ACADEMIC PROGRAM

SHADING AND LIGHTING FOR VIDEO GAMES AND IMMERSIVE SYSTEMS II

B.F.A. IN **ANIMATION**

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2023-2024

Name of the course:	Shading and Lighting for Video Games and Immersive Systems II
Degree :	Animation
Location:	Centro Universitario de Tecnología y Arte Digital
Area:	Art for Video Games and Immersive Systems
Year:	4º
Teaching period:	1
Type:	OBM
ECTS credits:	6
Teaching modality:	On campus
Language:	English
Lecturer / Email	Mercedes García Betegón/mercedes.garcia@u-tad.com
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SUBJECT DESCRIPTION

Area description

The subject includes all the courses that are part of the Mention in Art for Games and Immersive Systems. The subject allows for a deeper understanding in creation of digital content for games and immersive systems. Students in the mention will acquire theoretical, technical, and methodological knowledge with the aim of generating graphic elements such as 2D and 3D items, textures or icons for realtime rendering game engines and another interactive and immersive systems.

Subject description

In the course of Shading and Lighting for Video Games and Immersive Systems II will deepen the knowledge for the application of shaders, textures and lighting systems compatible with game engines for animations, particles, and video game cinematics.

COMPETENCIES AND LEARNING OUTCOMES

Competencies

BASIC AND GENERAL

CG2 - Know the vocabulary and concepts inherent to the digital artistic field.

CG4 - Apply the aesthetic and perception fundamentals of the image in terms of structure, form, color and space in the representation of digital content.

CG8 - Optimize the work according to the technological resources related to the processes and tools of the project to be developed.

CB1 - That students have demonstrated to possess and understand knowledge in an area of study that starts from the basis of general secondary education, and is usually found at a level that, although supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study.

CB2 - That students know how to apply their knowledge to their work or vocation in a professional manner and possess the skills that are usually demonstrated through the development and defense of arguments and problem solving within their field of study.

CB3 - That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant social, scientific or ethical issues.

CB4 - Students should be able to convey information, ideas, problems and solutions to both specialized and non-specialized audiences.

CB5 - That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

TRANSVERSALS

CT3 - Knowing the hardware and software fundamentals of computers and communication networks, as well as the principles of

storage and cloud computing along with their usefulness and application to the development projects of the digital economy.

CT4 - Update the knowledge acquired in the management of digital tools and technologies according to the current state of the sector and the technologies used.

CT5 - Demonstrate versatility, flexibility and creativity in the development of projects, activities and works.

CT6 - Develop collaborative projects in a climate of teamwork based on respect, cooperation and responsibility.

SPECIFIC

CE16 - Know the concepts and apply the tools and techniques that allow the introduction of visual effects in an audiovisual project.

SC17 - Use texturing techniques to apply materials to 3D models.

SC2 - Know and apply the fundamentals of photography, its elements of visual composition and the expressive value of lighting.

SC4 - Represent three-dimensional forms and spaces using the essential techniques of traditional and digital modeling.

SC9 - Use the techniques of modeling for the three-dimensional representation of forms from a design.

CE11 - Use the theory, techniques and tools associated with lighting, rendering and composition.

SPECIFIC TO THE MENTION

Students who choose this subject will acquire the following specific competences of the mention (CEAV):

- CEAV1: Build Rigs for video games from a given model according to the constraints of real-time interaction with the character.

- CEAV2: Build and adapt the models and assets generated in 3D for their import and use in a video game engine.

- CEAV3: Know the methodologies and the main dynamic simulation tools for the creation of real-time visual effects.

Learning outcomes

At the end of the degree, the graduate will be able to:

- Apply the fundamentals of visual language to the digital environment.

- Apply the visual language to the different animation techniques to transmit ideas.

- Recognize the software and hardware requirements that meet the needs of a project and its cloud storage requirements.

- Know the syntax and basic use of programming languages for rigging and particle simulation.

- Represent objects and spaces in 3D through modeling, texturing, lighting and digital rendering.

- Apply basic digital modeling techniques to the creation of 3D objects, figures and environments in video game projects.

- Create clean and optimized modeling meshes in the creation of objects, figures and 3D environments.

- Manage the interaction between different materials and lighting systems in 3D and 2D creation environments.

