BASIC DETAILS:

Subject:	INTELIGENCIA ARTIFICIAL PARA VIDEOJUEGOS (VIDEOJUEGOS)		
Id.:	31841		
Programme:	DOBLE GRADO EN INGENIERÍA INFORMÁTICA Y DISEÑO Y DESARROLLO DE VIDEOJUEGOS		
Module:	PROGRAMACIÓN DE VIDEOJUEGOS		
Subject type:	OPTATIVA		
Year:	4	**Teaching period:**	Segundo Cuatrimestre
Credits:	6	**Total hours:**	150
Classroom activities:	66	**Individual study:**	84
Main teaching language:	Inglés	**Secondary teaching language:**	Castellano
Lecturer:		**Email:**	

PRESENTATION:

Artificial Intelligence (AI) has seen immense progress in recent years. It is both, a thriving research field featuring an increasing number of important research areas, and a core technology for an increasing number of application areas. Artificial Intelligence is widely regarded in the computer games industry as the area where the most advances will be made in the coming decades. As well as equipping students for a career in the rapidly growing game industry, this couse will lead students to gain knowledge and skills in AI techniques that apply to other domains such as business planning and engineering. This course digs into the application of Artificial Intelligence to Games—focusing on core techniques, essential skills and principles transferable from one domain to another.The course explains the basic role of Artificial Intelligence (AI) in video games. The course shows how AI moves the story and its characters forward and shows how game programs can learn responses and generate plans and movements based on players' actions. It covers algorithms and languages that enable AI. These ideas are applied using Unity video game engine

The most important outcomes are:

- Identify tasks that can be tackled using AI techniques, and most important algorithms related.
- Select the appropriate AI technique for the problem under development.
- Design and implement basic AI algorithms for game tasks.
- Develop AI game engines.
- Use UNITY AI capabilities

PROFESSIONAL COMPETENCES ACQUIRED IN THE SUBJECT:

General programme competences	G01	Ability to use learning strategies independently for use in the continuous improvement of professional practice.
	G02	Ability to analyse and synthesise problems of their professional activity and apply in similar environments.
	G03	Ability to achieve common results through teamwork in a context of integration, cooperation and encouraging critical discussion.
	G04	Ability to critically think about information, data and lines of action and their implementation in relevant social, scientific ethical issues.
	G05	Ability to communicate in Spanish and English for professional issues in oral and written form.
	G06	Ability to solve complex problems or contingencies that arise during professional activity within any organisation and adapt to the needs and demands of their professional environment.
	G07	Ability to handle different complex knowledge models through a process of abstraction and its application to approach and solve problems.
	G08	Ability to understand the role of the scientific method in the generation of knowledge and its application to a professional environment.
	G09	Ability to work with respect for the environment and society through the proper use of technology and its application in promoting a sustainable economy and environment.
	G10	Ability to master information and communication technologies and their application in their professional field.
Specific programme	E01	Ability to solve mathematical problems inherent to engineering. Ability to apply knowledge about: algebra; geometry; differential and integral calculus; optimisation and numerical methods

competences	E02	Ability to understand and master the concepts of the general laws of classical mechanics, fields, waves and electromagnetism and their application for solving video game development problems.
	E03	Ability to develop the use and programming of computers, operating systems, databases and software and their application in the development of video games.
	E04	Ability to understand and master the basic concepts of discrete logic, algorithmic mathematical and computational complexity, and their application for solving engineering problems.
	E05	Ability to program applications both correctly, and efficiently, choosing the most appropriate paradigm and programming languages, applying knowledge of basic algorithmic procedures and using the types and structures of the most appropriate data.
	E06	Ability to learn, understand and evaluate the structure and architecture of computers, as well as their basic components.
	E07	Ability to design, analyse and implement applications based on the characteristics of the database.
	E08	Ability to learn and master the features, functionality and structure of the Distributed Systems, Computer Networks and the Internet and design and implement applications based on them.
	E09	Ability to learn and master the tools necessary for the storage, processing and access to information systems, including web-based.
	E10	Ability to be familiar with the characteristics, functions and structure of operating systems.
	E11	Ability to develop online games for multiple players.
	E12	Ability to understand and analyse the structure, organisation, function and interconnection of the devices and systems in video game platforms.
	E13	Ability to discover, design and assess the main foundations and techniques of player-computer interaction that guarantee the accessibility and userability of the systems, services and IT applications including video games.
	E14	Ability to apply the main foundations and techniques of the smart systems and their practical application in diverse environments.
	E15	Ability to apply the main foundations and techniques of programming in real time.
	E16	Ability to fully manage and plan software projects and handle suitable tools to do so.
	E17	Ability to understand and analyse the structure and function of the main hardware systems and peripherals in video game platforms.
	E18	Ability to understand and apply the principles of ergonomics and "Design for all" in order to develop universally accessible interfaces and devices in the field of video games.
	E19	Ability to recognise and apply the principles, methodologies and life cycle of software engineering.
	E20	Ability to generate and analyse expressive and narrative resources and their application to video games.
	E21	Ability to execute the art of video games, create characters and settings.
	E22	Ability to manage techniques and tools used for artistic representation and expression.
	E23	Ability to use creative processes in the design and development of video games.
	E24	Ability to specially visualise and have knowledge of the graphical representation techniques, both in terms of traditional methods of metrical geometrics and descriptive geometrics using computer-assisted design application.
	E25	Ability to design and create graphical elements and their application in the development of video games.
	E26	Ability to perform the design and creation of animated characters and their application in the development of video games.
	E27	Ability to apply the methods in the creation and preservation of synthetic images
	E28	Ability to perform the design and construction of models with the information necessary for the creation and display interactive images.
	E29	Ability to understand and apply the techniques of visualisation, animation, simulation and interaction on models
	E30	Ability to design, develop, select and evaluate applications and systems, ensuring reliability, safety and quality, according to ethical principles and legislation and regulations.
	E31	Ability to perform the evaluation of video games from their different approaches.
	E32	Ability to evaluate, use and spread game engines.
	E33	Ability to develop production developments in the field of video games.
	E34	Ability to create and analyse games on their fundamentals and develop the understanding of what are the keys that determine how they work and their development.
	E35	Ability to know and understand the video game industry from a business point of view
	E36	Ability to identify and implement legal and ethical aspects of the gaming industry
	E37	Ability to design and create sounds and sound environments and their application in game development

