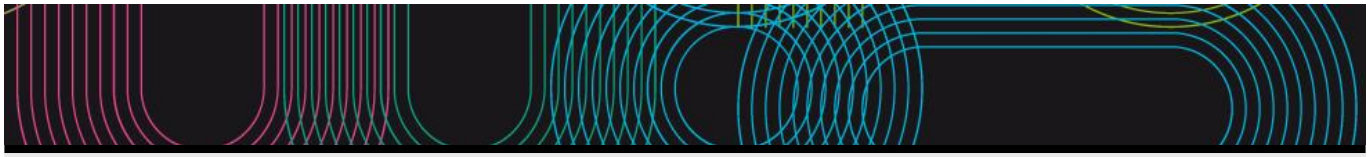

(*)Escola de Enxeñaría de Telecomunicación

(*)Páxina web

(*)

www.teleco.uvigo.es

(*)Presentación

The School of Telecommunication Engineering (EET) is a higher education school of the University of Vigo that offers Bachelor's degrees, Master's degrees and Doctoral programs in the fields of Telecommunications Engineering.

Bachelor's Degree in Telecommunication Technologies Engineering (EUR-ACE®).

The mail goal of the Bachelor's Degree in Telecommunication Technologies Engineering is to form professionals at the forefront of technological knowledge and professional competences in telecommunication engineering. This Bachelor has been recognized with the best quality seals, like the EUR-ACE's. **It has a bilingual option: up to 80% of the degree credits can be taken in English**.

http://teleco.uvigo.es/images/stories/documentos/gett/degree_telecom.pdf

www: http://teleco.uvigo.es/index.php/es/estudios/gett

Master in Telecommunication Engineering

The Master in Telecommunication Engineering is a Master's degree that qualifies to exercise the profession of Telecommunication Engineer, in virtue of the established in the Order CIN/355/2009 of 9 of February.

http://teleco.uvigo.es/images/stories/documentos/met/master_telecom_rev.pdf

www: http://teleco.uvigo.es/index.php/es/estudios/mit

Interuniversity Masters

The current academic offer includes interuniversity master's degrees that are closely related to the business sector:

Master in Cybersecurity: www: https://www.munics.es/

Master in Industrial Mathematics: www: http://m2i.es

International Master in Computer Vision: www: https://www.imcv.eu/

(*)Equipo directivo

MANAGEMENT TEAM

Directora: Rebeca Pilar Díaz Redondo (teleco.direccion@uvigo.gal)

Secretaría e Subdirección de Novas Titulacións: Pedro Rodríguez Hernández

(teleco.subdir.secretaria@uvigo.gal;teleco.subdir.novastitulacions@uvigo.gal)

Subdirección de Organización Académica: Pedro Comesaña Alfaro (teleco.subdir.academica@uvigo.gal)

Subdirección de Relaciones Internacionais e Subdirección de Infraestructuras: María Verónica Santalla del

Río (teleco.subdir.internacional@uvigo.gal; teleco.subdir.infraestructuras@uvigo.gal)

Subdirección Difusión e Captación: Laura Docio Fernández (teleco.subdir.captacion@uvigo.gal)

Subdirección de Calidade: Ana María Cao Paz(teleco.subdir.calidade@uvigo.gal)

BACHELOR□SDEGREE IN TELECOMMUNICATION TECHNOLOGIES ENGINEERING

Generalcoordinator: Lucía Costas Pérez (teleco.grao@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-gett/

MASTER IN TELECOMMUNICATION ENGINEERING

Generalcoordinator: Manuel García Sánchez (teleco.master@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-met/

MASTER INCYBERSECURITY

General coordinator:Ana Fernández Vilas (teleco.munics@uvigo.gal)

https://teleco.uvigo.es/es/documentos/acordos-es/comisions-academicas-es/miembros-de-la-comision-academica-del-munics/

MASTER ININDUSTRIAL MATHEMATICS

Generalcoordinator: Elena Vázquez Cendón (USC)

UVigo coordinator:José Durany Castrillo (durany@dma.uvigo.es)

http://www.m2i.es/?seccion=coordinacion

INTERNATIONALMASTER IN COMPUTER VISION

General coordinator: Xose Manuel Pardo López (USC)

UVigo coordinator:José Luis Alba Castro (jalba@gts.uvigo.es)

https://www.imcv.eu/legal-notice/

MASTER'S DEGREE IN QUANTUM INFORMATION SCIENCE AND TECHNOLOGIES (MQIST)

General coordinator: Javier Mas (USC)

Coordinador UVIGO: Manuel Fernández Veiga(teleco.mqist@uvigo.es)

https://quantummastergalicia.es/info

(*)Máster Universitaro en Realidade Estendida

Subjects			
Year 1st			
Code	Name	Quadmester	Total Cr.
10412-752100	Fundamentals of programming and electronics	1st	3
10412-752101	Content production	1st	3
10412-752102	XR Programming	1st	6
10412-752103	Production of XR projects	1st	4.5
10412-752104	XR Systems	1st	6

10412-752105	3D modeling and image rendering	1st	4.5
10412-752106	User interaction	1st	3
10412-752107	Remote and mobile XR	2nd	4.5
10412-752108	Interpretation of the environment	2nd	3
10412-752109	Sensorization of the environment	2nd	3
10412-752110	Group project	2nd	6
10412-752112	Advanced XR programming	2nd	4.5
10412-752113	Advanced image and sound rendering	2nd	4.5
10412-752114	Artificial intelligence and machine learning	2nd	4.5
10412-752118	User experience (UX) and gamification	2nd	4.5
10412-752119	Industrial applications	2nd	4.5
10412-752120	Systems integration	2nd	4.5

IDENTIFYING DATA				
Fundamentals of programming and electronics				
Subject	Fundamentals of programming and electronics			
Code	10412-752100			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Cao Paz, Ana María Fernández Iglesias, Manuel José			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103900&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Content production				
Subject	Content production			
Code	10412-752101			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Fernández Santiago, Luis Emilio			
Lecturers	Abal Silva, Alberto Fernández Santiago, Luis Emilio			
E-mail	faraon@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Content on the nomenclature and peculiarities of the graphic elements, and their workflows, used in graphic engines and frameworks for narrative, graphic and sound, in Augmented Reality products.			

Training and Learning Results	
Code	
B10	CON09 Identify the stages of the production flow of an Extended Reality product.
C8	HAB08 Construct a development workflow compatible with the generation of narrative, visual and audio content.
D5	CMP05.1 Process information from different sources for its use in the study and analysis.
D6	CMP05.2 Extract information from different sources for its use in the study and analysis.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Knowledge of the elements used in narrative on graphic engines, Conocimiento de los elementos que se utilizan en la narrativa mediante motores gráficos,	D5 D6
Workflow of generation of Audiovisual contents inside graphic engines.	B10 C8 D5 D6
Content management : formats and location	B10 C8 D5 D6

Contents	
Topic	
Elements used in narrative and graphic and sound arts.	3D Elements Models: parts and formats. Transformations. Surfaces (materials). Assets Sets, props, and accessories. Placeholders. Level-layout. Sound Objects Ambient sound. Listening point. Characters Rig. Animation. Retargeting and avatars in graphics engines.
Narrative content generation workflow.	Interactive Narrative Concepts Audiovisual Narrative
Sound content generation workflow.	Sound Enviroment

Visual content generation workflow.	Visual Environment Visual Pipeline Visual Pipeline Workflows
Interaction between the workflows of the different contents.	Pipelines interdependences
Content management: formats and international localization	File formats and types. Duplication by location.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	10.5	9	19.5
Laboratory practical	9	15	24
Mentored work	0	30	30
Objective questions exam	1.5	0	1.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	The teacher presents the subject, encouraging critical discussion of concepts. This may include providing written and/or audiovisual materials for offline study and preparation. The theoretical foundations for nomenclature and elements used in the production of content for extended reality are laid. This methodology addresses competencies B10, D5, and D6.
Laboratory practical	Use and adjust of elements and assets, identifying which ones to use in each situation. This methodology addresses competencies B10, D5, and D6.
Mentored work	Students are asked to independently complete tasks, short projects, or research papers on a topic. This methodology addresses competencies B10, C8, D5, and D6.

