

804260 - PGA - Advanced Graphics Programming

Coordinating unit:	804 - CITM - Image Processing and Multimedia Technology Centre		
Teaching unit:	804 - CITM - Image Processing and Multimedia Technology Centre		
Academic year:	2019		
Degree:	BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Optional) BACHELOR'S DEGREE IN VIDEO GAME DESIGN AND DEVELOPMENT (Syllabus 2014). (Teaching unit Optional)		
ECTS credits:	6	Teaching languages:	English

Teaching staff

Coordinator: Díaz García, Jesús

Degree competences to which the subject contributes

Specific:

CEVJ 5. (ENG) Utilizar lenguajes de programación, patrones algorítmicos, estructuras de datos, herramientas visuales de programación, motores de juego y librerías para el desarrollo y prototipado de videojuegos, de cualquier género y para cualquier plataforma y dispositivo móvil.

CEVJ 6. (ENG) Analitzar, decidir i aplicar tècniques de programació gràfica, física, intel·ligència artificial, interacció, realitat augmentada i xarxes a un projecte de videojoc.

Transversal:

04 COE N1. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 1. Planning oral communication, answering questions properly and writing straightforward texts that are spelt correctly and are grammatically coherent.

CT4. EFFECTIVE USE OF INFORMATION RESOURCES: Managing the acquisition, structuring, analysis and display of data and information in the chosen area of specialisation and critically assessing the results obtained.

07 AAT N1. SELF-DIRECTED LEARNING - Level 1. Completing set tasks within established deadlines. Working with recommended information sources according to the guidelines set by lecturers.

Teaching methodology

Lectures are divided in 2h sessions. During lectures, the teacher presents the theoretical concepts and explains them by means of examples that are solved in class. Some time is also dedicated to the resolution of the proposed exercises/projects of the subject with the assistance of the teacher (solve the doubts that may appear).

Learning objectives of the subject

- Acquire the knowledge on the state of the art and the possibilities that offer computer graphics in the field of design and development of video games.
- Complete the knowledge on computer graphics and GPU programming acquired in previous subjects (mainly Game Engines and Augmented Reality) to implement advanced computer graphics techniques.
- Take advantage of the computational power of current GPUs to develop advanced computer graphics algorithms in real time.



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Study load

Total learning time: 150h	Hours large group:	18h	12.00%
	Hours medium group:	30h	20.00%
	Hours small group:	0h	0.00%
	Guided activities:	12h	8.00%
	Self study:	90h	60.00%

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Content

<p>Design of Graphical User Interfaces</p>	<p>Learning time: 8h Practical classes: 4h Guided activities: 4h</p>
<p>Description: <ol style="list-style-type: none"> 1. Main aspects to consider when designing GUIs 2. Introduction of the software to use (Qt) </p> <p>Related activities: Project 1: design of graphical user interfaces using Qt</p>	
<p>Rendering of 3D scenes</p>	<p>Learning time: 8h Practical classes: 4h Guided activities: 4h</p>
<p>Description: <ol style="list-style-type: none"> 1. Rendering of geometric primitives 2. Scene interaction 3. Data loading 4. Colors, materials and illumination </p>	
<p>GPU programming</p>	<p>Learning time: 8h Practical classes: 4h Guided activities: 4h</p>
<p>Description: <ol style="list-style-type: none"> 1. Shaders programming 2. GLSL </p>	

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Advanced computer graphics techniques	Learning time: 36h Practical classes: 18h Guided activities: 18h
<p>Description:</p> <ol style="list-style-type: none"> 1. Advanced features of OpenGL 2. Materials and advanced illumination 3. Ray tracing 4. Cell shading 5. Other techniques <p>Related activities:</p> <p>Project 2: ray tracer implementation Final project: graphics engine implementation</p>	

Qualification system

Two practical exercises (PE) related to specific contents of the subject will be developed and evaluated during the course. As well, a final project (FP), where the student has to implement a graphics engine with some of the techniques presented at class, will be evaluated. Participation and learning attitude (PART) is also considered. This part will be evaluated according to the participation of the student at class (solving exercises, proposing solutions/alternatives), the interest shown in learning the different techniques. As a project subject, there is no reevaluation exam.

$$\text{Final mark} = 0.25 * \text{PE1} + 0.25 * \text{PE2} + 0.4 * \text{FP} + 0.1 * \text{PART}$$

Regulations for carrying out activities

Part of the activities will be developed at class with the assistance of the lecturer. Students should also work autonomously to finish the activities and projects proposed during the course.

Projects can be done in groups of 2 people and will be submitted via the Campus Virtual following the guidelines provided by the instructions document of each one (name of the files, etc.). Projects submitted after midnight of the specified date will be considered as NP. Any issues that do not allow the student to submit a project in time should have a reasonable cause and must be communicated with enough anticipation to the lecturer. The evaluation of the projects does not consist just on submitting the code, but also on oral presentations when required.

Projects have to be executed at CITM, so be sure that you work with the same version of the software as the one provided at the center and that your projects can be executed there without errors.

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Bibliography

Basic:

Kessenich, J.M.; Sellers, G.; Shreiner, D. OpenGL programming guide: the official guide to learning OpenGL, version 4.5 with SPIR-V. 9th ed. Upper Saddle River, NJ: Addison-Wesley, cop. 2017. ISBN 9780134495491.

Rost, Randi J; Licea-Kane, Bill; Ginsburg, Dan. OpenGL shading language. 3rd ed. Upper Saddle River, NJ: Addison Wesley, 2010. ISBN 9780321637635.

Möller, Tomas; Haines, Eric; Hoffman, Naty. Real-time rendering. 3rd ed. Wellesley: A K Peters, cop. 2008. ISBN 9781568814247.

Complementary:

Nguyen, Hubert. GPU gems 3. Upper Saddle River, NJ: Addison-Wesley, 2007. ISBN 9780321515261.

Others resources:

OpenGL: <https://www.opengl.org/>

ShaderToy: <https://www.shadertoy.com/>