ACADEMIC PROGRAM

PROGRAMMING FOR CG SCENES

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

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2023-2024

Name of the course:	Programming for CG scenes
Degree :	Animation
Location:	Centro Universitario de Tecnología y Arte Digital
Area:	Advanced 3D Techniques for Animation
Year:	3º
Teaching period:	2
Type:	OBM
ECTS credits:	6
Teaching modality:	On campus
Language:	English
Lecturer / Email	Miguel Angel Arribas Sanchez/miguel.arribas@u-tad.com
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SUBJECT DESCRIPTION

Area description

This subject is mandatory for the students that choose the Mention in Backend Animation Pipeline techniques.

This subject will allow the students who choose it to deepen the knowledge acquired in 3D techniques in the common part of the bachelor's degree applied to the final processes of 3D animation content production, known as Backend Pipeline. These processes, which without losing their technical component incorporate a high technical content, include lighting, compositing, 3D effects simulation, character effects (cloth, hair, fur) and the preparation of the character for animation through the Rigging process.

Subject description

The integrations between real or fictional elements that effects bring to the animation production process is one of the most complex and technical techniques within animation creation.

By programming scripts in MEL and Python, it is possible to generate new and customized effects, far beyond the standard ones offered by the programs themselves.

COMPETENCIES AND LEARNING OUTCOMES

Competencies

BASIC AND GENERAL

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 - Know 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.

CE7 - Create audiovisual pieces applying the principles of composition, audiovisual narrative and graphics animation to the realization, planning, editing and post-production of sequences and shots.

CE10 - Create images with a high level of finish using the most appropriate tools for the project of which it is part.

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 (CE3D):

- CE3D1: Build 3D Rigs from a given model.

- CE3D2: Know the internal structure of 3D scenes and be able to generate interfaces and automation of effects in 3D software through code.

- CE3D3: Know the methodologies and the main dynamic simulation tools for the creation of 3D visual effects.

Learning outcomes

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

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

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

- 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 software and hardware requirements for lighting, rendering and compositing.

- Integrate with visual consistency the various elements involved in a 2D or 3D layered composition in the post-production phase of the project.

- To integrate convincingly synthetic images, created with digital tools, and real images, recorded photographically.

- Determine the emitting elements, collisions and fields of particle systems in the creation of visual effects.

- 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 an animation scene using the necessary debugging tools.

- Program elements in a 2D or 3D scene for the simulation of visual effects or the technical optimization of scenes.

- Manage texture libraries for reuse in an animation scene.

- Combine the qualities of various materials such as reflection, refraction and specularity for the creation of shading.

- 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.

- Determine the chain of relationships in the construction of body, facial and node controls that are part of a 3D skeleton or rig.

- Establish the skinning of the different parts of a 3D model.

- Use different techniques of bone construction in 3D models according to the needs of character and object animation.

- Generate the character pickers or synoptics necessary for other members of a 3D production to manipulate 3D elements.

- Modify and debug the programming codes of a 3D animation scene.

- Automate the generation of digital effects in a 3D animation scene.

- Determine the different fields involved in collisions and particle interactions in the post-production phase of an audiovisual project.

- Control the dynamics and parameters involved in the simulation of fluids in a 3D animation scene.

- Establish the necessary elements in the creation of breaks and fractures in rigid models in a 3D simulation.

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

CONTENTS

· Internal technical structure of CG scenes.

· Programming for CG Softwares. APIs.

· Pipeline and programming within the Studio framework.

· Interface programming fundamentals.

· Programming for 3D Effects.

· Automation of effects by coding.

· Tools with interface for creating effects.

· Code debugging and optimization.

SUBJECT SYLLABUS

1. Basic programming concepts of Python

2. Maya API basics

3. Maya scripting examples

4. User interface programming

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence
Theoretical / Expository classes	22,00	22,00
Practical classes	33,75	33,75
Tutorials	4,25	2,13
Independent study and autonomous work of the student	35,00	0,00
Elaboration of work (group or individual)	50,75	0,00
Evaluation Activities	4,25	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 1-2 weeks

Theme 2- 3 weeks

Topic 3- 3 weeks

Theme 4-3 weeks

Theme 5-3 weeks

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)	MAXIMUM SCORE RESPECT 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	60	60
Objective test	30	30

General comments on the evaluations/assessments

Students must achieve 80% of the learning objectives to pass the course satisfactorily.

-Final numerical grade will be from 0 to 10, being a 5 the minimum grade to pass.

-Monitoring of the work in the classroom. The delivery of 80% of the weekly or biweekly practices or exercises is required to pass the course.

-Global evaluation of the learning process and acquisition of skills and knowledge.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

KAUFMANN, Morgan: Maya Python for Games and Film: A Complete Reference for Maya Python and the MayaPython API. Common.

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom
Theory

Materials:
Display - Digital whiteboard, Laptop

Software:
Autodesk Maya