Personalized assistance	
Methodologies	**Description**
Lecturing	Questions about the lecture sessions can be answered during office time. These office meetings will be held: -> Individually or -> in small groups (typically with a maximum of 2-3 people). Unless otherwise indicated, they must be arranged by appointment with the corresponding professor. The appointment must be requested and scheduled by email, preferably at the officially reserved time and location. Contact: Luis Fernández (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11658 Alberto Abal (uvigo), https://moovi.uvigo.gal/user/profile.php?id=17664
Laboratory practical	Questions about the practicals can be answered during the teacher's tutorials. The conditions are the same as those for the Master Class.
Mentored work	Questions about the practicals can be answered during the teacher's tutorials. The conditions are the same as those for the Master Class.

Assessment					
	Description	Qualification	Training and Learning Results		
Laboratory practical	Continuous assessment.	30	B10		D5
Mentored work	Assessment of practical assignments.	40	B10	C8	D5 D6
Objective questions exam	Test to check the understanding of concepts.	30	B10	C8	D5 D6

Other comments on the Evaluation

REGULAR OPPORTUNITY

The Final Grade for the subject is calculated as the weighted average of the grades for each section if the grades for the four tests are greater than or equal to 4. If any test is lower, or if any of the assessable assignments are not submitted on time and in the correct manner, the Final Grade will be the lower of 4.9 and the previous weighted average.

The person who submits the first (non-assessable) assignment on time will be considered to have opted for Continuous Assessment (CE). Otherwise, the person will be considered to have opted for Global Assessment.

There will be three assessable items; the details of each and the dates will be specified on the platform.

A.- Continuous monitoring: creation and lighting of a basic scene using elements generated and obtained from libraries. (30% of the grade)

B.- Supervised work: creation and lighting of a complex scene, written report on the process and selection of elements. (40% of the grade)

C.- Exam with objective questions. (30% of the grade)

OVERALL ASSESSMENT (GA).

The Final Grade for the subject is calculated as the weighted average of the grades for each section if the grades for the four tests are greater than or equal to 4. If any grade is lower, or if any of the assessable assignments are not submitted on time and in the correct manner, the Final Grade will be the lower of 4.9 and the above weighted average.

The Global Assessment (GA) will consist of a supervised assignment and a test. Details of each test and dates will be specified on the platform.

A.- Supervised assignment: creation and lighting of a complex scene, written report on the process and choice of elements. (60% of the grade)

B.- Objective question exam. (40% of the grade)

EXTRAORDINARY OPPORTUNITY

The conditions for passing the subject in the extraordinary opportunity will be the same as for the Global Assessment.

OTHER CONSIDERATIONS

All students who take any of the Final Exams are considered to have took the course. The grades for all written, midterm, or final tests and offline activities will only be valid for the academic year in which they are taken.

If plagiarism is detected in any of the assignments/tests/exams/quizzes completed, including offline activities submitted or completed in the virtual classroom, the final grade for the course will be Fail (0), and teachers will inform the School Administration of the matter so that appropriate action can be taken.

In the event of any inconsistencies that may have arisen between the different versions of the guide due to a translation error, the Spanish version will prevail

.

Sources of information

Basic Bibliography

Dunlop, R, **Production Pipeline Fundamentals for Film and Games**, 978-0415812290, 1, Routledge, 2014

Complementary Bibliography

Chandler, Heather Maxwell, **The game production handbook**, 978-1-4496-8809-7, 3, Jones & Bartlett Learning, 2014
Schell, Jesse, **The Art of Game Design**, 978-1-138-63209-7, 3, CRC Press, Taylor & Francis Group, 2020
Milic, Lea, **The Animation Producer's Handbook**, 978-0335220366, 1, Open University Press, 2006

Recommendations

Other comments

The use of generative artificial intelligence (GenIA) is permitted in academic activities related to this subject. It must be used ethically, critically, and responsibly.
When using GenIA, any results it provides must be critically evaluated, and any generated citations or references must be carefully verified. It is also recommended that you declare the use of the tools used and include the prompts.

IDENTIFYING DATA				
XR Programming				
Subject	XR Programming			
Code	10412-752102			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	Spanish Galician			
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The basics of how the Unity graphics engine works are reviewed. Robust, scalable, and efficient C# programming is discussed. Organizing the code structure of a complex project is discussed.			

Training and Learning Results	
Code	
B4	CON03 Recognise the main systems to be defined in a software architecture oriented to Extended Reality.
C3	HAB03 Develop complex applications in the most efficient way according to the interactive environment to be implemented.
D5	CMP05.1 Process information from different sources for its use in the study and analysis.
D6	CMP05.2 Extract information from different sources for its use in the study and analysis.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Know and understand the basics of how the Unity graphics engine works.	B4 D5 D6
Know how to program in C# within Unity in a robust, scalable, and efficient manner.	B4 C3 D5 D6
Design the code structure of a complex project.	B4 C3 D5 D6
Carry out a short project from conception to a functional prototype.	C3 D5 D6
Know and know how to use the Unity Physics System.	B4 D5 D6
Know and know how to use asynchronous processes when programming in C# within Unity.	B4 D5 D6
Know and know how to use delegates when programming in C# within Unity.	B4 D5 D6
Know and know how to use the scene loading and unloading processes within Unity.	B4 D5 D6
Know how to program a user interface following the MVP (Model-View-Presenter) programming pattern.	B4 D5 D6
Know how to interact in Unity with external audio middleware.	B4 D5 D6

Contents

Topic	
Graphics Engine Structure	Instances and Components. Assets. Prefabs Scriptable Objects
Physics System	Components that implement it. Coordinate Systems. Rotation.
C# Elements and Features	Collections: lists, dictionaries. Abstraction: interfaces. Use of Delegates: event, action, lambda, func. Asynchronous Processes: coroutines, async, await, task.
Scene Management	Loading and Unloading Scenes. Additive Scenes. Cross-References Between Scenes.
Sound	Native System. Interaction with External Middleware.
User Interface and Cameras	Basic System Model-View-Pattern (MVP) Programming Pattern

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	16	36	52
Practices through ICT	23.5	36	59.5
Mentored work	0	36	36
Objective questions exam	2	0	2
Systematic observation	0.5	0	0.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Presentation by the teacher of the content, encouraging critical discussion of the concepts. The theoretical foundations of algorithms and procedures used to solve problems are laid. This methodology develops the following knowledge, competencies, and skills: CON03, HAB03, CMP05.1, CMP05.2.
Practices through ICT	Management and adjustment of analysis tools and algorithms, identifying which ones to use in each situation. This methodology develops the following knowledge, competencies, and skills: CON03, CMP05.1, CMP05.2.
Mentored work	Independent work on a short project on a complex design that makes use of several topics covered in the subject. This methodology develops the following knowledge, competencies, and skills: HAB03, CMP05.1, CMP05.2.

Personalized assistance	
Methodologies	**Description**
Lecturing	Questions about the subject can be addressed during teacher tutorials. These tutorials will be held: -> Individually or in small groups (typically with a maximum of 2-3 people). -> Unless otherwise indicated, by appointment with the corresponding teacher. The appointment will be requested and scheduled by email, preferably at the officially reserved time and location. Contact: Antonio Pena (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11310 Contact: José Sanjurjo (udc), https://moovi.uvigo.gal/user/view.php?id=225534 Contact: Basilio Fraguela (udc), https://moovi.uvigo.gal/user/view.php?id=225537
Practices through ICT	Questions about the subject can be addressed during teacher tutorials. These tutorials will be held: -> Individually or in small groups (typically with a maximum of 2-3 people). -> Unless otherwise indicated, by appointment with the corresponding teacher. The appointment will be requested and scheduled by email, preferably at the officially reserved time and location. Contact: Antonio Pena (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11310 Contact: José Sanjurjo (udc), https://moovi.uvigo.gal/user/view.php?id=225534 Contact: Basilio Fraguela (udc), https://moovi.uvigo.gal/user/view.php?id=225537
Mentored work	Questions about the subject can be addressed during teacher tutorials. These tutorials will be held: -> Individually or in small groups (typically with a maximum of 2-3 people). -> Unless otherwise indicated, by appointment with the corresponding teacher. The appointment will be requested and scheduled by email, preferably at the officially reserved time and location. Contact: Antonio Pena (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11310 Contact: José Sanjurjo (udc), https://moovi.uvigo.gal/user/view.php?id=225534 Contact: Basilio Fraguela (udc), https://moovi.uvigo.gal/user/view.php?id=225537

Assessment			
	Description	Qualification	Training and Learning Results
Practices through ICT	Suggested Tasks.	20	
Mentored work	Preparation of a short project. Includes an oral exam.	30	
Objective questions exam	Final written test on the subject matter.	40	
Systematic observation	Observation of student attitudes and their contribution to the development of the subject.	10	

Other comments on the Evaluation

Other comments on Assessment

Students will be offered two assessment systems: CONTINUOUS ASSESSMENT, which is the recommended method and around which teaching activities are organized, and a GLOBAL ASSESSMENT option, which is only recommended in situations where it is impossible to follow the recommended system.

