan, English

### LECTURER

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**Coordinating lecturer:** Pep Cots

**Others:** Pep Cots  
Manuel Montoto

### PRIOR SKILLS

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Coding in C++. Previous knowledge and experience coding 2D games.

### TEACHING METHODOLOGY

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During the classes, the teacher will set out the objectives on a theoretical level and the problem to which we are looking for a solution. Together with the students, the teacher will analyse existing solutions that solve the challenges of real-time applications such as video games.

The teacher will provide source code that the students will be able to analyse and must complement and integrate into their own code for future use. After each session, the teacher will pose possible improvements and challenges to the students to help them and to guide them in their autonomous learning hours.

### LEARNING OBJECTIVES OF THE SUBJECT

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- Be able to identify and evaluate the technical characteristics of game engines as a technology for the creation of video games.
- Show understanding and be able to explain the operation of a game engine.
- Be able to perform extensions and modifications on game engines.
- Show mastery and be able to use game engines for the creation of video games.
- Show ability to analyze the technical characteristics of graphics libraries for the creation of synthetic images.
- Show knowledge and be able to explain the basic principles of the creation of synthetic images.
- Show knowledge and be able to use graphic libraries for the creation of 2D and 3D graphics.



## STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours medium group	30,0	20.00
Guided activities	12,0	8.00
Hours large group	18,0	12.00

**Total learning time:** 150 h

## CONTENTS

### OpenGL basics

**Description:**

Initialization  
Rendering in Core Profile mode  
Vertex Buffers

**Full-or-part-time:** 15h

Theory classes: 6h  
Self study : 9h

### Loading 3D models

**Description:**

Loading of model information: geometry and materials  
Rendering of single models

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

Theory classes: 4h  
Self study : 6h

### Camera and scene loading

**Description:**

Free roaming camera, FPS style and single model  
Loading scene information  
Execution in threads

**Full-or-part-time:** 15h

Theory classes: 6h  
Self study : 9h



### Basic rendering optimizations

**Description:**

Frustum culling  
Level of details  
Octree

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

Theory classes: 4h  
Self study : 6h

### Animation systems

**Description:**

Implementing a Transformation Tree  
Structure of an animation system  
Loading of animations  
Playing and blending of animations

**Full-or-part-time:** 25h

Theory classes: 10h  
Self study : 15h

### Component structure and player control

**Description:**

Component system for entities  
Messaging and event system  
Physics and player control

**Full-or-part-time:** 35h

Theory classes: 17h  
Self study : 18h

### 3D Audio

**Description:**

Loading and playing music  
Playing 3D effects

**Full-or-part-time:** 15h

Theory classes: 9h  
Self study : 6h

### Graphics effects

**Description:**

Particle systems  
Postprocess effects  
Illumination models

**Full-or-part-time:** 25h

Theory classes: 13h  
Self study : 12h



## ACTIVITIES

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### First assignment

**Description:**

First assignment about scene loading (GameObjects and components) with a weight of 20%.

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

Theory classes: 6h

Self study: 6h

### Second assignment

**Description:**

Second assignment about space optimizations, time management, mouse picking and optimized formats with a weight of 20%.

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

Self study: 6h

Theory classes: 6h

### Third assignment

**Description:**

Third assignment about a single high level system to choose from: animation, particles, audio, scripting, physics, shaders or UI with a weight of 20%.

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

Theory classes: 6h

Self study: 6h

## GRADING SYSTEM

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Final exam with a weight of 30% with all subject knowledge will be put to test.

First assignment about scene loading (GameObjects and components) with a weight of 20%.

Second assignment about space optimizations, time management, mouse picking and optimized formats with a weight of 20%.

Third assignment about a single high level system to choose from: animation, particles, audio, scripting, physics, shaders or UI with a weight of 20%.

The final exam can be reevaluated for its weight of 30%. In case of passing the course, the maximum final mark will be a 5.

Attitude and class participation will weight 10%

Irregular actions that may lead to a significant variation of the grade of one or more students constitute a fraudulent performance of an evaluation act. This action entails the descriptive grade of failure and a numerical grade of 0 for the ordinary global evaluation of the course, without the right to re-evaluation.

If the lecturers have indications of the use of AI tools not allowed in the evaluation tests, they may summon the students concerned to an oral test or a meeting to verify the authorship.



## BIBLIOGRAPHY

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### Basic:

- Gregory, Jason. Game engine architecture. 2nd ed. Boca Raton: CRC Press, Taylor and Francis Group, cop. 2014. ISBN 9781466560017.
- Nystrom, Robert. Game programming patterns. [United States?]: Genever Benning, 2014. ISBN 9780990582908.