	E38	Ability to produce an original project that integrates the skills acquired throughout the degree along with its presentation and defence before a university tribunal that relates to the field of design and game development.

PRE-REQUISITES:

It is recommended to have studied all subjects in previous semesters especially Intelligent Systems . Basic knowledge will be required in fields like AI, design, programming, object oriented programming, UML, version control...

Unity will be used as the main development platform, previous experience with Unity is not required, but it will help understanding the examples provided. Any other game engine can be used to develop any of the projects requested, but example templates for the projects will be delivered as Unity projects.

SUBJECT PROGRAMME:

Subject contents:

1 - Introduction to Artificial Intelligence in Videogames
1.1 - History
1.2 - Examples
2 - Planning
2.1 - Search Algorithms
2.2 - Pathfinding
3 - Decision Making
3.1 - Decision Trees and State Machines
3.2 - Behaviour Trees
3.3 - Scheduling
3.4 - Autonomous Movement
4 - Machine Learning
4.1 - State of the Art
4.2 - Machine Learning in Videogames
5 - Final project

Subject planning could be modified due unforeseen circumstances (group performance, availability of resources, changes to academic calendar etc.) and should not, therefore, be considered to be definitive.

TEACHING AND LEARNING METHODOLOGIES AND ACTIVITIES:

Teaching and learning methodologies and activities applied:

- **Master classes**
  - Lecturer will explain the theoretical part of the subject supported by ICT resources (computer, projector, internet) and a whiteboard.
  - Students will ask questions found during individual work sessions.
  - Student involvement, discussions, questions and concerns will be valued and will be added to final marks.
- **Practical work**
  - Practical sessions will lay out different problems with the aim on solving real world situations with the help of the lecturer.
- **Project based learning**
  - An important part of the learning process of the subject, and the final marks, will be obtained by solving practical problems while working individually and in groups. Students will receive the initial wording of the problem and a deadline. The main objective is to prepare the students to face real world problems and reach the learning outcomes of the subject easily and seamlessly.
- **Tutorial**
  - Students will be able to ask the lecturer those questions that were not answered during the master classes or the ones

that showed up during individual study. Students may ask for additional bibliography about a specific matter and any other kind of information related with this subject. On the other hand, along this sessions, students will be monitored and oriented in their way to complete the assigned tasks. Tutorial sessions will be set up by mutual agreement between the parts involved.

Student work load:

Teaching mode	Teaching methods	Estimated hours
Classroom activities	Master classes	15
	Practical exercises	15
	Workshops	15
	Laboratory practice	15
	Participation in seminars, conferences etc.	2
	Assessment activities	4
Individual study	Tutorials	6
	Individual study	20
	Individual coursework preparation	20
	Project work	25
	Research work	3
	Compulsory reading	5
	Recommended reading	5
	Total hours:	150

ASSESSMENT SCHEME:

Calculation of final mark:

Written tests:	20	%
Individual coursework:	25	%
Group coursework:	25	%
Final exam:	20	%
Involvement:	10	%
TOTAL	100	%

*Las observaciones específicas sobre el sistema de evaluación serán comunicadas por escrito a los alumnos al inicio de la materia.

BIBLIOGRAPHY AND DOCUMENTATION:

Basic bibliography:

Russell, Stuart, and Peter Norvig. "AI a modern approach." Learning 2.3 (2005): 4.

YANNAKAKIS, Georgios N.; TOGELIUS, Julian. Artificial Intelligence and Games (First Public Draft). 2017.

Recommended bibliography:

DÍAZ, Guillermo; IGLESIAS, Andrés. Swarm Intelligence Scheme for Pathfinding and Action Planning of Non-player Characters on a Last-Generation Video Game. En International Conference on Harmony Search Algorithm. Springer, Singapore, 2017. p. 343-353.

HASSABIS, Demis. Artificial Intelligence: Chess match of the century. Nature, 2017, vol. 544, no 7651, p. 413-414.

SHAKER, Noor; TOGELIUS, Julian; NELSON, Mark J. Procedural Content Generation in Games. Springer International Publishing, 2016.

SAFADI, Firas; FONTENEAU, Raphael; ERNST, Damien. Artificial intelligence in video games: Towards a unified framework. International Journal of Computer Games Technology, 2015, vol. 2015, p. 5.

CHAMPANDARD, Alex J. AI Game Development: Synthetic Creatures with Learning and Reactive Behaviors. New Riders. 2003.

Recommended websites:

Gamasutra	http://gamasutra.com/
GameDev	http://www.gamedev.net/
Unity	https://unity3d.com
Unreal Engine	https://www.unrealengine.com

* Guía Docente sujeta a modificaciones