CONTINUOUS ASSESSMENT

Continuous assessment consists of the tests detailed below in this guide. Continuous assessment is considered to be chosen once the proposed assignments offered within the first 4 weeks of the course being taught are submitted. Once these assignments are submitted, the student will be deemed to have taken the exam and will be assigned the grade resulting from the application of the criteria detailed below.

In order to ensure that a balanced minimum of the subject's competencies is acquired, passing the exam requires meeting these three conditions:

1) obtaining an overall grade equal to or higher than 5 (on a scale of 0 to 10).

2) obtaining a grade equal to or higher than 4 (on a scale of 0 to 10) in the final written exam.

3) obtaining a grade equal to or higher than 4 (on a scale of 0 to 10) in the project.

If all the requirements are not met, the final grade (on a scale of 0 to 10) will be the lower of the overall grade obtained and a score of 4.9.

The schedule for the various midterm assessment tests will be approved by the Master's Academic Committee (CAM) and will be available at the beginning of the semester.

OVERALL ASSESSMENT

If the proposed assignments are not submitted within the first 4 weeks of the course beginning, without justified cause, they will be assessed through a final written exam on the official date assigned by the Center. In addition, a project must be submitted in advance, including a descriptive report and an oral exam.

In order to ensure that a balanced minimum of the subject's competencies is acquired, passing the course requires meeting these three conditions:

1) Obtain an overall grade equal to or higher than 5 (on a scale of 0 to 10).

2) Obtain a grade equal to or higher than 5 (on a scale of 0 to 10) on the final written exam.

3) Obtain a grade equal to or higher than 5 (on a scale of 0 to 10) on the project.

If all the conditions are not met, the final grade (on a scale of 0 to 10) will be the minimum between the overall grade obtained and the value 4.9.

EXTRAORDINARY OPPORTUNITY

If you have been assessed by Continuous Assessment, you can choose between two options on the day of the exam:

* Take the final written exam again, on the official date assigned by the Center, and be assessed according to the Continuous Assessment system.

* Be assessed according to the rules described in the previous section for a Overall Assessment.

If you have NOT been assessed by Continuous Assessment:

* Be assessed according to the rules described in the previous section for a Overall Assessment.

If plagiarism is detected in any of the tests or assignments, the final grade will be FAIL (0), and the fact will be reported to the Center's management for the appropriate actions.

Sources of information
Basic Bibliography
Unity Technologies, **Unity web: API description, tutorials and more. (https://unity3d.com)**,
Robert Nystrom, **Game Programming Patterns (http://gameprogrammingpatterns.com/contents.html)**, ISBN-10: 0990582906, 1, Genever Benning, 2014
Jeff W. Murray, **C# Game Programming Cookbook for Unity 3D**, ISBN 978-0367321703, 2, CRC Press, 2021
Harrison Ferrone, **Learning C# by Developing Games with Unity**, ISBN 978-1837636877, 7, Packt Publishing, 2022
Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before
Fundamentals of programming and electronics/10412-752100

Other comments
The use of generative artificial intelligence (GAI) is permitted in the academic activities of this subject. It must be used ethically, critically, and responsibly. When using GAI, any results it provides must be critically evaluated, and any generated citations or references must be carefully verified. The use of the tools used must also be declared.

IDENTIFYING DATA				
Production of XR projects				
Subject	Production of XR projects			
Code	10412-752103			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	1st	1st
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103905&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
XR Systems				
Subject	XR Systems			
Code	10412-752104			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103906&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
3D modeling and image rendering				
Subject	3D modeling and image rendering			
Code	10412-752105			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	1st	1st
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103902&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
User interaction				
Subject	User interaction			
Code	10412-752106			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	1st
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Cuiñas Gómez, Íñigo Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103903&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Remote and mobile XR				
Subject	Remote and mobile XR			
Code	10412-752107			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Mandatory	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	López Bravo, Cristina			
Lecturers	Gil Castiñeira, Felipe José López Bravo, Cristina			
E-mail	clbravo@det.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This course provides a comprehensive overview of the creation and management of multi-user environments, as well as their integration with advanced mobile technologies. It focuses particularly on the use of specific libraries for the development of networked Extended Reality (XR) experiences and mobile devices, using the Unity platform. In addition, fundamental topics are covered, such as performance analysis, low-latency communications, and the use of emerging technologies□such as edge computing□to optimize the performance of XR applications in mobile environments. The course materials will be provided in English. This is an **English Friendly** course. International students may request from the teaching staff: a) materials and bibliographic references in English for following the course, b) tutorials in English, and c) tests and assessments in English.			

Training and Learning Results	
Code	
B5	CON04 Identify the principles of operation of the different types of sensors and devices adapted to the different operating environments.
C6	HAB06 Apply mobile and networked communication technologies for the generation of multi-user interactive environments.

Expected results from this subject	Training and Learning Results
Understanding the basic aspects of multi-user environments	C6 C13
Ability to design and develop multi-user applications for mobile devices with networked gameplay functionality	C6
Knowledge of the advantages and limitations of mobile devices as AR platforms	B5 C6
Understanding the needs and technologies of XR applications for mobile devices	B5 C6
Ability to design and develop XR applications for mobile devices.	B5 C6
Understanding the requirements, limitations, advantages, and technologies for remote rendering in XR applications	B5 C6
Ability to design and implement remote XR applications	B5 C6

Contents	
Topic	
Topic 1: Creation and Management of Multi-User Environments	Introduction Basic concepts (serialization, synchronization, latency, scalability, security) Network topologies (local, client-server, peer-to-peer, cloud) Performance Multi-user environments in Unity

Topic 2: Mobile Devices	Introduction Sensors Ecosystems and operating systems Development in Unity for Android
Topic 3: XR on Mobile Devices	Introduction Basic aspects Markers and interaction Advanced features
Topic 4: Remote XR	Remote rendering: advantages and limitations. Requirements and characteristics of communication networks for remote rendering: bandwidth, latency, jitter, etc. Architectures and technologies for remote XR: edge computing, streaming, equipment, etc.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	15.5	31	46.5
Practices through ICT	16	21	37
Mentored work	0	26	26
Objective questions exam	2	0	2
Systematic observation	1	0	1

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Presentation by the teaching staff of the main theoretical content related to the development of remote and mobile XR applications. This methodology will contribute to the acquisition of competencies CON04 and HAB06.
Practices through ICT	Completion by the students of guided and supervised practical exercises related to the content presented during the lectures. This methodology will focus on developing competencies CON04 and HAB06.
Mentored work	Students will carry out open-ended practical exercises related to the content covered in the lectures, in which they must incorporate new elements that require independent research and information selection. This methodology will actively foster the development of competencies CON04 and HAB06.

Personalized assistance

Methodologies	Description
Lecturing	The teaching staff of the course will provide individual and personalized support to students throughout the term, addressing their doubts and questions. Questions will be attended to either in person or online (during the lecture sessions or office hours). Office hours will be scheduled with students by appointment. Contact: Cristina López Bravo (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11583; Felipe Gil Castiñeira (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11664; Carlos Vázquez Regueiro (udc), https://moovi.uvigo.gal/user/profile.php?id=225535.
Practices through ICT	The teaching staff of the course will provide individual and personalized support to students throughout the term, addressing their doubts and questions. Additionally, the instructors will advise and guide students during the completion of the tasks assigned in the laboratory practices. Questions will be attended to either in person or online (during the laboratory sessions or office hours). Office hours will be scheduled with students by appointment. Contact: Cristina López Bravo (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11583; Felipe Gil Castiñeira (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11664; Carlos Vázquez Regueiro (udc), https://moovi.uvigo.gal/user/profile.php?id=225535.
Mentored work	The teaching staff of the course will provide individual and personalized support to students throughout the term, addressing their doubts and questions. Additionally, the instructors will advise and guide students during the completion of the tasks assigned for their mentored work. Questions will be attended to either in person or online (during the mentored work follow-up sessions or office hours). Office hours will be scheduled with students by appointment. Contact: Cristina López Bravo (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11583; Felipe Gil Castiñeira (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11664; Carlos Vázquez Regueiro (udc), https://moovi.uvigo.gal/user/profile.php?id=225535.

