

**COURSE DATA****DATA SUBJECT**

Code: 36477
Name: Procedural techniques in animation
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1407 - Degree in Multimedia Engineering	Escola Tècnica Superior d'Enginyeria	4	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1407 - Degree in Multimedia Engineering	Optatividad	ELECTIVES

COORDINATION

LOZANO IBAÑEZ MIGUEL

SUMMARY

Procedural Techniques in Animation is a subject of the *Optativity* track that is taught in the first semester of the fourth year of the degree in Multimedia Engineering. It focuses on the practical development of the fundamentals of the production of computer animations and digital visual effects

PREVIOUS KNOWLEDGE**RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE**

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

It is recommended to have passed the following courses: Physics, Mathematics, Programming, Fundamentals of Computer Graphics, Computer Graphics, Animation and Simulation.

COMPETENCES / LEARNING OUTCOMES



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G1 - Be able to relate and structure information from different sources and to integrate ideas and knowledge. (RD1393/2007)

G2 - Have the learning skills needed to undertake further studies or to gain further training with a certain degree of autonomy. (RD1393/2007)

I10 - e able to design and evaluate human-computer interfaces that ensure accessibility and usability of computer systems, services and applications.

MM11 - Have knowledge and ability to apply the different mechanisms and elements to create both linear and non-linear audiovisual stories according to different production formats, technologies and media.

MM21 - Communicate effectively, both in writing and verbally, knowledge, procedures, results and ideas related to ICT and specifically to multimedia, and know their socioeconomic impact.

MM24 - Be able to design, develop, evaluate and ensure the accessibility, ergonomics, usability and security of multimedia systems, services and applications and of the information that these manage.

MM28 - Be able to solve problems with initiative, decision-making and creativity and to communicate and transmit the knowledge, abilities and skills of a multimedia engineer.

MM2 - Be able to understand and manage the different technologies involved in multimedia systems, both from the point of view of hardware and electronics and of software.

MM7 - Be able to apply the principles of audiovisual graphic design and communication to multimedia products.

DESCRIPTION OF CONTENTS

1. Introduction

Structure and materials of the course.
Teaching and assessment methodology.
Present and future of computer animation.

2. Artificial Intelligence based animation

Agents and artificial perception .
Reactive behaviors: Flocking, Prey-Pred.
Proactive behaviors: maps and pathfinding algorithms.



3. Decision taking for virtual actors

Reasoning models. Inference. Rule based systems.
FSM-Finite State Machines.
Learning: basic models

4. Fluids

Navier-Stokes equations
Particle-based fluid simulation
SPH discretization

5. Deformable materials

Elasticity models.
Discretizations.
Position Based Dynamics

6. Procedural Modelling

Algorithms for geometric modelling of complex structures such as terrain, vegetation and other complex scenarios.

7. Real-time Animation Based on Shaders

Introduction to Shaders.
Procedural Animation of Geometry (Vertex Shaders).
Procedural Animation of Visual Appearance (Fragment Shaders).

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	30,00
Laboratory	20,00
Classroom practices	10,00
Total hours	60,00

NON PRESENCIAL ACTIVITIES

Activity	Hours
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Attendance at other activities	3,00
Individual or group project	30,00
Independent study and work	32,00
Preparation of lessons	10,00
Preparation for assessment activities	0,00
Resolution of case studies	15,00
Total hours	90,00

TEACHING METHODOLOGY

Teaching will consist of a combination of lectures, problem sessions and practical activities to be performed by the student. This teaching will be supplemented by individual work of students, focusing on the study, problem solving, and job preparation for delivery. In addition, there will be sessions on lab work with your computer.

The theoretical activities consist of conducting master classes on topics that will be developed to provide a global and inclusive, analyzing in detail the key issues and more complex, promoting at all times, student participation.

Practical activities consist of exercises and problem solving. Depending upon the availability, seminars will be held, which will address topics on applications and less formal aspects of the subject and conducting hands-on labs. Laboratory sessions will consist in solving problems related to the theoretical contents through the implementation of the techniques developed. Deliverable works (projects) will play an important role in the methodology. A reduced number of open projects in which the students will practice some of the proposed techniques. The student's personal work consists mainly in three aspects:

- Preparing lessons in advance and recommended reading texts
- Problem solving proposed by Professor
- Development works to be delivered to Professor

EVALUATION

Evaluation will follow a Continuous Evaluation methodology:

First Call

Continuous Evaluation.

1. Along the course a set of tasks to be assessed individually (laboratory sessions, problems, projects, individual and group work, etc.) will be proposed.
2. Other assessable tasks will be selected by the teacher from the following categories: problems, projects, individual work or group work.
3. Since the responsibility to learn and demonstrate what they have learned is individual, the teacher may request students to explain the work done in any given task.



4. A student will go to second call if:
 1. A student fails or does not deliver on time two tasks proposed.
 2. A student copied a task (this can affect more students).
 3. A student is unable to explain or maintain an argument on issues related to the code, on the decisions taken or the writing of some of the tasks he has delivered.

Students who cannot attend lectures for a justified reason, must inform the professors and establish a work plan that is equivalent to classroom work.

Second call

Students who have not passed the first round evaluation shall establish a work plan with teachers to achieve the objectives of the course before the date scheduled for evaluation in second call, with similar jobs to those made during the course.

In any case, the evaluation of this subject will be done in compliance with the University Regulations in this regard, approved by the Governing Council on 30th May 2017 (ACGUV 108/2017)

Copying or plagiarism of any activity that is part of the evaluation will result in the impossibility of passing the course, and the student will then be subject to the appropriate disciplinary procedures indicated in the ACTION PROTOCOL FOR FRAUDULENT PRACTICES AT THE UNIVERSITY OF VALENCIA (ACGUV 123/2020).

REFERENCES

- K. Erleben et al. "Physics Based Animation". Charles River Media, 2005.
- Rick Parent, "Computer Animation - Algorithms and Techniques". Morgan Kaufmann 2008.
- E. Lengyel. "Mathematics for 3D game programming and computer graphics". Charles River Media. 2004
- D.M. Bourg y G. Seeman. "AI for game developers". O'Reilly, 2004
- I. Kerlow, "The art of 3D computer animation and effects". John Wiley & Sons, 2009.
- J.M. Van Verth y L.M. Bishop. "Essential mathematics for games and Interactive Applications". Morgan Kaufmann Publishers, 2008
- S. Rabin "AI game programming wisdom". Charles River Media, 2002
- Beginner's guide to Unity Shader Graph : create immersive game worlds using Unity's Shader tool. Alda, Alvaro. New York : Apress Media LLC. 2023.