- Create environments with a high degree of verisimilitude through the use of layers, alphas and other basic digital compositing techniques.

- Identify the software and hardware requirements necessary for lighting, rendering and compositing.

- Simulate the dynamic elements and situations involved in atmospheric phenomena, such as clouds, fog, rain, smoke, fire, or in the breakage and destruction of rigid solid bodies by collisions or explosions.

- Optimize the programming code used in a video game by means of the necessary debugging tools.

- Apply the required textures and shaders convincingly and according to the needs of the production in the various parts of a 3D animation scene such as sets, objects or characters.

- Identify the interaction needs between 3D models and users in the construction of rigs for video games.

- Generate the interactive controls of a 3D model for the creation of video games.

- Create the skinning or appearance of the interactive 3D character according to the needs of the system or hardware in a video game production.

- Calculate the optimal degree of polygonization of models and assets according to the technical limitations of the system or hardware in video game projects.

- Produce different versions of models and assets according to the game engine or final hardware.

- Determine the different components and fields involved in the collisions and interactions of particles rendered in real time in the creation of visual effects.

- Know the hardware limitations that can affect the generation of real-time rendered effects.

CONTENTS

· Visual programming of shaders

· Map baking techniques

· Advanced baking techniques

· Advanced texturing tools

· Lightmaps and precalculated illumination

· Iluminación en tiempo real

SUBJECT SYLLABUS

Module 1: Process optimization

Lightmass importance volume

Texture coding

Unification of other faces and channels in a solatexture

Material functions

-Module 2: Animation

Character animation

Kinematics

-Module 3: Advanced concepts

Particles

Post-processing

HDRI

Modifications in runtime using blueprints

Unreal Engine 5 and Lumen

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence
Theoretical / Expository classes	22,50	22,50
Practical classes	33,50	33,50
Tutorials	3,75	1,88
Independent study and autonomous work of the student	36,25	0,00
Elaboration of work (group or individual)	50,00	0,00
Evaluation Activities	4,00	4,00
TOTAL	150	61,88

Teaching methodologies

Expository method or master class

Case method

Problem-based learning

Cooperative or collaborative learning

Inquiry-based learning

Flipped classroom or inverted classroom methodology

Gamification

TEMPORAL DEVELOPMENT

Theme 1-4 weeks

Theme 2- 5 weeks

Theme 3- 5 weeks

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE	MAXIMUM SCORE RESPECT

	FINAL ASSESSMENT (%)	TO THE FINAL ASSESSMENT (%)
Assessment of participation in class, exercises or projects of the course	10	20
Assessment of assignments, projects, reports, memos	30	60
Objective test	30	60

GRADING CRITERIA

ASSESSMENT SYSTEM	ORDINARY EVALUATION	EXTRAORDINARY EVALUATION
Assessment of participation in class, exercises or projects of the course	10	10
Assessment of assignments, projects, reports, memos	40	40
Objective test	50	50

General comments on the evaluations/assessments

In order to pass the course, it will be necessary to obtain a mark higher or equal to 5 in the final average evaluation.

The evaluation considerations are detailed below:

- Throughout the course, 2 exercises will be carried out, which make up a total of 40% of the course. Each exercise will include an extra section, where the student will have the opportunity to obtain extra points, which will be weighted with the rest of the exercises, but not with the objective test.

- The objective test consists of developing a project in UE5 together with a development report.

- A 10% of the mark will be awarded on the basis of participation in class, with the teacher's discretion as to how this participation is to be assessed.

- In order to pass the course in the ordinary call, it will be necessary to obtain a grade higher or equal to 5 between exams, exercises and participation.

- In the extraordinary call, a practical exam will be held which will account for 100% of the grade. It will not be taken into account and it will not be possible to hand in the exercises in the extraordinary exam.

- Plagiarism or copying of another student, partially or totally, will result in an automatic failure of the course for all the parts involved. In addition, the university may open disciplinary proceedings against both students, which may even lead to their expulsion.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

Main references :

Official Unreal Engine documentation on texturing, material editor and lighting: https://docs.unrealengine.com/

Recommended references:

Official Unreal Engine documentation on visual design, rendering and graphics: https://docs.unrealengine.com/

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom
Theory

Materials:
Display - Digital whiteboard, Laptop

Software:
Unreal engine, Photoshop