Assessment

	Description	Qualification	Training and Learning Results	
Mentored work	Students must submit a report on the work carried out. This report should include the submission of a video presenting their work. Additionally, this presentation will be conducted live, in order to interview the students about their work.	30	B5	C6
Objective questions exam	Short-answer exam covering the theoretical and practical content reviewed throughout the course, both in lectures and laboratory sessions. This exam will be held at the end of the semester.	30	B5	C6
Systematic observation	During the practical sessions, continuous monitoring of the design and progress of the work will be carried out. Students must submit a report documenting the work completed.	40	B5	C6

Other comments on the Evaluation

ORDINARY EXAM

Following the degree program□s guidelines, two evaluation systems will be offered to those taking this course: continuous assessment and global assessment.

Before the end of the fourth week of the course, students must inform the teaching staff of their chosen assessment system. Those who opt for the continuous assessment system cannot be graded as "not presented" if they submit any assignment or assessment test after communicating their decision.

Continuous Assessment

The final grade for the course will be the weighted arithmetic mean of the previously indicated tests. To pass the course, the final grade must be equal to or greater than five.

Global Assessment

The final grade for the course will be the weighted arithmetic mean of the previously indicated tests. To complete the evaluation by systematic observation, students must submit a dossier outlining the process followed. To pass the course, the final grade must be equal to or greater than five.

EXTRAORDINARY EXAM

The evaluation will consist of an objective-question exam and submission of the reports from all practical exercises carried out throughout the course, for which a grade higher than five has not been obtained. To complete the evaluation by systematic observation, students must submit a dossier outlining the process followed. To pass the course, the final grade must be equal to or greater than five.

END-OF-PROGRAM EXAM

The assessment system will be the same as the global assessment of the ordinary exam.

OTHER COMMENTS

The scheduling of the different intermediate assessment tests will be approved by the Master's Academic Committee (CAM) and will be available at the beginning of the semester.

The grades obtained are valid only for the current academic year.

The use of any materials during exams and assessment tests must be explicitly authorized by the teaching staff.

In case plagiarism is detected in any submitted work or test, the final grade for the course will be a fail (0), and the instructors will report the matter to the school administration for appropriate action.

Sources of information

Basic Bibliography

Chung, Jong-Moon, **Emerging Metaverse XR and Video Multimedia Technologies**, Apress: Berkeley, CA, USA, 2022

Hung, Patrick, Hongwei Kan, and Greg Knopf, **Edge Computing Acceleration: From 5G to 6G and Beyond.**, John Wiley & Sons, 2024

Molisch, Andreas F., **Wireless communications: from fundamentals to beyond 5G**, John Wiley & Sons, 2022

Unity Technologies, Introduction to multiplayer networking in Unity, Unity Technologies,

Updated documentation and materials for Unity for Android,

Documentation and materials for ARCore (AR Foundation),

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

XR Systems/10412-752104

IDENTIFYING DATA				
Interpretation of the environment				
Subject	Interpretation of the environment			
Code	10412-752108			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	2nd
Teaching language	#EnglishFriendly Spanish Galician			
Department				
Coordinator	Balado Frías, Jesús			
Lecturers	Balado Frías, Jesús			
E-mail	jbalado@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	This course provides the foundations and techniques for understanding and modeling the environment in Extended Reality (XR) applications. It covers the use of external SDKs in graphics engines to estimate geometric models using primitive surfaces, as well as user navigation in virtual or mixed environments. Methods are explored for identifying interaction surfaces, handling occlusion, and performing joint estimation of the environment and navigation. Additionally, object recognition is introduced as a key component to enhance immersive and adaptive experiences in XR environments.			

Training and Learning Results	
Code	
B2	CON02.1 Identify the technical requirements of the different technologies for the integration of immersive environments and current and future trends when developing applications.
C4	HAB04 Use libraries to capture the environment and carry out computer vision or augmented reality and act on it.
C9	HAB09 Analyse evidence gathered in problem solving using the scientific method.
D5	CMP05.1 Process information from different sources for its use in the study and analysis.
D6	CMP05.2 Extract information from different sources for its use in the study and analysis.

Expected results from this subject	Training and Learning Results
Identify the technical capabilities and limitations of the main SDKs (ARCore, OpenXR, Meta) for environment interpretation in XR experiences.	B2
Implement computer vision and spatial perception techniques using AR and XR libraries to detect surfaces, objects, and interactive elements.	C4
Analyze user behavior and navigation within an XR environment based on spatial data collected in real time.	C9
Represent environments using simplified geometric models based on primitive surfaces, optimizing their use in XR experiences.	D5
Evaluate different approaches to occlusion and interaction with physical and virtual surfaces according to system requirements.	D6
Integrate object recognition in XR environments to enhance contextual understanding and user interaction.	C4 D5

Contents	
Topic	
Introduction and ARCore	The fundamentals of environment interpretation in XR experiences are introduced through ARCore. Concepts such as plane detection, motion tracking (SLAM), and surface estimation on mobile devices using built-in sensors are addressed.
OpenXR	OpenXR is presented as an open standard for cross-platform XR development. Its modular structure, device compatibility, and integration with graphics engines such as Unity are explained, highlighting its use in portable experiences.
Meta SDK	The Meta SDK is explored, focusing on the creation of immersive experiences, with emphasis on hand tracking, environmental occlusion, and advanced environment detection, leveraging the hardware capabilities of devices such as the Meta Quest.

Comparison and Integration of SDKs	The differences and complementarities between ARCore, OpenXR, and the Meta SDK are analyzed. The technological choices are discussed according to the objectives of the project, comparing capabilities in perception, interaction, and portability.
Geometric Models with Primitive Surfaces	Techniques for estimating the environment using simple geometric representations based on primitive surfaces (planes, spheres, cubes) are studied. Their use is analyzed as a way to simplify spatial modeling and facilitate interaction in XR.
User Navigation	The estimation and control of user navigation in XR environments are addressed, including tracking of position, orientation, and trajectories. The interpretation of movement in relation to the modeled environment, navigable zones, and motor profiles is discussed.
Occlusions and Interaction Surfaces	Techniques to manage occlusion between virtual and real elements are explored, along with the identification of surfaces suitable for interaction. Approaches to segmentation and spatial representation are reviewed to achieve greater realism.
Object Recognition	Object recognition in XR environments is introduced as a mechanism to enrich contextual perception. Methods of detection and spatial tagging are studied, along with their integration with user navigation and interaction.

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	10	18	28
Laboratory practical	9	18	27
Mentored work	0	18	18
Objective questions exam	2	0	2

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Classes combine theoretical content with practical demonstrations. A brief period for group discussion or analysis of technical decisions or alternative solutions is included, encouraging critical thinking and active student participation.
Laboratory practical	The practical sessions are conducted in digital environments using specific tools such as Unity, extended reality SDKs, and XR devices. Students apply the course content by completing guided tasks that simulate real-life situations involving interpretation of the environment, using a progressive and autonomous approach. Resources such as online repositories and technical documentation are used.
Mentored work	The supervised work consists of the individual or group development of a technical proposal related to environmental interpretation in XR environments. During the process, students receive support and guidance from the faculty to define objectives, select appropriate tools, and justify design decisions. This work promotes the integrated application of acquired knowledge and enhances analytical and synthesis skills.

Personalized assistance

Methodologies	Description
Laboratory practical	Contact: Jesús Balado-Frías (uvigo) https://moovi.uvigo.gal/user/profile.php?id=102075
Mentored work	Contact: Jesús Balado-Frías (uvigo) https://moovi.uvigo.gal/user/profile.php?id=102075

Assessment

	Description	Qualification	Training and Learning Results	
Laboratory practical	Report on the internships carried out.	30	C4	D5 D6
Mentored work	Presentation of the developed project	40	C4	D5 D6
Objective questions exam	Resolution of theoretical and practical questions related to the subject.	30	C9	

Other comments on the Evaluation

Ordinary Continuous Evaluation

A student is considered to opt for Continuous Evaluation (CE) if he/she takes the intermediate follow-up control test.

Otherwise, the student is considered to opt for Global Evaluation (EG).

The Final Grade of the subject is calculated as the weighted average of the qualifications of each section if the grade of the Final Exam is greater or equal to 4. If it is lower, the Final Grade will be the minimum between 4.9 and the previous weighted average.

Extraordinary continuous evaluation

For this second opportunity, the grade obtained in the internship report made during the period of continuous evaluation will be kept. The calculation of the final grade will follow the same methodological parameters as in the first opportunity regarding the minimum grades to be obtained.

Global evaluation

Those students who have renounced to the continuous evaluation or who have not passed the minimum grades required in the continuous evaluation will have the option of taking a global evaluation maintaining the same percentages in the mentioned methodologies. The recovery of practices and tutored work will be done by submitting a new practice report and a new memory.

Calendar of exams

The lanification of the different intermediate evaluation tests will be approved by the Master's Academic Committee (CAM) and will be available at the beginning of the term.

Sources of information

Basic Bibliography

Seungkeun Yeom , Juui Kim , Hyuna Kang , Seunghoon Jung , Taehoon Hong, **Digital twin (DT) and extended reality (XR) for building energy management**, https://doi.org/10.1016/j.enbuild.2024.114746, Elsevier, 2024

Finian Lugtigheid; Andrew J. Park; Eunju Hwang; Valerie Spicer; Patricia L. Brantingham, **Sidewalk-Based Accessible Pedestrian Routing**, https://doi.org/10.1109/UEMCON62879.2024.10754683, IEEE, 22024

Complementary Bibliography

Shixian Li, Qian-Cheng Wang, Hsi-Hsien Wei and Jieh-Haur Chen, **Extended Reality (XR) Training in the Construction Industry: A Content Review**, https://doi.org/10.3390/buildings14020414, MDPI, 2024

Diego Aneiros-Egido , Jesús Balado , Ha Tran , and Lucía Díaz-Vilariño, **Virtual Reality Experience Analysis from Point Cloud Data**, https://doi.org/10.1007/978-3-031-43699-4_6, Springer Nature, 2024

Recommendations

Subjects that are recommended to be taken simultaneously

Sensorization of the environment/10412-752109

Subjects that it is recommended to have taken before

XR Systems/10412-752104

IDENTIFYING DATA				
Sensorization of the environment				
Subject	Sensorization of the environment			
Code	10412-752109			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	3	Mandatory	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	González Jorge, Higinio			
Lecturers	González Jorge, Higinio			
E-mail	higiniog@uvigo.gal			
Web	http://moovi.uvigo.gal			
General description	Matter that presents the different sensors of surroundings used in reality widespread and his formats of data of exit.			

Training and Learning Results	
Code	
B5	CON04 Identify the principles of operation of the different types of sensors and devices adapted to the different operating environments.
C7	HAB07 Employ input and output devices to create XR systems.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
To know the principles of operation of the distinct types of sensors used in extended reality.	B5
To know the different entrances and exits of data of the sensors used in extended reality.	C7

Contents	
Topic	
1. Foundations.	Introduction to the sensors of the environment (image, acoustic, etc). Navigation sensors (GNSS). INS sensors (control of attitude).
2. Passive sensors.	Electromagnetic spectrum. Properties of the light. Sensors of image. Lens. Parameters of an image (format, bits, frame rate, resolution, SNR, gain, etc). Noise. Interfaces. Types of digital cameras. Photogrammetry. Stereo imaging. Photogrammetry (practical case).
3. Active sensors.	Basic principles of LiDAR. Components of the system. Types of LiDAR (terrestrial and mobile). The point cloud. Main characteristics. Indoor navigation (SLAM). Systems of coordinates. Registration of LiDAR point clouds (practical case).
4. Point could saving.	Point clouds. Formats. Datasets.
5. Processing of point clouds.	Metric of precision. Elimination of noise. Filters of floor. Generation of meshes. Visualisation of point clouds - LOD.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	11	16	27
Practices through ICT	10	38	48

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	Presentations where will explain the different contents.
Practices through ICT	Practices of processing of data of the sensors used in the course.

Personalized assistance	
Methodologies	**Description**
Lecturing	Attention to students in tutorials and telematically. For all teaching modalities, the tutoring sessions can be carried out by telematic means (e-mail, videoconference, moovi forums, ...) by prior arrangement. Higinio González Jorge (UVIGO): https://moovi.uvigo.gal/user/view.php?id=14190&course=25591 Margarita Amor López (UDC): https://moovi.uvigo.gal/user/view.php?id=225538&course=25591
Practices through ICT	Attention to students in tutorials and telematically. For all teaching modalities, the tutoring sessions can be carried out by telematic means (e-mail, videoconference, moovi forums, ...) by prior arrangement. Higinio González Jorge (UVIGO): https://moovi.uvigo.gal/user/view.php?id=14190&course=25591 Margarita Amor López (UDC): https://moovi.uvigo.gal/user/view.php?id=225538&course=25591

Assessment				
	Description	Qualification	Training and Learning Results	
Lecturing	Examination of objective questions.	30	B5	C7
Practices through ICT	Practice report.	70	B5	C7

Other comments on the Evaluation

Ordinary Continuous Evaluation

Students who complete the internship reports within the indicated deadlines are considered to opt for Continuous Evaluation (CE). Otherwise, the student is considered to opt for Global Evaluation (EG).

The Final Grade of the subject is calculated as the weighted average of the qualifications of each section if the grade of the exam of objective questions is higher or equal to 4. If it is lower, the Final Grade will be the grade of the exam of objective questions.

Extraordinary continuous evaluation

For this second opportunity, the grade obtained in the internship report made during the period of continuous evaluation will be kept. The calculation of the final grade will follow the same methodological parameters as in the first opportunity regarding the minimum grades to be obtained.

Global evaluation

Those students who have renounced to the continuous evaluation or who have not passed the minimum marks required in the continuous evaluation will have the option of taking a global evaluation maintaining the same percentages in the mentioned methodologies. The recovery of practices and tutored work will be done by submitting a new practice report and a new memory.

Calendar of exams

The planning of the different intermediate evaluation tests will be approved by the Master's Academic Committee (CAM) and will be available at the beginning of the term.

Sources of information

Basic Bibliography

Leonel Germán Corona Ramírez, Griselda Stephany Abarca Jiménez, Jesús Mares Carreño, **Sensores y actuadores**, 9786074389364, 1º, Grupo Editorial Patria, 2014

Philip E. Human, **Realidad Extendida (XR) en Educación y Trabajo**, 9798313530475, 1º, Independiente, 2025

Bernd Jahne, **Digital Image Processing**, 9783540571834, 6ª, Springer, 2005
Pinliang Dong, Qi Chen, **LiDAR Remote Sensing and Applications**, 9781351233354, 1, CRC, 2017

Complementary Bibliography

Recommendations

Subjects that are recommended to be taken simultaneously

Interpretation of the environment/10412-752108

Subjects that it is recommended to have taken before

XR Systems/10412-752104

IDENTIFYING DATA				
Group project				
Subject	Group project			
Code	10412-752110			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web	http://moovi.uvigo.gal			
General description	The project proposes the development of a complex Extended Reality project as a team, using agile development methodologies. It includes the development of a technical report and the public presentation of a functional prototype.			

Training and Learning Results	
Code	
B11	CON10 Define the appropriate methodology and techniques taking into account the characteristics of the project to be addressed.
C2	HAB02 Apply existing technology to know how to design interactive environments.
C3	HAB03 Develop complex applications in the most efficient way according to the interactive environment to be implemented.
C10	HAB10 Use basic tools of information and communication technologies (ICT) necessary for the exercise of their profession
C11	HAB11 Produce texts of different types especially related to their professional profile, facilitating their understanding by the people to whom they are addressed.
C12	HAB12 Debate and argue constructively the solutions to proposed challenges.
D1	CMP01 Integrate Extended Reality methodologies, proposing appropriate solutions from an industrial, technical and economic point of view.
D4	CMP04 Design effectively complex design engineering projects, solving the conceptual, technical and organisational aspects of the project.
D8	CMP07 Plan and coordinate tasks in interdisciplinary or transdisciplinary teams, offering proposals that contribute to the efficiency of collaborative work
D9	CMP08 Integrate respect for diversity and equity among all people in their profession, implementing an inclusive approach with a gender perspective.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Know how to program in C# within Unity in a robust, scalable, and efficient manner.	B11 C2 C3 C10 D1 D4
Design the code structure of a complex project.	B11 C2 C3 C10 C12 D1 D4
Carry out an XR project from conception to a functional prototype.	B11 C2 C3 C10 C12 D1 D4 D8

Understand project management using agile methodologies.	B11 C12 D8 D9
Organize a work group to carry out an XR project, including the technical ability to gather information, interpret technical specifications, discuss different options, and select a specific tool combination.	B11 C2 C3 C10 C11 C12 D1 D4 D8 D9
Adapting to new environments, managing internal roles within the group, and resolving conflicts.	C12 D8 D9
Proposing an appropriate solution from an industrial and technical perspective.	B11 C2 C3 C10 C12 D1 D4
Knowing how to effectively present results, both in writing and orally, to a demanding audience.	C11 C12

Contents

Topic	
Project approach	Selection of production software, version control, and repository. Definition of the QA system to be used. Agreement on nomenclature and style. Proposal of a code structure based on specifications. Division of roles and definition of tasks.
Project development	Agile development management. Agile testing.
Project completion	Final testing. Preparation of a technical report. Public presentation of a functional prototype.

Planning

	Class hours	Hours outside the classroom	Total hours
Project based learning	39.5	100	139.5
Presentation	2	8	10
Systematic observation	0.5	0	0.5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Project based learning	The project involves the development of a complex Extended Reality project as a team, using agile development methodologies. This methodology addresses the following knowledge, competencies, and skills: CON10, HAB02, HAB03, HAB10, HAB12, CMP01, CMP04, CMP07, and CMP08.
Presentation	A technical report is written describing the project implementation. The developed functional prototype is orally presented to a public audience. This methodology addresses the following knowledge, competencies, and skills: HAB11 and HAB12.

Personalized assistance

Methodologies	Description

Project based learning	Questions about the subject can be resolved during tutoring sessions. These tutoring sessions will be held: -> Individually or in small groups. -> Unless otherwise indicated, by appointment with the corresponding professor. The appointment will be requested and scheduled by email, preferably at the officially reserved time and location. Contact: Antonio Pena (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11310 Contact: Alberto Luaces (udc), https://moovi.uvigo.gal/user/profile.php?id=225533 Contact: Diego Andrade (udc), https://moovi.uvigo.gal/user/profile.php?id=225540
Presentation	Questions about the subject can be resolved during tutoring sessions. These tutoring sessions will be held: -> Individually or in small groups. -> Unless otherwise indicated, by appointment with the corresponding professor. The appointment will be requested and scheduled by email, preferably at the officially reserved time and location. Contact: Antonio Pena (uvigo), https://moovi.uvigo.gal/user/profile.php?id=11310 Contact: Alberto Luaces (udc), https://moovi.uvigo.gal/user/profile.php?id=225533 Contact: Diego Andrade (udc), https://moovi.uvigo.gal/user/profile.php?id=225540

Assessment

	Description	Qualification	Training and Learning Results		
Project based learning	The quality of the overall project is assessed. The grade is the same for all team members.	40	B11	C2 C3 C10	D1 D4
Presentation	The technical report describing the project's implementation is evaluated. The oral public presentation of the developed functional prototype is evaluated. The grade is the same for all team members	20		C11 C12	
Systematic observation	Each student's contribution to the project is assessed based on the instructors' observations throughout the process. In addition, an individual oral test is given on the project as a whole.	40	B11	C2 C3 C10	D1 D4 D8 D9

Other comments on the Evaluation

Students will be offered two assessment systems: CONTINUOUS ASSESSMENT, which is the recommended method and around which teaching activities are organized, and a GLOBAL ASSESSMENT option, which is only recommended in situations where it is impossible to follow the recommended system.

CONTINUOUS ASSESSMENT

Continuous assessment consists of the tests detailed below in this guide. It is understood that continuous assessment has been chosen once the commitment document has been signed, which will be offered after the first 4 weeks of teaching the course. Once submitted, the student will be deemed to have taken the exam and will be assigned the grade resulting from the application of the criteria detailed below.

In order to ensure that a balanced minimum of the subject's competencies is acquired, passing must meet these three conditions:

1) obtain an overall grade equal to or higher than 5 (on a scale of 0 to 10).

2) obtain a grade equal to or higher than 5 (on a scale of 0 to 10) in the ongoing assessment, which includes an oral exam on the completed project.

3) obtain a grade equal to or higher than 5 (on a scale of 0 to 10) in the project.

If all these conditions are not met, the final grade (on a scale of 0 to 10) will be the lower of the overall grade obtained and a score of 4.9.

The schedule for the various midterm assessment tests will be approved by the Master's Academic Committee (CAM) and will be available at the beginning of the semester.

GLOBAL ASSESSMENT

If the commitment document, which will be offered after the first 4 weeks of the course, is not signed, the assessment will be conducted through a final written exam, which will cover aspects of group project development, on the official date assigned by the Center. In addition, the student must submit a project, which will be planned in advance, including a descriptive report and an oral exam. The weighting of each of these exams in the final grade will be as follows:

Final exam: 10%

Project: 40%

Descriptive report: 20%

Oral exam: 30%

In order to ensure that a balanced minimum of the subject's competencies is acquired, passing must meet these three conditions:

1) obtain an overall grade equal to or higher than 5 (on a scale of 0 to 10)

2) obtain a grade equal to or higher than 5 (on a scale of 0 to 10) in the final written exam

3) obtain a grade equal to or higher than 5 (on a scale of 0 to 10) in the project

4) obtain a grade equal to or higher than 5 (on a scale of 0 to 10) in the oral exam

If all of these conditions are not met, the final grade (on a scale of 0 to 10) will be the lower of the overall grade obtained and 4.9.

EXTRAORDINARY OPPORTUNITY

You will be evaluated according to the rules described in the previous section for a Global Evaluation.

If plagiarism is detected in any of the tests or assignments, the final grade will be FAIL (0) and the fact will be reported to the Center's management for the appropriate actions.

Sources of information

Basic Bibliography

Keith Clinton, **Agile Game Development with SCRUM**, 0321618521, 1, Addison-Wesley, 2010

Tilo Linz, **Testing in Scrum: A Guide for Software Quality Assurance in the Agile World**, 1937538397, 1, Rocky Nook, 2014

Annie Eaton, **The Extended Reality Blueprint: Demystifying the AR/VR Production Process**, 1394207689, 1, Wiley, 2024

Complementary Bibliography

Recommendations

Subjects that it is recommended to have taken before

XR Programming/10412-752102
Production of XR projects/10412-752103

Other comments

The use of generative artificial intelligence (GAI) is permitted in the academic activities of this subject. It must be used ethically, critically, and responsibly. When using GAI, any results it provides must be critically evaluated, and any generated citations or references must be carefully verified. The use of the tools used must also be declared.

IDENTIFYING DATA				
Advanced XR programming				
Subject	Advanced XR programming			
Code	10412-752112			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103912&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Advanced image and sound rendering				
Subject	Advanced image and sound rendering			
Code	10412-752113			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103913&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Artificial intelligence and machine learning				
Subject	Artificial intelligence and machine learning			
Code	10412-752114			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Burguillo Rial, Juan Carlos			
Lecturers	Burguillo Rial, Juan Carlos Docio Fernández, Laura			
E-mail	jrial@uvigo.es			
Web	http://moovi.uvigo.es			
General description	The subject enters to the students in the technicians of artificial intelligence and automatic learning. In particular it pursues that, when finalising the subject, the student was able of: - Know and comprise the fundamental concepts on artificial intelligence. - Implement algorithms of automatic learning supervised/no supervised with classical neural networks and deep. - Apply the knowledges purchased and resolve problems in new surroundings or little known inside contexts wider and multidisciplinary, being able to integrate knowledges. The matter will be given in Spanish.			

Training and Learning Results	
Code	
B2	CON02.1 Identify the technical requirements of the different technologies for the integration of immersive environments and current and future trends when developing applications.
B3	CON02.2 Define the technical requirements of the different technologies for the integration of immersive environments and current and future trends when developing applications.
C2	HAB02 Apply existing technology to know how to design interactive environments.

Expected results from this subject	Training and Learning Results
Understand the basic concepts of the intelligent systems and his applications for image processing.	B2
Develop systems with capacities of machine learning.	B3 C2
Integrate technologies of artificial intelligence and machine learning for the development of intelligent systems on the extended reality context, with intelligent and efficient features.	B2 B3 C2

Contents	
Topic	
Introduction to artificial intelligence	Methodologies for the development of technical models and for dimensionality reduction.
Machine learning	Unsupervised learning Supervised learning Classification and regression
Neural network architectures	Types of neural networks Deep Learning
AI applications in extended reality	Generative AI, image generation, Natural language processing, etc.

Planning	Class hours	Hours outside the classroom	Total hours
Lecturing	16.5	28.5	45
Laboratory practical	15	28	43
Mentored work	0	23	23
Objective questions exam	1.5	0	1.5

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies	
	Description
Lecturing	Lecturing consists on explaining the different contents of the course program, with the help of electronic means (presentations, videos, etc.). This activity will be done individually. The related competencies are: B2, B3.
Laboratory practical	There will be different practical practices related with the content of the course, that the students must solve individually or in groups. The related competencies are: B3, C2.
Mentored work	The scope and aims of the projects, use cases and/or practical problems will require the autonomous student work, supported by the teachers. This activity will be done individually or in groups. The related competencies are: B2, B3, C2.

Personalized assistance	
Methodologies	**Description**
Lecturing	In practical training activities and tutoring sessions, course instructors will provide individual guidance to each student on the tasks to be completed, with the goal of guiding their approach and methodology. They will also offer information on coordinating the course with other content and subjects in the curriculum. It is recommended that students discuss any questions with instructors throughout the course to improve their understanding of basic concepts and help them complete the tasks and activities to be assessed. Students can request tutoring support through the Moovi platform. Contact: Juan Carlos Burguillo Rial (UVIGO, Coordinator), https://moovi.uvigo.gal/user/view.php?id=11297&course=25595 Contact: Laura Docío Fernández (UVIGO), https://moovi.uvigo.gal/user/view.php?id=11629&course=25595 Contact: Francisco Bellas Bouza (UDC), https://moovi.uvigo.gal/user/view.php?id=225536&course=25595
Laboratory practical	In practical training activities and tutoring sessions, course instructors will provide individual guidance to each student on the tasks to be completed, with the goal of guiding their approach and methodology. They will also offer information on coordinating the course with other content and subjects in the curriculum. It is recommended that students discuss any questions with instructors throughout the course to improve their understanding of basic concepts and help them complete the tasks and activities to be assessed. Students can request tutoring support through the Moovi platform. Contact: Juan Carlos Burguillo Rial (UVIGO, Coordinator), https://moovi.uvigo.gal/user/view.php?id=11297&course=25595 Contact: Laura Docío Fernández (UVIGO), https://moovi.uvigo.gal/user/view.php?id=11629&course=25595 Contact: Francisco Bellas Bouza (UDC), https://moovi.uvigo.gal/user/view.php?id=225536&course=25595
Mentored work	In practical training activities and tutoring sessions, course instructors will provide individual guidance to each student on the tasks to be completed, with the goal of guiding their approach and methodology. They will also offer information on coordinating the course with other content and subjects in the curriculum. It is recommended that students discuss any questions with instructors throughout the course to improve their understanding of basic concepts and help them complete the tasks and activities to be assessed. Students can request tutoring support through the Moovi platform. Contact: Juan Carlos Burguillo Rial (UVIGO, Coordinator), https://moovi.uvigo.gal/user/view.php?id=11297&course=25595 Contact: Laura Docío Fernández (UVIGO), https://moovi.uvigo.gal/user/view.php?id=11629&course=25595 Contact: Francisco Bellas Bouza (UDC), https://moovi.uvigo.gal/user/view.php?id=225536&course=25595
Tests	**Description**
Objective questions exam	In practical training activities and tutoring sessions, course instructors will provide individual guidance to each student on the tasks to be completed, with the goal of guiding their approach and methodology. They will also offer information on coordinating the course with other content and subjects in the curriculum. It is recommended that students discuss any questions with instructors throughout the course to improve their understanding of basic concepts and help them complete the tasks and activities to be assessed. Students can request tutoring support through the Moovi platform. Contact: Juan Carlos Burguillo Rial (UVIGO, Coordinator), https://moovi.uvigo.gal/user/view.php?id=11297&course=25595 Contact: Laura Docío Fernández (UVIGO), https://moovi.uvigo.gal/user/view.php?id=11629&course=25595 Contact: Francisco Bellas Bouza (UDC), https://moovi.uvigo.gal/user/view.php?id=225536&course=25595

Assessment		
	Description	Qualification Training and Learning Results

Lecturing	There will be a theoretical examination at the end of the course on the contents of the subject. It will be composed by short questions and/or of selection of multiple option, and of questions of development where the student will describe one or several concepts, relating them to each other, and illustrating them with examples.	50	B2 B3	
Laboratory practical	The students will make a group of practices for the computer laboratory, where they will work with the concepts studied along the theoretical classes.	30	B3	C2
Mentored work	The students will perform a task, either individualy or in groups, on the concepts studied along the classes and those that have analysed in the laboratoy practices.	20	B2 B3	C2

Other comments on the Evaluation

To pass, the following three conditions must be met:

1) Obtain an overall grade, calculated as the weighted average of the grades, equal to or higher than 5 (on a scale of 0 to 10).

2) Obtain a grade equal to or higher than 4 (on a scale of 0 to 10) on the final theoretical exam.

3) Obtain a grade equal to or higher than 4 (on a scale of 0 to 10) on each of the practical assignments and the supervised project.

If all of these conditions are not met, the final grade (on a scale of 0 to 10) will be the lower of the overall grade obtained and 4.9.

The schedule for the various midterm assessment tests will be approved by the Master's Academic Committee (CAM) and will be available at the beginning of the semester.

The final exam questions will focus on specific content developed in the subject related to their competencies, which may have been acquired by the student in both the expository and interactive sections.

Continuous Assessment:

Students who submit any of the laboratory exercises are considered eligible for Continuous Assessment (CA). Otherwise, they are eligible for Global Assessment (GA).

Global Assessment:

Students who have not submitted the exercises will be assessed for Global Assessment and must submit all of them by the date designated in advance by the course instructors.

Extraordinary Assessment:

Only the grade obtained in the exercises (practical and supervised assignments) during the course will be retained, as well as their weight in the final grade. Students who did not achieve the cut-off grade for the activities proposed during the previous exam may submit, prior to the second-chance final exam, activities similar to those they failed, which will be proposed by the instructors.

The final exam questions will focus on specific content developed in the subject in relation to their competencies, which may have been acquired by the student in both the lecture and interactive sections.

End-of-Program Assessment:

Repeating students and/or those exempt from attendance will take the exam under the same conditions as students in the first sitting.

Not presented:

Students will receive a grade of "no-show" if they do not take the final exam.

Fraudulent Completion of Exercises or Tests:

In cases of fraudulent completion of exercises or tests, the official performance assessment regulations of each institution will apply. In particular, if any form of plagiarism is detected in any of the tests or exams, the final grade will be FAIL (0), and the incident will be reported to the appropriate academic authorities.

Sources of information
Basic Bibliography
Stuart Russell, Peter Norvig, **Artificial Intelligence: A Modern Approach**, 3ra, Prentice Hall, 2014
Marsland, Stephen, **Machine Learning: An Algorithmic Perspective**, Chapman and Hall/CRC Press, 2014
Sutton, R. S., Barto, A. G.,, **Reinforcement learning: An introduction**, 2da, MIT Press, 2018
Complementary Bibliography
Alpaydin, E., **Introduction to machine learning**, 3ra, MIT Press, 2010
Sebastian Raschka, Vahid Mirjalili, **Python machine learning : aprendizaje automático y aprendizaje profundo con Python, scikit-learn y TensorFlow**, Marcombo, 2019
Brink, H., Richards, J., & Fetherolf, M., **Real-world machine learning**, Manning Publications, 2016

Recommendations

Other comments

The student would have to keep updated on the theoretical contents in order to be able to apply the knowldedge adquired on the laboratory practices and group tasks.

IDENTIFYING DATA				
User experience (UX) and gamification				
Subject	User experience (UX) and gamification			
Code	10412-752118			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	1st	2nd
Teaching language	Spanish Galician			
Department				
Coordinator	Legerén Lago, Beatriz			
Lecturers	Legerén Lago, Beatriz Rodríguez Ferrando, Olaia			
E-mail	blegeren@uvigo.es			
Web	http://moovi.uvigo.gal			
General description	Within the framework of this master's degree, this course addresses the fundamentals of user experience (UX) and user-centered design, essential for creating effective immersive environments. Research techniques are taught to understand how users interact in VR and AR, as well as the integration of UX into project workflows. Gamification is also explored as a tool to enhance immersion and engagement, managing motivation through challenges and rewards. Emphasis is placed on practical applications for developing innovative, user-centered solutions.			

Training and Learning Results	
Code	
C4	HAB04 Use libraries to capture the environment and carry out computer vision or augmented reality and act on it.
D2	CMP02 Innovate new products or services, focusing on users (UX) and different use cases.

Expected results from this subject	
Expected results from this subject	Training and Learning Results
Enter the basic principles of UX and its importance in immersive technologies.	D2
Teach methods of compilation and analysis of data centred in the user.	C4
Explain how to include the UX from the conceptualization until the development.	D2
Explore how the gamificación can enrich experiences inmersivas. And comprise the motivational factors key in experiences inmersivas.	D2

Contents	
Topic	
Foundations of the experience of user (UX) and design centred in the user	Principles of the experience of user (usability, accessibility, consistency). Design centred in the user: Definition, profits and cases of study. Peculiarities of the UX in surroundings of virtual reality and increased.
Technicians of investigation of user	Qualitative techniques: interviews, contextual observation, and focus groups. Quantitative technicians: surveys, analysis of metrics, and A/B proofs Mapping of the experience of the user in RV/RA (journey mapping).
Integration of the UX the flow of work of a project. Practical application to a project	Agile methods and his relation with the UX. Iterative design and prototyping. Testing and feedback in early iterations.
The gamificación like tool to improve the experience of user	What is gamification and how to apply it in VR/AR? Design of challenges, interactions and rewards.

Challenges, interactions and rewards. Management of the motivation.	Theories of motivation (intrinsic vs. extrinsic). How to manage the curve of difficulty in experiences gamificadas. Avoid the fatigue of the user in widespread surroundings.

Planning			
	Class hours	Hours outside the classroom	Total hours
Lecturing	15	15	30
Case studies	14	10	24
Mentored work	0	56	56
Objective questions exam	2	0	2
Systematic observation	0.5	0	0.5
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description
Lecturing	Exhibition by part of the professor of the contents of the matter, boosting the critical discussion. Of the concepts. It can consist in providing material writing and/or audiovisual to study and prepare of virtual way, seating the theoretical bases and the knowledges that will tackle in each one of the subjects.
Case studies	It will propose , of autonomous way, the resolution of tasks and short projects or works of investigation.
Mentored work	The student will develop a work that will be supervised by the educational along the development of the same.

Personalized assistance	
Methodologies	**Description**
Lecturing	Attention to students in tutorials and teleconferences. For all teaching modalities, tutoring sessions may be carried out by telematic means (e-mail, videoconference, Moovi forums, ...i) by prior arrangement. Contact: Beatriz Legerén (uvigo), https://moovi.uvigo.gal/user/view.php?id=10450 Contact: Olalla Rodríguez (uvigo), https://moovi.uvigo.gal/user/view.php?id=225662
Case studies	Attention to students in tutorials and telematically. For all teaching modalities, tutoring sessions can be carried out by telematic means (e-mail, videoconference, Moovi forums, ...) by prior arrangement. Contact: Beatriz Legerén (uvigo), https://moovi.uvigo.gal/user/view.php?id=10450 Contact: Olalla Rodríguez (uvigo), https://moovi.uvigo.gal/user/view.php?id=225662
Mentored work	Attention to students in tutorials and telematically. For all teaching modalities, tutoring sessions can be carried out by telematic means (e-mail, videoconference, moovi forums, ...) by prior arrangement. Contact: Beatriz Legerén (uvigo), https://moovi.uvigo.gal/user/view.php?id=10450 Contact: Olalla Rodríguez (uvigo), https://moovi.uvigo.gal/user/view.php?id=225662

Assessment				
	Description	Qualification	Training and Learning Results	
Mentored work	(*)Os alumnos desenvolverán un proxecto que combine principios de UX e gamificación nunha contorna de RV/RA.	40	C4	
Objective questions exam	(*)Os alumnos realizarán un examen de preguntas obxectivas que muestren os coñecementos adquiridos na materia.	40		D2
Systematic observation	(*)Se fara un seguimento continuado da actividade do alumnado no só nas clases senon a través do desenvolvemento das prácticas.	20	C4	D2

Other comments on the Evaluation

Students will be offered two assessment systems: CONTINUOUS ASSESSMENT, which is the recommended method and around which teaching activities are organized, and a GLOBAL ASSESSMENT option, which is only recommended in situations where it is impossible to follow the recommended system.

Students must inform the teacher of their express refusal to use the continuous assessment system within the deadline established by the school for this purpose; they must submit the completed and signed document provided for this purpose.

CONTINUOUS ASSESSMENT

Continuous assessment consists of the tests detailed below in this guide.

- Supervised work (40%), objective question examination (40%), and systematic observation (20%). In order to ensure the acquisition of a balanced minimum of subject competencies, a passing grade of at least 5 points on each test is required, without weighting.

If this is not the case, the student must repeat the failed test(s) in the July session, with the final grade recorded on the June transcript as the minimum score between the overall grade obtained and a 4.9.

In each test, not only the knowledge acquired will be taken into account, but also the presentation of the knowledge, neatness, handwriting, writing, spelling, and grammar. Poor practice in this area will result in a reduction of points or even a failure in the subject.

COMPLETE ASSESSMENT

In accordance with the Student Statute of the University of Vigo, students who do not opt for the continuous assessment option will be entitled to a comprehensive exam on the dates determined by the faculty.

The comprehensive assessment test will be held on the date and at the time specified by the center in the official examination calendar.

The student must pass each of the assessment tests detailed below, obtaining a minimum score of 5 points on each without weighting.

- Assignment (40%), objective question exam (40%); the systematic observation section is replaced by an oral presentation of the completed work (20%).

If this is not the case, the student must repeat the failed test(s) in the July session, with the final grade recorded on the June transcript as the lower of the overall grade obtained and a 4.9.

If plagiarism is detected in any of the tests or assignments, the final grade will be FAIL (0), and the event will be reported to the center's administration for the appropriate actions.

Sources of information
Basic Bibliography
Lidwell,w et alt, **Universal Principles of Design, Updated and Expanded Third Edition: 200 Ways to Increase Appeal, Enhance Usability, Influence Perception, and Make Better Design Decisions**, 076037516X, Rockport Universal, 2023
Yablonski, J, **Las leyes del UX: Utilizando la psicología para mejorar la experiencia de usuario (UX) (Diseño Web y Digital)**, 978-8434262492, 2022
Khaled, Al Ghanmi, N et alt, **Integrating Scrum development process with UX design Flow**, 10.11591/eei.v9i6.2484, 2020
Abdulsalam S M, Kianososh K, **Enhancing Gamified Online Learning User Experience (UX): A Systematic Literature Review of Recent Trends**, https://doi.org/10.2174/9789814998819121010l, 2021
C.Zhang, **"The Why, What, and How of Immersive Experience**, 10.1109/ACCESS.2020.2993646,
R. A. Putawaand D. Sugianto, **Exploring User Experience and Immersion Levels in Virtual Reality: A Comprehensive Analysis of Factors and Trends**, 2024
Complementary Bibliography
Pereyra, I et alt, **Universal Principles of UX: 100 Timeless Strategies to Create Positive Interactions between People and Technology**, 0760378045, Rockport Universal, 2023
Ramírez-Oliveira, G et alt, **Mapeo sistemático de la literatura sobre experiencia de usuario en sistemas de recomendación**, 1940-2171,
Escallada, O et alt, **MAPPING HUMAN FACTORS IN VIRTUAL REALITY: VRUX.**, https://doi.org/10.61547/3488, 2020
Ferreira, B et alt, **Lessons learned to improve the UX practices in agile projects involving data science and process automation.**, https://doi.org/10.1016/j.infsof.2022.107106, 2023
Ning, B., **A UX-Driven Design Method for Building Gamification System**, https://doi.org/10.1007/978-3-319-91797-9_9, 2018
Kartevoll, Morten, **Improving User Experience with Gamification and Reward Systems**, http://hdl.handle.net/11250/2456865, 2017
Shin, D., **How does immersion work in augmented reality games? A user-centric view of immersion and engagement**, https://doi.org/10.1080/1369118X.2017.1411519, 2017

Recommendations

Subjects that it is recommended to have taken before

User interaction/10412-752106

IDENTIFYING DATA				
Industrial applications				
Subject	Industrial applications			
Code	10412-752119			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Balado Frías, Jesús Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103915&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations

IDENTIFYING DATA				
Systems integration				
Subject	Systems integration			
Code	10412-752120			
Study programme	(*)Máster Universitaro en Realidade Estendida			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	4.5	Optional	1st	2nd
Teaching language				
Department				
Coordinator	Pena Giménez, Antonio			
Lecturers	Pena Giménez, Antonio			
E-mail	apena@gts.uvigo.es			
Web				
General description	Subject coordinated by the University of A Coruña. Link: https://academica.udc.gal/doa/consultaPublica/look[conpub]MostrarPubGuiaDocAs?entradaPublica=true&_codAsignatura=103917&idiomaPais=es.ES			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Planning			
	Class hours	Hours outside the classroom	Total hours
*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.			

Methodologies	
	Description

Personalized assistance

Assessment		
Description	Qualification	Training and Learning Results

Other comments on the Evaluation

Sources of information
Basic Bibliography
Complementary Bibliography

Recommendations